ANNOTATED BIBLIOGRAPHY ON THE ECOLOGY OF THE LAKE WASHINGTON DRAINAGE

Richard S. Wydoski

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November 1972.

ABSTRACT

This annotated bibliography contains 392 published and unpublished references that pertain to the natural resources in the Lake Washington watershed, with particular emphasis on the aquatic environment. All references are indexed by keywords.

PREFACE

The following annotated bibliography on the Lake Washington watershed has been compiled as a ready reference source for researchers. All references were assigned selected key words, which are listed in the index. The bibliography contains unpublished as well as published literature useful to researchers who are planning studies in the watershed. The listing of an unpublished research report done at the University of Washington includes the location and the sponsoring professor's name. Usually the only copy of this type of paper is in the files of the professor, who should be contacted directly for access to the manuscript. A few selected newspaper articles are included. Abbreviations follow the Word-Abbreviation List, National Clearinghouse for Periodical Title Word Abbreviations, American National Standards Institute, Standards Committee Z39 (1971).

A number of pertinent papers on the drainage have been published by the Washington State Water Pollution Control Commission and the Washington State Department of Water Resources. These two agencies are now a part of the new Washington State Department of Ecology. Most titles should be available at the Department of Ecology library in Olympia.

No doubt an undertaking of this kind will omit works that should be included in the bibliography. Notification of such omissions will be appreciated. Please send full information on items and any new papers on the watershed to the central office of the Coniferous Forest Biome, University of Washington AR-10, Seattle 98195. In the future, a computer retrieval system will be used to store all titles and retrieval will be made by keywords. As the research on the Coniferous Forest Biome continues, the list of keywords can be expanded for faster retrieval of titles. Suggestions for keywords to be added to the list should also be made to the central office.

The work reported in this paper was supported by National Science Foundation grant GB-20963 to the Coniferous Forest Biome, Ecosystem Analysis Studies, U.S./International Biological Program. This is contribution 15 from the Coniferous Forest Biome.

Miss Karen Visdall did a commendable job in searching a good deal of the literature, verifying entries, and making notations. Mrs. Eleanor Dahlager and Mrs. Jeanne Rensel, of the Washington State Department of Ecology, gave freely of their time in locating references at their library. Mr. Donald Kauffman and Mr. Richard Laramie, of the Washington State Department of Fisheries, were most cooperative in allowing the review of their unpublished data and gave permission to have this material included in the bibliography. Dr. Richard Whitney, University of Washington College of Fisheries, helped with the editing of the preliminary version of this bibliography. Dr. Dale Cole, University of Washington College of Forest Resources, provided a listing of the terrestrial entries and helped to guide us in locating additional items. Mrs. Thelma Walker was most

patient with the typing of several versions of this manuscript. L. J. Gregg organized the several versions and typed the final draft. My sincere appreciation is extended to all of these people and others who provided titles or suggestions.

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1. ADDOR, E. E. 1972. Theodolite surveying for nondestructive biomass sampling. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 167-176. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: CONIFEROUS, FOREST BIOMASS, SURVEY

   Presents a preliminary test of theodolite surveying to determine the biomass in a Douglas-fir stand at the Thompson Research Center.

2. AJWANI, S. 1956. A review of Lake Washington watershed, historical, biological, and limnological. M.S. thesis, Univ. Washington, Seattle. 148 p. KEYWORDS: BIBLIOGRAPHY, LAKE WASH, HISTORY, REVIEW

   A comprehensive review of the Lake Washington watershed through 1955.

3. ALLEN, G. H. 1956. Migration, distribution and movement of Puget Sound silver salmon. Ph.D. thesis, Univ. Washington, Seattle, 295 p. KEYWORDS: SALMON, DISTRIBUTION, MIGRATION, MOVEMENT

   Study of migration, distribution, and homing instinct of five groups of marked silver salmon (*Oncorhynchus kisutch*) that were planted during the spring of 1952 in Puget Sound streams. Two groups (both from the same stock) of 12-month-reared fingerlings were "mass-planted" in the Lake Washington watershed.

4. ———. 1958. Survival through hatching of eggs from silver salmon (*Oncorhynchus kisutch*). Trans. Am. Fish. Soc. 87(1957):207-219. KEYWORDS: ANADROMOUS, FISH, SALMON, REPRODUCTION, SURVIVAL

   Describes survival of eggs that were obtained from 1950-brood-year salmon. These fish were recovered during the 1953/1954 spawning season at the University of Washington College of Fisheries trap.

5. ———. 1959a. Growth of marked silver salmon (*Oncorhynchus kisutch*) of the 1950 brood in Puget Sound. Trans. Am. Fish. Soc. 88(4):310-318. KEYWORDS: FISH, GROWTH, SALMON, LAKE WASH

   Two stocks of marked silver salmon (*Oncorhynchus kisutch*) were released into Minter Creek and the Lake Washington watersheds during the spring of 1952. Average lengths of all marked salmon recovered in the Pacific Ocean at the same time and place, and at time of escapement, showed that the Lake Washington salmon were larger than those from Minter Creek.

6. ———. 1959b. Behavior of chinook and silver salmon. Ecology 40(1): 108-113. KEYWORDS: BEHAVIOR, FISH, SALMON

During the escapement of 1953/1954, 83 chinook and 113 silver salmon returned to the University of Washington College of Fisheries hatchery. External stimuli initiated their return to the pond (which is considered analogous to a salmon's movement onto the spawning beds in natural areas).

7. ———. 1965. Estimating error associated with ocean recoveries of fin-marked coho salmon. Trans. Am. Fish. Soc. 94(4):319-326. KEYWORDS: FISH, MARKING, SALMON, SAMPLING

Estimation of error associated with ocean recoveries of coho salmon released into Puget Sound in 1952 from the Lake Washington watershed and Minter Creek. Errors include unauthentic recoveries, duplication of marks, and fin regeneration. Major source of error in ocean fisheries recoveries was attributed to salmon clipped of only one fin.

8. ———. 1966. Ocean migration and distribution of fin-marked coho salmon. J. Fish. Res. Board Can. 23(7):1043-1061. KEYWORDS: FISH, DISTRIBUTION, MIGRATION, SALMON, SALTWATER

Differences in migration, distribution, and movements of five groups of fin-marked cohos were correlated with time, place, and method of planting. Fish planted in southern Puget Sound remained within Puget Sound to a greater degree than fish planted in middle Puget Sound from the Lake Washington watershed.

9. ———. 1968. Mortality of coho smolts migrating through a lake system. Ecology 49(5):1001-1002. KEYWORDS: FISH, MORTALITY, LAKE, SALMON

Two groups of fin-marked 1950-brood coho salmon were planted into Lake Washington drainage in the spring of 1952. One group, with left ventral marks, was planted at the University of Washington, which is 8 km from Puget Sound. The other group, with right ventral marks, was planted at the Issaquah Creek hatchery, which is 56 km from Puget Sound. The right-ventral-marked fish suffered 22% greater mortality than left-ventral-marked fish.

10. ———. 1969. Catch-to-escapement rates of fin-marked 1950-brood Puget Sound coho salmon. Trans. Am. Fish. Soc. 98(4):599-610. KEYWORDS: FISH, ESCAPEMENT, SURVIVAL, SALMON

Catch-to-escapment (C-E) ratios of five groups of fin-marked 1950-brood Puget Sound coho salmon are summarized. For salmon released at Minter Creek the C-E ratio was 4:1, whereas salmon released at Lake Washington had a C-E ratio of 3:1. In contrast, for salmon

migrating into the Pacific Ocean (90% of the Lake Washington and 45% of the Minter Creek), the Lake Washington salmon had a C-E ratio ten times greater than the Minter Creek salmon (14:1 versus 1.4:1).

11. AMES, J. 1969. Lake Washington sockeye freshwater investigations. Wash. State Dep. Fish. Ann. Rep. 79(1969):9-14. KEYWORDS: FISH, LIFE HISTORY, LAKE WASH, SALMON

Freshwater management study of the Cedar River sockeye run to obtain information toward a prediction of sockeye escapement needed to utilize fully the available spawning grounds and maximize the yield. The report covers spawning escapement enumeration; studies on tagging, spawner density prediction, and juvenile sockeyes; and suggestions for future work.

12. ———. 1970a. 1970 Hydraulic sampling--Cedar River sockeye. Unpubl. MS, Lake Wash.--Cedar River file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: CEDAR RIVER, SAMPLING, SPAWNING, SURVIVAL, SALMON

Hydraulic sampling for preemergent sockeye fry in Cedar River. One hundred six samples were taken in a 22-km stretch of the river. Data are broken down into parent year (1967/1969), escapement, number of samples, living fry per square yard, and percentage of survival.

13. ———. 1970b. Report of the salmon escapement in the State of Washington, 1969. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. General, p. 1-8; Puget Sound, p. 1-42. KEYWORDS: ESCAPEMENT, SALMON, WASHINGTON

Detailed report on salmon escapement by species and by area.

14. ———. 1971. Lake Washington sockeye salmon--1970 freshwater investigations. Wash. State Dep. Fish. Ann. Rep. 80(1970):67-68. KEYWORDS: DESCRIPTION, ESCAPEMENT, FRESHWATER, SALMON, LAKE WASH

Description of the 1970 sockeye salmon in the Lake Washington drainage. The 1970 escapement was estimated at 110,000 spawners in the Cedar River, 11,000 in other tributaries, and 3000 lake beach spawners.

15. ANDERSON, G. C. 1954. A limnological study of the seasonal variations of phytoplankton populations. Ph.D. thesis, Univ. Washington, Seattle. 268 p. KEYWORDS: DISTRIBUTION, GROWTH, LIMNOLOGY, PHYTOPLANKTON, POPULATION, LAKE WASH, EUTROPHIC

Physical and chemical conditions influencing growth and distribution of phytoplankton were studied in Lake Washington, a soft-water lake relatively low in dissolved nutrients. On the basis of hypolimnetic oxygen deficit, the lake was in the early stages of eutrophy. The heat budget was moderately high for a large, deep lake. The phytoplankton population was varied and showed a spring and a late summer bloom. The dominant groups were Chrysophyta and Pyrrophyta. Phytoplankton population consisted of 49 species, 23 species fewer than were reported in 1933.

16. ———. 1961. Recent changes in the trophic nature of Lake Washington--A review. IN: U.S. Department of Health, Education, and Welfare, Algae and metropolitan wastes, p. 27-33. U.S. Dep. Health, Educ., Welfare, Robert A. Taft, Sanit. Eng. Cent., Cincinnati, Ohio, Tech. Rep. W61-3. KEYWORDS: EUTROPHIC, HISTORY, LAKE WASH, LIMNOLOGY

Provides background history and reviews the limnological changes that had occurred in Lake Washington.

17. ANONYMOUS. 1970. Crawfish farm is being tried. Fish. Hunting News, West. Wash., 26 Dec. 1970., p. 10. KEYWORDS: CRUSTACEAN, HARVEST, LAKE WASH

The Washington State Department of Fisheries issued a permit to Hoviland Seafood Co., Kirkland, to take 454 kg (1000 pounds) of crawfish from Lakes Union and Washington and the Lake Washington Ship Canal. These were to be reared in a small lake near Bellevue. The permit allowed experiments in the culture, growth, and breeding of crawfish, but no sale or commercial use. The permit was valid until 31 Dec. 1970 and experiments were to be closely monitored by fisheries shellfish biologists.

18. BAGLEY, C. B. 1929. History of King County. Vol. I. S. J. Clarke Publ. Co., Seattle. 889 p. KEYWORDS: HISTORY, KING COUNTY

A complete account of King County covering historical beginnings, pioneers, growth of industries, Indians, education, Chinese agitation, public departments, newspapers, financial institutions, roads, politics, King County Port Commission, fish and fisheries, grades and regrades, waterways, and individual communities.

19. BALCI, A. N. 1964. Physical, chemical and hydrological properties of certain western Washington forest floor types. Ph.D. thesis, Univ. Washington, Seattle. 191 p. KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, HYDROLOGY, SOIL

Forest floors were described and classified on five sites of old-growth coniferous forests in the Olympic and Cascade Mountains. Two major

forest floor types, mor and duff mull, were identified. Hydrologic characteristics of the forest floor were determined under artificial rainfall intensities of 15 cm hr^{-1} and 2.3 cm hr^{-1}. These included flow rate, time lag to steady flow, effective saturation, retention capacity, and infiltration capacity. A permanent plot was established in a young red alder stand in the Cedar River watershed to study the dynamics of an alder forest floor relevant to water quality.

20. BALLARD, T. M. 1968. Carbon dioxide production and diffusion in forest floor material--A study of gas exchange in biologically active, porous media. Ph.D. thesis, Univ. Washington, Seattle. 120 p. KEYWORDS: CARBON, CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, MODEL, PRODUCTION, SOIL

Mathematical models and experimental methods were developed for field and laboratory study of carbon dioxide production, gradients, and exchange in forest floors of the Cedar River watershed. By use of a more general form of Koepf's equation, short-term responses to environmental change could be studied. A multilayered model was used to describe carbon dioxide flux through the forest floor. Experimental data were readily processed by solving an equation for individual layers and joining solutions at the layer boundaries.

21. ———. 1970. Gaseous diffusion evaluation in forest humus. Soil Sci. Soc. Am. Proc. 34(3):532-533. KEYWORDS: CARBON, CYCLE, MOVEMENT, CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST

Penman's ratio of direct length to effective diffusion path length L/L_e, is not directly predictable from forest floor air content. The diffusion coefficient of a gas in the unsaturated porous medium can be estimated from temperature, air pressure, porosity, moisture content, and an empirically determined value of L/L_e. A steady-state carbon dioxide diffusion method was proposed for measuring L/L_e and the gaseous diffusion coefficient in disturbed or intact forest floor samples.

22. ———. 1971. Role of humic carrier substances in DDT movement through forest soil. Soil Sci. Soc. Am. Proc. 35(1):145-147. KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, PESTICIDE, MOVEMENT, SOIL

Thirty times as much DDT was recovered by leaching with water when urea was present to disperse the humic acids. A method using Alundum tension lysimeters yielded no detectable amount of DDT. In DDT-treated humic extracts, 91% of phosphorous, oxygen, and DDT was recovered.

23. BARTOO, N. 1970. Taylor Creek in Dead Horse Canyon. Unpubl. MS, (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 10 p. (Typewritten) KEYWORDS: BIOLOGICAL, SURVEY, STREAM, LAKE WASH

Contains information on chemical, physical, and biological data with a partial history of the creek. Fish species found include cutthroat trout, coho salmon, steelhead trout, and three species of cottids.

24. ———. 1972. The vertical and horizontal distributions of northern squawfish (*Ptychocheilus oregonensis*), peamouth (*Mylocheilus caurinus*), yellow perch (*Perca flavescens*), and adult sockeye salmon (*Oncorhynchus nerka*) in Lake Washington. M.S. thesis, Univ. Washington, Seattle. 60 p. KEYWORDS: ABUNDANCE, DISTRIBUTION, FISH, FRESHWATER, GILL NET, LAKE WASH, SAMPLING

Summarizes the vertical and horizontal distribution of four abundant species in Lake Washington by season. These data were to be used to design a time schedule that would provide adequate sampling of fish to determine their relative abundance and biomass.

25. BARTOO, N., R. HANSEN, and R. WYDOSKI. 1972. A portable vertical gill net system. Intern. Rep. 42, US/IBP Coniferous Forest Biome, Univ. Wash. AR-10, Seattle (in press). KEYWORDS: DESCRIPTION, FISH, FRESHWATER, GILL NET, LAKE, SAMPLING

Description of the gear, method of operation, and effectiveness of gill nets in sampling fish to determine their vertical and horizontal distribution. These nets were designed to be used in a systematic sampling scheme of benthic and littoral fish in the Lake Washington drainage.

26. BAUER, D. H. 1971. Carbon and nitrogen in the sediments of selected lakes in the Lake Washington drainage. M.S. thesis, Univ. Washington, Seattle. 91 p. KEYWORDS: CARBON, LAKE, NITROGEN, SEDIMENT

Summarizes data on depth, total carbon, exchangeable ammonium ion, total nitrogen, carbon-nitrogen ratio, percentage of clay, and the cation exchange capacity of the sediments from Lakes Washington and Sammamish, Chester Morse Reservoir, and Findley Lake.

27. BECKER, C. D. 1964. The parasite-vector-host relationship of the hemoflagellate *Cryptobia salmositica* Katz, the leech *Piscicola salmositica* Meyer, and certain freshwater teleosts. Ph.D. thesis, Univ. Washington, Seattle. 200 p. KEYWORDS: FISH, FRESHWATER, PARASITE

Reviews the literature and summarizes the life history of *Cryptobia*. The parasite was found in the coastrange sculpin, and coho, chinook, and sockeye salmon in the Lake Washington drainage, including the

University of Washington ponds, Hiram M. Chittenden Locks, Cedar River, and Issaquah Creek.

28. BECKER, C. D., and M. KATZ. 1965. Distribution, ecology, and biology of the salmonid leech, *Piscicola salmositica* (Rhynchobdellae: Piscicolidae). J. Fish. Res. Board Can. 22(5):1175-1195. KEYWORDS: FISH, FRESHWATER, PARASITE

Describes the life history of this leech that was collected from chinook, coho, and sockeye salmon in the Lake Washington drainage.

29. ———. 1965. Infections of the hemoflagellate, *Cryptobia salmositica* Katz, 1951, in freshwater teleosts of the Pacific Coast. Trans. Am. Fish. Soc. 94(4):327-333. KEYWORDS: FISH, FRESHWATER, PARASITE

Infections of the hemoflagellate *Cryptobia salmositica* occurred in 16 species of teleosts from southern British Columbia to northern California. *C. salmositica* was found in the blood of teleosts where the leech vector *Piscicola salmositica* occurred, an environment characterized by streams of low temperature, graveled beds, and moderate to swift currents. Specific information is given on infections of fish in the Lake Washington drainage.

30. BELL, M. C. 1967. Projected water needs for fish and wildlife, Appendix D (44 p.). IN: An initial study of the water resources of the State of Washington, Vol. I, A first estimate of future demands for water in the State of Washington. Wash. State Water Resour. Cent., Pullman. KEYWORDS: FISH, WATER, WILDLIFE

Deals with the question of the quantity of flow or volume as related to the total water resources for fish and wildlife. Provides a table that projects the water needs for fish and wildlife in thousands of acre feet by the years 1980 and 2020. The basic flow figures are based on spawning requirements of salmonid fishes. Data for the Lake Washington drainage are given under basin no. 8.

31. BELLEVUE PLANNING DEPARTMENT. 1972. Bellevue comprehensive plan--701 study. Planning Department, City of Bellevue, Wash. 7 vol. KEYWORDS: LAKE WASH, LAKE SAMM, WATERSHED, URBAN, MANAGEMENT, HISTORY, ECONOMICS, POPULATION.

A detailed summary of Bellevue, Washington, and the land between Lakes Washington and Sammamish. The seven volumes are titled as follows: Environmental Focus (climate, topography, drainage basins, erosion potential, stream problems, etc.) 84 p., Land Use (historical land use, comprehensive planning, etc.) 36 p. + 3 appendixes, Economic Study (covers land use patterns with a focus on the central business district, commercial and manufacturing)

42 p. + 4 appendixes, People (summary of age, race, characteristics) 31 p. + 1 appendix, Housing (history and trends in population density, housing units) 64 p., Neighborhoods (inventory and analysis) 47 p. + 1 appendix, Trends (suburbanization compared with national trends) 48 p. + 1 appendix.

32. BENDER, D. L. 1967. Water resources research needs in the State of Washington. Wash. State Water Resour. Cent., Pullman, Rep. No. 1. 96 p. KEYWORDS: WASHINGTON, WATER, RESOURCES

A compilation of ideas and suggestions expressed in reports by professors in the water resources field at the University of Washington and Washington State University on water resource research needs. Each subject reports accounts for the basic water resource problems: water quality, water quantity, estimates of growth, storage, interregional diversion, and planning.

33. BENSON, W. W. 1967. A study of the periphyton of Lake Washington. M.S. thesis, Univ. Washington, Seattle. 88 p. KEYWORDS: LAKE WASH, PERIPHYTON, PRODUCTION

Annual production cycle of periphyton in Lake Washington parallels the cycle of the phytoplankton. Colonization rates, production rates, and carrying capacities vary throughout the year. During the summer, nutrient depletion by the phytoplankton affects the carrying capacity through reduction of growth rates and changes in species composition in the association. Net annual periphyton production in Lake Washington appears to be two to three times greater than any other lake studied in the area.

34. BERGGREN, T. J. 1971. A life history study on black crappie of Lake Washington. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 17 p. (Typewritten) KEYWORDS: AGE-GROWTH, FISH, LAKE WASH

Provides a length-weight relationship and back calculations of growth for 111 black crappie collected from Lake Washington between April and June 1970.

35. BOATMAN, L. 1966. A study of the mosses at Cedar River watershed. Unpubl. MS (Undergrad. Res. Program--Prof. Cole), Coll. For. Resour., Univ. Wash., Seattle. 42 p. (Typewritten) KEYWORDS: ABUNDANCE, CEDAR RIVER, DISTRIBUTION, MOSS

Includes identification, distribution, quantitative estimates, growth, and chemical composition of the various mosses in the Cedar River watershed. *Eurhynchium oreganum* was the predominant moss in the watershed and was found in Douglas-fir and alder communities.

36. BODHAINE, G. L., B. L. FOXWORTHY, J. F. SANTOS, and J. E. CUMMANS. 1963. The role of water in shaping the economy of the Pacific Northwest. U.S. Dep. Inter., Geol. Surv., Tacoma, Wash. 317 p. KEYWORDS: ECONOMY, NORTHWEST, WATER

Describes the geographic and hydrologic environment; summaries of the surface water, groundwater, and relation of ground- and surface water are provided for the Lake Washington basin under power supply area 43. Also summarizes the historic, present, and future uses of water, quantities required, supplies available, water resources versus current and prospective uses, and potential growth of the Pacific Northwest.

37. BODHAINE, G. L., and W. H. ROBINSON. 1952. Floods in western Washington--Frequency and magnitude in relation to drainage basin characteristics. U.S. Dep. Inter., Geol. Surv. Circ. 191. 124 p. KEYWORDS: FLOOD, WEST WASH

Summarizes the dates, gage height in feet, and discharge in cubic feet per second for floods at various stations in the Lake Washington basin (p. 84-90). The number of water years varies by station, and the range varies from 1896 to 1951.

38. BOHLE, M. S. 1972. Age and growth of peamouth (*Mylocheilus caurinus*) from Lake Washington. Unpubl. MS (Fish. 499--Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 18 p. (Typewritten) KEYWORDS: AGE-GROWTH, FISH, LAKE WASH

Provides a body-scale relationship, length-weight relationship, and an analysis of the age and growth for this abundant cyprinid from Lake Washington.

39. BOJORQUEZ, L., D. GRIGGS, D. HENRY, and H. HOLM. 1971. Stream survey of Kelsey and Coal Creeks--Fish population study. Unpubl. MS (GIS 397--Prof. Welch, Whitney, Wydoski), Coll. Fish., Univ. Wash., Seattle. 30 p. (Typewritten) KEYWORDS: ABUNDANCE, BIOMASS, FISH, FRESHWATER, STREAM

Preliminary study of the fish populations in these two eastern tributaries to Lake Washington. Estimates of population size and biomass were made for different sections of each stream.

40. BOUGHNER, R. C. 1954. An investigation of subsurface water currents in Lake Washington around Mercer Island, including design of suitable floats. M.S. thesis, Univ. Washington, Seattle. 34 p. KEYWORDS: WATER, CURRENT, LAKE WASH

Study of residual currents and wind-induced currents in Lake Washington during winter and spring months. There exists a prevailing southerly current on the east side of Mercer Island that flows like a river. Surface currents to the 3-m level occurred on the east side of Mercer Island until the water passed the island's southern end.

41. BRENNAN, B. M. 1939. Spawning area in the Cedar River. Unpubl. MS, Lake Wash.--Cedar River file, 1936-1969, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: CEDAR RIVER, SPAWNING, SALMON

Construction of the diversion dam at Landsburg reduced the spawning area in the Cedar River by an estimated 50%. It was recommended that the fish be allowed to cross the pipeline and proceed to the water supply dam, where a fishway would bypass the dam and thereby allow access for the salmon to the upper Cedar River.

42. BRETZ, J. H. 1910. Glacial lakes of Puget Sound. J. Geol. 18:448-458. KEYWORDS: GLACIAL, LAKE, WASHINGTON

Topography of Puget Sound at the advance of the Vashon Glaciation was closed on the east and west by mountain ranges, open to the south by a low gravel plain, and open to the north from where the glacier came. When the ice sheet retreated, water accumulated at the ice front to the south and spread across the land forming many glacial lakes.

43. BRIX, R. 1970. A weight-length relationship for the peamouth chub, *Mylocheilus caurinus*. Unpubl. MS (Fish. 499--Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 13 p. (Typewritten) KEYWORDS: FISH, FRESHWATER, MODEL

Presents the length-weight relationship for 87 female peamouth chubs collected from Lake Washington. Also, the percentage of spent females was followed between January and May to determine the time of spawning for this species.

44. BROWN AND CALDWELL, CIVIL AND CHEMICAL ENGINEERS. 1958. Metropolitan Seattle sewerage and drainage survey: A report for the City of Seattle, King County, State of Washington. Seattle, Wash. 558 p. + appendix. KEYWORDS: ECONOMY, POLLUTION, SEWAGE, SURVEY, WATER

A report of a survey covering the following: major sewage and drainage problems then confronting the metropolitan Seattle area; the objectives, scope, and procedures of the survey; a chronological history of sewerage development and events; physical and economic environmental factors as they relate to the future growth and development of metropolitan Seattle; a description of the existing facilities (sewerage, sewage disposal, and drainage); the characteristics of the sewage to be dealt with; and environmental and economic effects of then current deficiencies. Before developing sewerage and drainage facilities, detailed planning should account for costs, legal requirements of waste disposal, beneficial water uses to be protected, characteristics of potential receiving waters, and potential waste disposal sites. Lists all the possible alternatives when building the sewerage and drainage facilities. Comparison of alternative plans is based on costs, duplication of operation, interference with business activity, quality of effluents,

expansion of facilities, simplicity of processes, and esthetic considerations. Finally, recommendations pertaining to design, construction, and financing of the proposed sewerage and drainage facilities are provided.

45. BROWN, L. G. 1968. A study of the age and growth of black crappie (*Pomoxis nigromaculatus*) in Lake Washington. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 20 p. (Typewritten) KEYWORDS: AGE-GROWTH, FISH, FRESHWATER, LAKE WASH

An excellent summary of age, growth, and food habits of black crappie in Lake Washington. Back calculations of growth for this species in this area are compared with other locations in the United States.

46. BUCKLEY, R. M. 1962. Resident races in Pacific Northwest salmon of the genus *Oncorhynchus* with a special section of "residual" Lake Washington chinook, *Oncorhynchus tshawytscha*. Unpubl. MS (Fish. 499--Prof. DeLacy), Coll. Fish., Univ. Wash., Seattle. 21 p. (Typewritten) KEYWORDS: FISH, LAKE WASH, SALMON

Review of the literature on resident races of Pacific Northwest salmon of the genus *Oncorhynchus* and preliminary summary of work done by the Washington State Department of Fisheries on resident chinook salmon in Lake Washington.

47. ———. 1964. Incidence of beach spawning sockeye salmon in Lake Washington and Lake Sammamish. Wash. State Dep. Fish. Ann. Rep. 75(1964):28-29. KEYWORDS: FISH, LAKE, SPAWNING, SALMON

Small gravel substrate indicated favorable spawning habitat for sockeye salmon along east and west shorelines of Lake Sammamish and the east shoreline of Lake Washington at Pleasure Point, Bellevue, Enatai Beach, and Juanita Point. Spawning activity was in the first meter of water.

48. BUCKRIDGE, T. N. 1956. A study of hybridization of cutthroat trout (*Salmo clarkii*) as a management practice. M.S. thesis, Univ. Washington, Seattle. 50 p. KEYWORDS: FISH, FRESHWATER, HYBRID

Study was part of a long-range hybrid program of cutthroat trout from Lake Whatcom and University of Washington stocks. The university stock originated from trout collected in Thornton (Matthews) Creek, a western tributary to Lake Washington.

49. CAMPBELL, M. S. 1943. Sources and extent of Lake Washington pollution. Wash. State Pollut. Control Comm. Pollut. Ser. Bull. 29. 37 p. KEYWORDS: BACTERIA, LAKE WASH, POLLUTION, SEWAGE

Washington State Department of Health's findings from bacteriological analysis showed that Lake Washington was contaminated in areas at the north and south end and on the east shore, and was unsafe for domestic use without adequate treatment. A total of 1468 premises on the lakeshore were sampled: 19% discharged domestic wastes into the lake, 37% used lake water for domestic purposes, and 29% of these used no form of chlorination.

50. CHASAN, D. J. 1971. The Seattle area wouldn't allow death of its lake. Smithsonian 2(4):6-13. KEYWORDS: HISTORY, LAKE WASH

Popular historical review of changing the eutrophic condition of Lake Washington. Discusses how concerned citizens took up the politics of antipollution and succeeded in cleaning up the lake.

51. CHASE, M. 1921. Monthly and yearly summaries of hydrometric data in the State of Washington: 1878-1920. Wash. State Dep. Conserv. Dev., Div. Water Resour., Water Supply Bull. 1. 140 p. KEYWORDS: HYDROLOGY, STREAMFLOW, WASHINGTON

A summation of all official records pertaining to streamflow in the State of Washington, kept by the U.S. Geological Survey, the U.S. Reclamation Service, U.S. Weather Bureau, U.S. Forest Service, U.S. Office of Indian Affairs, and private irrigation and power companies prior to the establishment of the Division of Water Resources of the Department of Conservation and Development in 1921. Good coverage of streamflows in the Puget Sound drainage, prior to the diversion of the Cedar River from the Duwamish River.

52. CLARKE, E. 1967. How Seattle is beating water pollution. Harper's 234:91-95. KEYWORDS: POLLUTION, SEWAGE, LAKE WASH

METRO (Municipality of Metropolitan Seattle) is Seattle's solution to water pollution. Solutions and failures in 1958 and 1967 are discussed. METRO includes raw sewage treatment plants at Renton, West Point in Seattle, and soon a 3.2-km tunnel under downtown Seattle that will intercept all the lines still discharging raw sewage into Elliott Bay. History of Pollution, shift of sewage dumping from Lake Washington into Elliott Bay in the 1930s, growth of the east side population, and effects of sewage increases on Lake Washington are discussed.

53. COLE, D. W. 1966. The forest soil: Retention and flow of water. Proc. Soc. Am. For. 1966:150-154. KEYWORDS: CONIFEROUS, FOREST, SOIL, WATER

Summarizes the flow and retention of water in a forest soil in the Cedar River watershed, as related to rainfall and soil depth, as well as to forested and clearcut conditions.

54. ———. 1968. A system for measuring conductivity and flow in a forest soil. Water Resour. Res. 4(5):1127-1136. KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, WATER, FLOW, SOIL

An integrated system has been developed for collecting, recording, and analyzing data describing the behavior of water flowing through a forest soil in the Cedar River watershed. This system includes tension lysimeters installed in such a way that the overlying soil and rooting systems are undisturbed. Solutions collected during periods of flow are passed through flow cells measuring conductivity, acidity, and rate of water flow. The sensitivity of the soil measure flowmeter is in excess of 0.002 cm hr^{-1}. The electrical output from the flow, coupled to a data logging facility, is printed as perforations in paper tape. Computer analysis converts these data to tabular and graphic form.

55. ———. 1971. Elemental demands, cycling and loss of elements from a forest ecosystem. Unpubl. MS, Workshop on nutritional problems and practices on forest land (19, 20, 21 Jan.), Lake Wilderness Center, Maple Valley, Wash. Sponsored by the College of Forest Resources, Univ. Washington, Seattle. 15 p. (Typewritten) KEYWORDS: CEDAR RIVER, WATERSHED, ELEMENT, DEMAND, MINERAL CYCLE, CONIFEROUS, FOREST, ECOSYSTEM

Examines the basic processes of a forest ecosystem in the Cedar River watershed. The study includes the basic characteristics of the forest ecosystem, the distribution of elements, cycling, transfer mechanisms and pathways, seasonal trends in net nitrogen flux, ionic and conductivity changes, uptake of elements by the forest, and transfer of elements through the soil profile.

56. COLE, D. W., and T. M. BALLARD. 1969. Mineral and gas transfer in a forest floor--A phase model approach. IN: C. T. Youngberg and C. B. Davey (eds.), Tree growth and forest soils, p. 347-358. Oregon State Univ. Press, Corvallis. KEYWORDS: CONIFEROUS, FOREST, MINERAL, SOIL, MODEL

A phase model approach is recommended for studies of mineral and gas transfer in the forest floor. Components of interest are sought within solid, liquid, and gas phases. Transfer within and between phases can often be dealt with in terms of simple physical and mathematical models. This approach allows a variety of nondestructive ecosystem monitoring techniques. Analysis of physical transfer data can permit inferences about many chemical and biological processes, and relationships between solid and liquid phases are examined for several nutrient elements. Gas phase relationships are illustrated by carbon dioxide exchange data.

57. COLE, D. W., and S. F. DICE. 1969. Biomass and nutrient flux in coniferous forest ecosystems--The development of a quantitative ecological approach. IN: R. D. Taber (ed.), Proc. Symp. Coniferous

For. North. Rocky Mt., Univ. Mont., Missoula, 17-20 Sept. 1968, p. 55-70. KEYWORDS: CONIFEROUS, FOREST, BIOMASS, NUTRIENT, CYCLE, SOIL

Many types of accumulations and redistributions occur as a forest ecosystem develops. Although the most dramatic of these is the accretion of organic material through vegetative growth, there are concurrent processes of uptake and accumulation producing a buildup of nutrients within the vegetation. This development in terms of biomass and nutrients is neither steady nor unidirectional, but is best represented as a complex of cycles producing transfer within the system. Elemental cycling and biomass redistribution are discussed in terms of nutrient uptake and accumulation, primary production, return to the forest floor, nutrient movement through forest floor and soil, and short-term nutrient flux. General models are presented to illustrate the interrelationship between components of the ecosystem and their connecting pathways.

58. COLE, D. W., and S. P. GESSEL. 1965. Movement of elements through a forest as influenced by tree removal and fertilizer additions. IN: C. T. Youngberg (ed.), Forest-soil relationships in North America, p. 95-104. Oregon State Univ. Press, Corvallis. KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, ELEMENT, MOVEMENT, SOIL

The influence of clearcutting and fertilizer additions on movement of elements through a forest soil was evaluated in a tension lysimeter study at the Cedar River watershed. Tension lysimeters were installed beneath the forest floor and at 91 cm depth in four 0.04-ha (0.1-acre) plots. One plot was clearcut, two plots received 37 kg ha^{-1} (200 lb/acre) nitrogen, as urea on one plot and as ammonium sulfate on the other. The final plot remained untreated. Leachates were collected monthly for 10 months from all plots; flow volume and levels of nitrogen, phosphorus, potassium, and calcium were determined.

59. ———. 1968. Cedar River research--A program for studying pathways, rates, and processes of elemental cycling in a forest ecosystem. Univ. Wash., For. Resour. Monogr., Contrib. 4. 53 p. KEYWORDS: CEDAR RIVER, WATERSHED, DESCRIPTION, MINERAL CYCLE, CONIFEROUS, FOREST, ECOSYSTEM

A unified perspective of the Cedar River research program is presented. Background information on the location, geologic history, soil types, vegetative cover, climate, and plot layouts provides a description of the experimental area. Details are given on the design and field operation of the important instrumentation, specifically, the tension lysimeter, water flowmeters, acidity and conductivity flowmeters, stemflow gages, and forest floor decomposition cuvettes. The collection of data from these and other instruments and their automatic recording on punched paper tape is described. An outline is given of the further data processing by computer.

Major research results in the fields of mineral and water transfer are summarized. The studies have been under both natural and altered ecosystem conditions.

60. COLE, D. W., S. P. GESSEL, and S. F. DICE. 1967. Distribution and cycling of nitrogen, phosphorus, potassium and calcium in a second-growth Douglas-fir ecosystem. IN: H. E. Young (chm.), Proc. Symp.: Primary Productivity and Mineral Cycling in Natural Ecosystems, p. 193-197. Univ. Maine Press, Orono. KEYWORDS: CEDAR RIVER, WATERSHED, NITROGEN, PHOSPHORUS, MINERAL CYCLE, SOIL

The distribution and transfer of elements was followed in a second-growth Douglas-fir ecosystem at the Cedar River research area. The ecosystem consists of a 36-year-old Douglas-fir plantation located on glacial outwash soil. Data are presented for the dry matter, nitrogen, phosphorus, potassium, and calcium. Rates of elemental transfer were measured between the forest and the forest floor, between the forest floor and mineral soil, and through the soil system. Uptake rates of the vegetation, calculated from redistribution patterns within the vegetation, are reported. The efficiency of elemental utilization by the vegetation and change in the elemental status of the soil through elemental uptake are discussed.

61. COLE, D. W., and C. C. GRIER. 1972. Mineral cycling in Douglas-fir--Intensive study progress report. Intern. Rep. 19, US/IBP Coniferous For. Biome, Univ. Wash. AR-10, Seattle. 5 p. KEYWORDS: CONIFEROUS, FOREST, CEDAR RIVER, WATERSHED, MINERAL CYCLE

Outlines intensive studies of mineral cycling in young-growth Douglas-fir stands at the Thompson Research Center since 1966.

62. COLE, D. W., and P. S. MACHNO. 1969. Factors affecting percolation in forest soils. IN: A. H. Laycock (ed.). Water balance in North America, p. 101-109. Am. Water Resour. Assoc. Proc. Ser. 7. KEYWORDS: CONIFEROUS, FOREST, WATER, FLOW, SOIL

Variation in percolation in a forest soil depends upon soil properties such as pore size, distribution, and layering, and partly on external properties of the system such as rates and duration of precipitation and water used by vegetation. The principles of soil moisture retention and soil water flow are applied to understanding this variation. Techniques discussed for measurement of percolation include soil moisture resistance units, neutron probes, tensiometers, psychrometers, and lysimeters. It was found that the lag time between the peak precipitation rate and peak flow rate of water through the forest floor is highly correlated with the length of the dry period before the storm.

63. COLLIAS, E. E., and G. R. SECKEL. 1954. Lake Washington Ship Canal data. Dep. Oceanogr., Univ. Wash., Spec. Rep. 2. 27 p. KEYWORDS: FRESHWATER, LIMNOLOGY, LAKE WASH, CANAL

Provides physical and chemical data that were collected by the Department of Oceanography on Lakes Union and Washington and Salmon Bay in the ship canal from 29 Nov. 1950 through 22 Dec. 1953.

64. COLUMBIA BASIN INTERAGENCY COMMITTEE. 1948. Principal hydroelectric power projects in the Pacific Northwest: The Columbia Basin Interagency Committee and the Pacific Northwest. Columbia Basin Interagency Committee, Box 4208, Portland, Oreg. 97209. KEYWORDS: WATER, POWER, NORTHWEST

The appendix provides a list of hydroelectric power projects, operating agencies, locations, capacities, and federal authorization.

65. ———. 1964a. Water and power resources report for the North Cascades Mountain study. Columbia Basin Interagency Committee, Box 4208, Portland, Oreg. 97209. 41 p. + appendix. KEYWORDS: WATER, POWER, RESOURCES

A study of all resource potential of the federal lands in the North Cascade Mountains in the State of Washington. Includes tables, charts, and plates. Plates are unusually good maps showing drainage basins by county, core area and influence zone, streamflow runoff from Oct. 1952 to Sept. 1962, potential groundwater yields, irrigation development, and major coal-bearing areas.

66. ———. 1964b. Multiple-purpose water development and control, including flood control and navigation: The Cedar River--Lake Washington basin, Washington. Section F, Water and power resources report for North Cascade Mountain study. Part II, Specific investigations, p. 137-144. Columbia Basin Interagency Committee, Box 4208, Portland, Oreg. 97209. KEYWORDS: WATER, RESOURCES, MANAGEMENT

Reviews location of watershed, influence of the City of Renton on the river, farmland uses in the basin, climate, mean annual flows in the Cedar River, City of Seattle's water and power projects, rechanneling, flood damage, federal flood control and drainage improvement, construction of Lake Washington Ship Canal and locks, navigation, and multiple-purpose development (additional flood control, power production and water supply, anadromous fish runs, etc.). Map shows existing and potential power plants.

67. ———. 1965. Coordinated comprehensive river basin planning estimates, fiscal year 1967: Puget Sound and adjacent water basin study. Columbia Basin Interagency Committee, Box 4208, Portland,

Oreg. 97209. 20 p. + appendix. KEYWORDS: MANAGEMENT, RIVER, WATERSHED, ECONOMICS, RESOURCES

The Army Corps of Engineers was authorized to make a comprehensive study of Puget Sound and adjacent waters by the Flood Control Act of 1962, Section 209, Public Law 87-874. In June 1963 the Columbia Basin Interagency Committee was organized to prepare coordinated estimates for the Puget Sound study. The Cedar and Sammamish Rivers are covered in the report. Topics considered include regional economics studies, land use and development, hydrologic studies, power, fisheries and wildlife, municipal and industrial water supply, water quality control, recreation, forest and mineral resources, and flood control.

68. COLUMBIA--NORTH PACIFIC TECHNICAL STAFF. 1970. Columbia--North Pacific region comprehensive framework study of water and related lands. Pacific Northwest River Basins Comm., Box 908, Vancouver, Wash. KEYWORDS: MANAGEMENT, WATER, WATERSHED

Separate appendixes published by the commission are as follows: (I) History of study, (II) The region, (III) Legal and administrative background, (IV) Land and mineral resources, (V) Water resources, (VI) Economic base and projections, (VII) Flood control, (VIII) Land measures and watershed protection, (IX) Irrigation, (X) Navigation, (XI) Municipal and industrial water supply, (XII) Water quality and pollution control, (XIII) Recreation, (XIV) Fish and wildlife, (XV) Electric power, and (XVI) Comprehensive framework plan.

69. COMIS, J. G. 1970. A general survey of Coal Creek. Unpubl. MS, Garbage Utility Dep., City of Seattle, Wash. 37 p. (Typewritten) KEYWORDS: FRESHWATER, STREAM, SURVEY

A preliminary survey of Coal Creek that contains information on the flora and basic water chemistry, bottom fauna, and fish.

70. COMIS, J. G. et al. 1971. Stream ecology study: An interdisciplinary watershed study of Kelsey and Coal Creeks, King County, Washington. Water Air Resour. Div., Dep. Civil Eng., Univ. Wash., Seattle. 193 p. KEYWORDS: ECOSYSTEM, FRESHWATER, STREAM

This study summarizes an intensive effort for 15 weeks by 28 students from various disciplines. The study was organized into four major sections, physical, biological, water quality, and applied, with an overall objective of studying the problems of urbanization on small watersheds.

71. COMITA, G. W. 1953. A limnological study of planktonic copepod populations. Ph.D. thesis, Univ. Washington, Seattle. 195 p. KEYWORDS: ARTHROPOD, LAKE WASH, LIMNOLOGY, PLANKTON, POPULATION, PELAGIC

The dominant calanoid populations of three Washington State lakes, Washington, Chase, and Snohomish, and of one arctic lake in Alaska were studied. Species development, egg production, time of maximum population, duration of larval instars, average size of the animal during each instar, and sex ratios were covered.

72. COMITA, G. W., and G. C. ANDERSON. 1959. The seasonal development of a population of *Diaptomus ashlandi* Marsh and related phytoplankton cycles in Lake Washington. Limnol. Oceanogr. 4(1):37-52. KEYWORDS: PHYTOPLANKTON, POPULATION, CYCLE, LAKE WASH

A study of a *Diaptomus ashlandi* population and the simultaneous phytoplankton cycles in Lake Washington.

73. CONEY, B. 1969. Sockeye abound in Lake Washington but forget it, sportsmen, they don't bite. Pacific Search 3(10):(unnumbered). KEYWORDS: FISH, LAKE WASH, RECREATION, SALMON

A popular article on the growing sockeye salmon population in the lake and the potential for sport and commercial fisheries.

74. CORNELL, HOWLAND, HAYES AND MAEERFIELD, ENGINEERS AND PLANNERS. 1965. A report on an engineering investigation of the municipal water system. City of Renton, Wash. 77 p. + appendixes. KEYWORDS: MANAGEMENT, WATER

An investigation of Renton's municipal water system concluded that the water supply was adequate for then current needs, and that there was ample water available to meet all demands through 1985.

75. CRANE, W. J. B. 1972. Urea-nitrogen transformation, soil reactions, and elemental movement via leaching and volatilization in coniferous forest ecosystems following fertilization. Ph.D. thesis, Univ. Washington, Seattle. 284 p. KEYWORDS: CONIFEROUS, ECOSYSTEM, FERTILIZER, LEACHING, NUTRIENT, CYCLE, NITROGEN

A comprehensive descriptive and predictive model of soil/urea chemistry and behavior in a coniferous forest ecosystem on the Cedar River. Specific aspects concern the ureolysis and nitrification transforms of urea, soil reaction, and elemental movement by leaching and volatilization. Rainfall is studied as a major variable throughout. The thesis approaches several applied environmental aspects of nitrogenous forest fertilization.

76. CRANE, W. J. B., D. W. COLE, and S. P. GESSEL. 1971. Forest soil/urea-N chemistry--Research at the University of Washington. Unpubl. MS, Coll. For. Resour., Univ. Wash., Seattle. 8 p. (Typewritten) KEYWORDS: CONIFEROUS, FOREST, ION, MINERAL CYCLE, NITROGEN, SOIL

Describes the research program on forest soil chemistry as related to nitrogen cycling on the Thompson Research Center on the Cedar River.

77. CRUTCHFIELD, J. A., J. A. ADAMS, and W. R. BUTCHER. 1967. Demand for water-based outdoor recreation, Appendix E (56 p.). IN: An initial study of the water resources of the State of Washington, Vol. I, A first estimate of future demands for water in the State of Washington. Wash. State Water Resour. Cent., Pullman. KEYWORDS: DEMAND, FRESHWATER, RECREATION

Summarizes projected demand for water-based recreation for the Northwest. Lake Washington was listed among the 10 largest contributors to the freshwater salmon catch in 1964. Also provides other information on the projected demand for other water-based recreation such as demand for spiny-ray fishing, pleasure boating, use of parks, and so on, that can be applied to recreation in Lake Washington and Lake Sammamish.

78. DALSEG, R. D., and R. J. HANSEN. 1969. Bacteriological and nutrient budget of the Sammamish River; study period March 1967--Feb. 1969. Municipality of Metropolitan Seattle, Wash. 18 p. KEYWORDS: BACTERIA, NUTRIENT, SAMM RIVER

It was estimated that 36% of total phosphorus and 28% of the total nitrate-nitrogen load entering Lake Washington enters from the Sammamish River. Provides data on the nutrient contribution (ammonia, nitrates, phosphates) from the origin of the Sammamish River, Swamp Creek, North Creek, Bear Creek, Evans Creek, and at the mouth of the Sammamish River. Also gives monthly averages of ammonia, nitrites, and nitrates and phosphates from June 1967 until Feb. 1969. Summarizes total and fecal coliform counts.

79. DALSEG, R. D., G. W. ISAAC, and R. I. MATSUDA. 1966. A survey of stream conditions in Issaquah Creek. Munic. Metrop. Seattle, Water Qual. Ser. 3. 24 p. KEYWORDS: STREAM, SURVEY, WATER QUALITY

Lake Sammamish was undergoing eutrophication. The major cause was the contribution of nutrients from its major tributary, Issaquah Creek.

80. DANIELSON, R. M. 1965. A preliminary study of the soil- and litter-inhabiting mesofauna of several forest sites in the Douglas-fir region. Unpubl. MS (Undergrad. Res. Program--Prof. Gessel), Coll. For. Resour., Univ. Wash., Seattle. 125 p. (Typewritten) KEYWORDS: CONIFEROUS, FAUNA, SOIL

Summarizes the quantity and quality of the soil fauna on a variety of forest sites in the Douglas-fir community. Samples of the forest

floor and soil fauna were analyzed for nitrogen, carbon, carbon-nitrogen ratio, and manganese. Photographs (color and black-and-white) and descriptions of selected families of animals are also provided.

81. DART, J. D. 1952. The changing hydrologic pattern of the Renton-Sumner Lowland, Washington. Yearb. Assoc. Pac. Coast Geogr. 14:19-23. KEYWORDS: CEDAR RIVER, HYDROLOGY

Follows changes that made the Cedar River the major inlet into Lake Washington.

82. DELACY, A. C., L. R. DONALDSON, and E. L. BRANNON. 1969. Spawning behavior of chinook salmon. Univ. Wash. Coll. Fish. Res. Fish. Contrib. 300:59-60. KEYWORDS: BEHAVIOR, SPAWNING, SALMON

Homing behavior study of *Oncorhynchus tshawytscha*, chinook salmon, in Lake Washington.

83. DICE, S. F. 1970. The biomass and nutrient flux in a second-growth Douglas-fir ecosystem (a study in quantitative ecology). Ph.D. thesis, Univ. Washington, Seattle. 165 p. KEYWORDS: CONIFEROUS, FOREST, BIOMASS, NUTRIENT, MODEL

Mathematical models of biomass flux and nutrient flux in a forest ecosystem.

84. DICE, S. F., and D. W. COLE. 1972. The utility of regression techniques for estimating biomass of second-growth Douglas-fir. Unpubl. MS, Coll. For. Resour., Univ. Wash., Seattle. 21 p. (Typewritten) KEYWORDS: CONIFEROUS, FOREST, BIOMASS, NUTRIENT, MODEL

Provides biomass estimates of second-growth Douglas-fir from regression techniques that use easily derived dimensions of the trees.

85. DOBBIN, C. N. 1933. Freshwater Ostracoda of Washington. M.S. thesis, Univ. Washington, Seattle. 57 p. KEYWORDS: FAUNA, FRESHWATER, WASHINGTON

A key to the freshwater Ostracoda found in Washington, together with descriptions of the genera and brief descriptions and drawings of the species.

86. DONALDSON, L. R. 1970. Selective breeding of salmonid fishes. IN: W. J. McNeil (ed.), Marine aquaculture, p. 65-74. Oregon State Univ. Press, Corvallis. KEYWORDS: FISH, BREEDING, REPRODUCTION

Summarizes data on the selective breeding of chinook salmon and rainbow trout at the University of Washington with an emphasis on growth and fecundity. Both species have been liberated in the Lake Washington drainage.

87. DONALDSON, L. R., and G. H. ALLEN. 1958. Return of silver salmon, *Oncorhynchus kisutch* (Walbaum), to point of release. Trans. Am. Fish. Soc. 87(1957):13-22. KEYWORDS: ESCAPEMENT, LAKE WASH, SALMON

Silver salmon were transferred after a year of rearing at the Soos Creek hatchery to the Lake Washington watershed where 36,833 were reared for two months at the Issaquah hatchery (right ventral mark) and 34,405 were reared for two months at the University of Washington hatchery (left ventral mark) before they were released. Returning salmon were recovered at their point of release rather than their native stream.

88. DONALDSON, L. R., D. D. HANSLER, and T. N. BUCKRIDGE. 1957. Interracial hybridization of cutthroat trout, *Salmo clarkii*, and its use in fisheries management. Trans. Am. Fish. Soc. 86(1956):350-360. KEYWORDS: BREEDING, FISH FRESHWATER

Initial stock for experiments at the University of Washington were obtained in 1933 from Thornton (Matthews) Creek, which is a northeastern tributary of Lake Washington. Field testing was made in Echo Lake, northeast of Seattle.

89. DONALDSON, L. R., and D. MENASVETA. 1961. Selective breeding of chinook salmon. Trans. Am. Fish. Soc. 90(2):160-164. KEYWORDS: BREEDING, SALMON

Fish for the initial experiments were obtained from the Soos Creek hatchery. The progeny of these fish were planted in Lake Union and later returned to the ponds at the University of Washington where selective breeding, since 1949, has produced stocks of chinook salmon that are more resistant to high temperature and disease, mature earlier, and have a higher survival rate than nonselected stocks.

90. DONALDSON, L. R., and P. R. OLSON. 1957. Development of rainbow trout brood stock by selective breeding. Trans. Am. Fish. Soc. 85(1955):93-101. KEYWORDS: BREEDING, FRESHWATER, FISH

Describes the selective breeding of rainbow trout at the University of Washington for over 23 years. Gives data on age, length-weight relationships, and fecundity. Releases of these fish have been made in Lake Washington.

91. DRIGGERS, V. W. 1964. Tracer dye studies of Lake Union and Bellingham Bay. M.S. thesis, Univ. Washington, Seattle. 73 p. KEYWORDS: FLOW, LAKE, WATER

Rhodamine B dye was used to examine the transport phenomenon in Lake Union and in Bellingham Bay.

92. DRYFOOS, R. L. 1965. The life history and ecology of the longfin smelt in Lake Washington. Ph.D. thesis, Univ. Washington, Seattle. 159 p. KEYWORDS: ECOLOGY, LIFE HISTORY, PELAGIC, FISH, FRESHWATER, LAKE WASH

Detailed summary of the life history of the landlocked population of longfin smelt in Lake Washington.

93. EDMONDS, R. L. 1972. Decomposition of litter in the coniferous biome: A simple preliminary model. Intern. Rep. 16, US/IBP Coniferous For. Biome, Univ. Wash. AR-10, Seattle. 17 p. KEYWORDS: DECOMPOSITION, CONIFEROUS, FOREST, MODEL

Describes a preliminary model relating the decomposition of litter in a coniferous forest to environmental factors.

94. EDMONDSON, W. T. 1961. Changes in Lake Washington following an increase in the nutrient income. Proc. Int. Assoc. Theor. Appl. Limnol. 14:167-175. KEYWORDS: EUTROPHIC, NUTRIENT, LAKE WASH

Describes the eutrophication of Lake Washington.

95. ———. 1963. Pacific Coast and Great Basin. IN: D. E. Frey (ed.), Limnology in North America, p. 371-392. Univ. Wisconsin Press, Madison. KEYWORDS: LAKE WASH, LIMNOLOGY, EUTROPHIC, SEWAGE

A limnological review of Lake Washington, covering signs of eutrophication, sewage disposal in the lake, proposed action to divert sewage to Puget Sound, and properties of the lake associated with increased productivity. Bibliography is extensive.

96. ———. 1966. Changes in the oxygen deficit of Lake Washington. Proc. Int. Assoc. Theor. Appl. Limnol. 16:153-158. KEYWORDS: EUTROPHIC, LAKE WASH, OXYGEN

Describes the effect of eutrophication on dissolved oxygen in Lake Washington.

97. ———. 1967. Why study blue-green algae? IN: Federal Water Pollution Control Administration, Environmental requirements of blue-green algae, p. 1-5. FWPCA, Pac. Northwest Water Lab., Corvallis, Oreg. KEYWORDS: ALGAE, EUTROPHIC, LAKE WASH

Discusses occurrence of *Oscillatoria rubescens* and *O. agardhii* in Lake Washington that was associated with the sewage enrichment of the lake.

98. ———. 1968. Water quality management and lake eutrophication: The Lake Washington case. IN: T. H. Campbell and R. O. Sylvester (eds.), Water resources management and public policy, p. 139-178. Univ. Washington Press, Seattle. KEYWORDS: EUTROPHIC, LAKE WASH, MANAGEMENT, WATER QUALITY

Explains biological aspects of the pollution problem in Lake Washington as well as a review of the limnological background of other lakes.

99. ———. 1969a. Eutrophication in North America. IN: Eutrophication: Causes, consequences, correctives, p. 124-149. NAS-NRC Publ. 1700, Washington, D.C. 661 p. KEYWORDS: EUTROPHIC, LAKE WASH, LAKE SAMM

Provides summaries of case histories of eutrophication that include Lakes Washington and Sammamish.

100. ———. 1969b. Cultural eutrophication with special reference to Lake Washington. Commun. Int. Assoc. Theor. Appl. Limnol. 17:19-32. KEYWORDS: EUTROPHIC, LAKE WASH

This paper describes the study of sediments in Lake Washington. It also discusses the paleolimnological approach to determination of past conditions.

101. ———. 1970. Phosphorus, nitrogen, and algae in Lake Washington after diversion of sewage. Science 169(3946):690-691. KEYWORDS: ALGAE, LAKE WASH, NITROGEN, PHOSPHORUS, SEWAGE

After diversion of sewage effluent of Lake Washington, winter concentrations of phosphate and nitrate decreased at different rates. The amount of phytoplanktonic chlorophyll in the summer was very closely related to the mean winter concentration of phosphate, but not to that of nitrate or carbon dioxide.

102. EDMONDSON, W. T. 1972. Nutrients and phytoplankton in Lake Washington. IN: G. E. Likens (ed.), Nutrients and eutrophication: The limiting-nutrient controversy, p. 172-188. Special Symposia, Vol. 1, Am. Soc. Limnol. Oceanogr., Lawrence, Kans. 328 p. KEYWORDS: LAKE WASH, NUTRIENT, PHYTOPLANKTON, SEWAGE

Lake Washington was enriched with increasing volumes of effluent from secondary sewage treatment in the period 1941/1963. After diversion of effluent, starting in 1963, winter phosphate decreased by 1969 to 28% of its 1963 value, summer chlorophyll concentrations decreased about as much, but nitrate and carbon dioxide fluctuated from year to year at relatively high values.

103. EDMONDSON, W. T., and D. E. ALLISON. 1970. Recording densitometry of X-radiographs for the study of cryptic laminations in the sediment of Lake Washington. Limnol. Oceanogr. 15(1):138-144. KEYWORDS: LAKE WASH, RADIOGRAPH, SEDIMENT

X-radiographs of sediment cores from Lake Washington revealed prominent laminations that are not visible to the eye. A band occurring at a depth of about 16 cm in the central part of the lake is attributed to the lowering of the lake level in 1916. Therefore the mean rate of deposition has been about 3.1 mm per year.

104. EDMONDSON, W. T., G. C. ANDERSON, and D. R. PETERSON. 1956. Artificial eutrophication of Lake Washington. Limnol. Oceanogr. 1(1):47-53. KEYWORDS: EUTROPHIC, LAKE WASH, SEWAGE, URBAN

The biological character of Lake Washington has changed in productivity with the great increase in treated sewage that came with the growth of the human population. In 1933 and 1950 the dominant phytoplankton organisms were *Anabaena* and various diatoms and dinoflagellates; but in 1955 the blue-green alga *Oscillatoria rubescens* was dominant. The hypolimnetic oxygen deficit was 1.13 mg cm^{-2} $month^{-1}$ in 1933, 2.00 in 1950, and 3.13 in 1955.

105. EDMONDSON, W. T., G. W. COMITA, and G. C. ANDERSON. 1962. Reproduction rate of copepods in nature and its relation to phytoplankton populations. Ecology 43:625-634. KEYWORDS: ARTHROPOD, LAKE WASH, PHYTOPLANKTON, POPULATION

Summary of the reproductive rate in copepods in Lakes Washington, Chase, and Lenore.

106. EGGERS, D. M., and L. M. MALE. 1972. The modeling process relating to questions about coniferous lake ecosystems. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 33-36. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: CONIFEROUS, FOREST, LAKE, ECOSYSTEM, MODEL

Reviews the salient features of lake communities and factors involving the higher consumers of lake ecosystems as related to modeling.

107. ELDRIDGE, E. F. 1956. A biennium and status report of the Washington Pollution Control Commission to November 1, 1956. Report to the governor and Wash. State Pollut. Control Comm., Olympia. 70 p. KEYWORDS: LAKE WASH, SEWAGE, WATER QUALITY

Provides a summary of water quality objectives and minimum treatment requirements. Provides a listing of cities, institutions, and installations having sewage treatment plants, type of treatment, and population served. Also gives a listing of industrial waste permits by city. Includes information on these topics for the cities surrounding the Lake Washington drainage.

108. ELDRIDGE, E. F., and W. W. BERGERSON. 1948. The Seattle sewage treatment problem with comments on the Wolman report. Wash. State Pollut. Control Comm., Olympia. 12 p. + 2 maps. KEYWORDS: LAKE, POLLUTION, SEWAGE

Reviews the sewage treatment problem in Seattle, and criticizes the Wolman report on the problem as inconclusive.

109. EMERY, R. M. 1972. Initial responses on phytoplankton and related factors in Lake Sammamish following nutrient diversion. Ph.D. thesis, Univ. Washington, Seattle. 222 p. KEYWORDS: CARBON, EUTROPHIC, LAKE, NITROGEN, NUTRIENT, PHOSPHORUS, PHYTOPLANKTON

A two-year study (1970/1972) on Lake Sammamish was carried out to evaluate the responses of phytoplankton and related factors to a sewage diversion project completed in September 1968. Trophic indexes (i.e., nutrient concentrations; phytoplankton biomass, productivity, and species composition; hypolimnetic oxygen; and water transparency) of prediversion years in Lake Sammamish were compared with those of Lake Washington.

110. EMERY, R. M., C. E. MOON, and E. B. WELCH. 1972a. Delayed recovery in a mesotrophic lake following nutrient diversion. J. Water Pollut. Control Fed. (in press). (Presented at 38th Ann. Meet., Pac. Northwest Pollut. Control Assoc., Spokane, Wash., 27-29 Oct. 1971.) KEYWORDS: LIMNOLOGY, NUTRIENT, SEWAGE, LAKE WASH, LAKE SAMM

Limnological conditions in Lake Sammamish prior to an abrupt reduction in nutrient income (via sewage diversion) are compared with those conditions present in Lake Washington before the diversion of sewage into that lake.

111. ———. 1972b. Urban runoff and lake enrichment: Enriching effects of urban runoff on the productivity of a mesotrophic lake. Unpubl. MS, Dep. Civil Eng., Water Air Resour. Div., Univ. Wash., Seattle. 20 p. (Typewritten) KEYWORDS: EUTROPHIC, LAKE SAMM, PRODUCTIVITY, RUNOFF, URBAN

Lake Sammamish had not shown a significant recovery resulting from a sewage diversion project completed in 1968. Extensive urban development in the lake's watershed was considered as a possible factor that might be inhibiting the lake's recovery. Results of the study do not support the contention that urban runoff is seriously enriching the limnetic regime of the lake.

112. ERICKSON, O. T. 1931. A campaign story dealing with our water supply and power plant investments. (Pamphlet, 19 p. Northwest Collect., Suzzalo Libr., Univ. Wash., Seattle.) KEYWORDS: CEDAR RIVER, POWER, WATER, RESOURCES

Narrative on the Cedar River water and power project, the Cedar River masonry dam, water and light plants, logging in the watershed, storage of snow, water runoff, and reforestation.

113. ERICKSON, R. C., and R. R. WHITNEY. 1972. Lake Washington thermal study. Intern. Rep. 35, US/IBP Coniferous For. Biome, Univ. Wash. AR-10, Seattle (in press). KEYWORDS: LAKE WASH, TEMPERATURE, WATER

Summary of temperature data collected during July of 1971 that also includes the pertinent results of the reports by Fraser (1971) and Weaver (1971) for the period of December 1970 through June 1971.

114. ETLINGER, H. 1972. DDT and dieldrin residues in Lake Washington fish. Unpubl. MS (Fish. 600--Prof. Wedenmeyer), Coll. Fish., Univ. Wash., Seattle. 8 p. (Typewritten) KEYWORDS: FISH, LAKE WASH, PESTICIDE

This preliminary study indicated that DDT and dieldrin exist in very low levels in selected fish from Lake Washington. Sample sizes varied from 1 to 10 specimens and included brown bullhead, largescale sucker, coho salmon, northern squawfish, and peamouth.

115. EVERMANN, B. W., and S. E. MEEK. 1897. Salmon investigations in the Columbia River basin and elsewhere on the Pacific Coast in 1896. Bull. U.S. Fish. Comm. 17:15-84. KEYWORDS: FISH, DISTRIBUTION, LAKE SAMM, LAKE WASH, SALMON

Ten regions were investigated including the Puget Sound tributaries and Lakes Sammamish, Union, and Washington.

116. FERGUSON, C. H. 1965. Reproductive rate of *Diaptomus ashlandi* in Lake Washington, an enriched lake. M.S. thesis, Univ. Washington, Seattle. 38 p. KEYWORDS: EUTROPHIC, LAKE WASH, LAKE SAMM, REPRODUCTION, ZOOPLANKTON

Describes the reproductive rate of this zooplankter when the lake was undergoing increased productivity. Preserved samples from 1949/1950,

1957/1958, and 1962/1964 were used for the study. Also provides some data on the reproductive rate of this zooplankter from Lake Sammamish for 1964/1965.

117. FIEDLER, G. H. (Hearing Officer). 1971. Report of hearing, conclusions and recommendations in the matter of the establishment of minimum water flows on the Cedar River, tributary of Lake Washington, situated in King County, Washington. Unpubl. MS, central files, Washington State Dep. Ecology, Olympia. 44 p. + 13 exhibits. KEYWORDS: CEDAR RIVER, FISH, FLOW, STREAM

A public hearing held on 22 May 1970 at the Puget Sound Power and Light Company in Bellevue, Wash. Ten official statements were entered into the record.

118. FISCUS, G. 1967. Lake Washington sockeye. Wash. State Dep. Fish. Ann. Rep. 77(1967):19-20. KEYWORDS: ESCAPEMENT, LAKE WASH, SALMON

Summary of 1967 run of sockeye salmon into Lake Washington.

119. FISH, E. R. 1967. The past and present in Issaquah, Washington. Kingsport Press, Kingsport, Tenn. 186 p. KEYWORD: HISTORY

A historical look at Issaquah: coal mining, logging, recreation, transportation by water and land, civic growth, etc.

120. FOSTER, R. F. 1943. Sources of pollution in Lake Washington canal and Lake Union. Wash. State Pollut. Control Comm., Pollut. Ser. Bull. 28. 24 p. KEYWORDS: CANAL, LAKE WASH, POLLUTION

Reports on 65 sources of pollution in the Lake Washington Ship Canal and Lake Union.

121. FOX, J. D., Jr., and W. J. COLLINS. 1971. A preliminary study of the hydrology of Mercer and Coal Creeks. Unpubl. MS (Fish. 600--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 27 p. + appendixes. (Typewritten) KEYWORDS: HYDROLOGY, STREAMFLOW

Description of drainage basins and an analysis of annual runoff, rainfall, and streamflow.

122. FRASER, J. L. 1969. Studies of spawning sockeye salmon *Oncorhynchus nerka* in a study section of the Cedar River in 1969. Unpubl. MS (Fish. 499--Prof. DeLacy), Coll. Fish., Univ. Wash., Seattle. 23 p. (Typewritten) KEYWORDS: CEDAR RIVER, SALMON, SPAWNING

Preliminary study of spawning sockeye salmon in the Cedar River that summarizes migration into the river, time spent on redds, and estimates of egg retention. Fraser was employed by the Washington State Department of Fisheries during this study.

123. ———. 1971. Lake Washington temperature studies. Unpubl. MS (Fish. 499--Prof. Whitney). Coll. Fish., Univ. Wash., Seattle. 13 p. (Typewritten) KEYWORDS: LAKE WASH, TEMPERATURE, WATER

Summarizes vertical temperature profiles for the south end of Lake Washington from December 1970 to March 1971.

124. FRITSCHEN, L. J. 1972. The lysimeter installation on the Cedar River watershed. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 255-260. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: WATER, MOVEMENT, CONIFEROUS, FOREST, CEDAR RIVER, WATERSHED

Describes a lysimeter installation that was constructed around the root ball of a Douglas-fir tree. The lysimeter will be used to study evapotranspiration and volume changes in relation to soil water potential and atmospheric demand, to test cuvette and meteorological methods, to determine canopy interception, and to assess the effects of irrigation and fertilization.

125. GERKE, R. J. 1969a. Results of field testing a sonar salmon counter in the Cedar River. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 7 p. KEYWORDS: ABUNDANCE, CEDAR RIVER, SALMON, SAMPLING

Describes an experiment to enumerate the upstream migration of sockeye salmon in 1968 with the use of an accoustical counting device. The counter was estimated to be 58% accurate, based on data from the enumeration of the 1968 spawning migration of sockeye. Factors affecting the accuracy of the counting device were the small size and fast swimming speed of the sockeye, inadequate water depth for optimum operation, and false counts from debris.

126. ———. 1969b. Results of sampling the 1969 sockeye smolt out-migration in the Lake Washington Ship Canal. Unpubl. MS, Sockeye Popul. Distrib. file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: ABUNDANCE, MOVEMENT, SALMON, LAKE WASH, CANAL

Field sampling of the out-migration of sockeye smolts from Lake Washington to determine age, sizes, and numbers. Sampling was done in the forebay of the Hiram M. Chittenden Locks. Survival rate in the Lake Washington watershed was estimated to be 10%.

127. GESSEL, S. P. 1972. Organization and research program of the Western Coniferous Forest Biome. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 7-14. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: DESCRIPTION, REVIEW, CONIFEROUS, FOREST

Describes the administrative and research organization of the Coniferous Biome study and presents the broad objectives of the program.

128. GESSEL, S. P., and A. N. BALCI. 1965. Amount and composition of forest floors under Washington coniferous forests. IN: C. T. Youngberg (ed.), Forest-soil relationships in North America, p. 11-23. Oregon State Univ. Press, Corvallis. KEYWORDS: CARBON, CONIFEROUS, FOREST, NITROGEN, SOIL

Most common types of the major forest floor in western Washington old-growth coniferous forests are mor and duff mull. Differences between properties of the two types are that weight loss on ignition of mor is significantly greater than for duff mull and that the carbon-nitrogen ratio of mor is higher than for duff mull.

129. GESSEL, S. P., and D. W. COLE. 1965. Influence of removal of forest cover on movement of water and associated elements through soil. J. Water Works Assoc. 57(10):1301-1310. KEYWORDS: CEDAR RIVER, WATERSHED, ALTERATION, CONIFEROUS, FOREST, ELEMENT, WATER, MOVEMENT.

A tension lysimeter study was made at the Cedar River watershed to determine the influence of clearcutting on yield and mineral content of soil water. Data on movement of water and elements in forested and clearcut areas were collected from immediately under the forest floor and at 91 cm depth.

130. GIBBS, C. V. 1968. Receiving-water monitoring: Key to Seattle METRO pollution-abatement program. IN: T. H. Campbell and R. O. Sylvester (eds.), Water resources management and public policy, p. 179-186. Univ. Washington Press, Seattle. KEYWORDS: POLLUTION, WATER QUALITY

The water Quality Control Division of Seattle's METRO monitors the waste-disposal receiving waters.

131. GLADWELL, J. A., and A. C. MUELLER. 1967. Sammamish--Cedar River watershed #8. IN: An initial study of the water resources of the State of Washington, Vol. II, Water resources atlas of the State of Washington, Sec. IX, Watershed subdivision, p. 33-38. Wash. State Water Resour. Cent., Pullman. KEYWORDS: LAKE WASH, PHYSICAL, WATER, WATERSHED

Presents a broad view of the physical aspects of the water resources of the Lake Washington drainage basin.

132. GOULD, H. R., and R. F. BUDINGER. 1958. Control of sedimentation and bottom configuration by convection currents, Lake Washington, Washington. J. Mar. Res. 17:183-198. KEYWORDS: LAKE WASH, CURRENT, SEDIMENT, WATER, GLACIAL

Describes how Lake Washington was formed into a W-shaped trough by the Vashon ice sheet.

133. GOWAN, R. 1972. Comparison of horizontal and vertical gill nets in sampling three species of fish in Lake Washington, March 28--May 18, 1972. Unpubl. MS (Fish. 499-Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 7 p. (Typewritten) KEYWORDS: ABUNDANCE, FRESHWATER, FISH, LAKE WASH, GILL NET

Summarizes the catch-per-unit-of-effort (number of fish per square foot of webbing per hour) for northern squawfish, yellow perch, and peamouth that were captured by horizontal and vertical gill nets in less than 18 m of water.

134. GRAF, D. F. 1971. The effects of Lake Sammamish zooplankters upon the growth and standing crop of four phytoplankters. Unpubl. MS (for nonthesis M.S. degree--Prof. Welch), Dep. Civil Eng., Water Air Resour. Div., Univ. Wash., Seattle. 27 p. (Typewritten) KEYWORDS: GROWTH, PREDATION, STANDING CROP, PHYTOPLANKTON, ZOOPLANKTON, LAKE SAMM

Summary of interactions between zooplankton and phytoplankton in Lake Sammamish.

135. GRAY, P. L. 1965. Fecundity of the chinook salmon (*Oncorhynchus tshawytscha*) related to size, age, and egg diameter. M.S. thesis, Univ. Washington, Seattle. 65 p. KEYWORDS: FISH, REPRODUCTION

This study summarizes a selective breeding experiment for fish that returned during 1960/1963 to the holding pond at the University of Washington College of Fisheries.

136. GREEN, S. B., and T. H. CAMPBELL. 1967. Current usage and pricing, Appendix A (63 p.). IN: An initial study of the water resources of the State of Washington, Vol. I, A first estimate of future demands for water in the State of Washington. Wash. State Water Resour. Cent., Pullman. KEYWORDS: DEMAND, ECONOMY, WATER

Summarizes community uses of water such as rates of use, variation in rates of use, and prices. Good summaries of time-rates of demand are provided for Seattle. Also includes industrial water uses.

137. GRIER, C. C. 1972. Effects of fire on the movement and distribution of elements within a forest ecosystem. Ph.D. thesis, Univ. Washington, Seattle. 166 p. KEYWORDS: CONIFEROUS, ECOSYSTEM, ELEMENT, FIRE, MOVEMENT, SOIL

The transfer of calcium, magnesium, potassium, and sodium, and some aspects of the transfer of nitrogen and phosphorus, in response to slash fire in Douglas-fir, were examined at the Thompson Research Center. Burning resulted in measurable losses and redistribution of elements both during and after the fire. Major redistributions of elements caused by fire occurred during formation of the ash layer and its redistribution by wind, and through leaching of ash elements into the soil. Convection and volatilization were responsible for the loss of up to 90% of the nitrogen, 60% of the phosphorus, and 20% of the base elements originally in the fuel. The major loss and redistribution of elements after a fire occur during the leaching of ions from the ash layer.

138. GRIER, C. C., and D. W. COLE. 1971. Influence of slash burning on ion transport in a forest soil. Northwest Sci. 45(2):100-106. KEYWORDS: CONIFEROUS, FOREST, ION, MOVEMENT, FIRE, SOIL

Nutrient flux through a forest soil after fires in areas with two different fuel loadings was evaluated using tension lysimeters. Analysis of the collected gravitational water showed the following: Burning caused substantial increases in the concentration of ions entering the soil. Ion loss from the rooting zone also increased. These increases are related to the weight of fuel on the soil surface. Leaching of ions from the ash layer caused the major chemical changes occurring in the soil. There was no evidence that heating of the mineral soil appreciably affected the chemical composition of the leachates. Most of the ions leached from the ash layer were adsorbed in the A and B horizons of this soil. Total flow, flow rate, and time between wetting fronts influence the amount of ion transport after burning. The principal anion in the soil solution of the treatment plots was bicarbonate, but carbonate, sulfate, phosphate, and silicate were also present. Leaching loss of nitrogen occurred only in trace amounts and at concentrations less than in the control plot. Calcium was the major cation in the fuel while potassium was the major cation leached from the ash layer; magnesium was the major cation leached from the rooting zone.

139. GRIER, C. C., and D. W. COLE. 1972. Elemental transport changes occurring during development of a second-growth Douglas-fir ecosystem. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.),

Proceedings--Research on coniferous forest ecosystems--A symposium, p. 103-113. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: MINERAL CYCLE, CONIFEROUS, FOREST

Reviews the mineral cycling process in a second-growth Douglas-fir stand at the Thompson Research Center on the Cedar River watershed. Presents data on the transfer of elements between components of a Douglas-fir ecosystem.

140. GRIER, C. C., and J. G. McCOLL. 1971. Forest floor characteristics within a small plot in Douglas-fir in western Washington. Soil Sci. Soc. Am. Proc. 35(6):988-991. KEYWORDS: CONIFEROUS, FOREST, DESCRIPTION, SOIL

Chemical and physical properties and their variabilities within a single small plot of a Douglas-fir stand.

141. GRIFFITHS, M., P. A. PERROTT, and W. T. EDMONDSON. 1969. Oscillaxanthin in the sediment of Lake Washington. Limnol. Oceanogr. 14(3):317-326. KEYWORDS: EUTROPHIC, LAKE WASH, SEDIMENT

Oscillaxanthin was determined quantitatively from portions of five sediment cores. Oscillaxanthin is produced by *Oscillatoria rubescens* and *O. agardhii*, both of which have been abundant in Lake Washington since 1955. Therefore the first appearance of oscillaxanthin (before 1950) probably came early in the sewage enrichment of the lake.

142. GRIGGS, D. T. 1971. Characteristics and estimations of the fish populations of Kelsey and Coal Creeks with an emphasis upon cutthroat trout and coho salmon. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 29 p. KEYWORDS: ABUNDANCE, FISH, FRESHWATER, MOVEMENT, STREAM

Provides information on population estimates, condition factors, tagging, and movement of coho salmon and cutthroat trout.

143. GRONDAL, B. L. 1945. Relation of runoff and water quality to land and forest use in Cedar River watershed. J. Am. Water Assoc. 37(1):15-20. KEYWORDS: ALTERATION, CEDAR RIVER, WATER QUALITY, FOREST

The Seattle City Council appointed a commission to study the Cedar River watershed to determine future logging policies. This commission recommended a continuation of logging on a controlled, sustained-yield basis, and the rationale of the conclusion is outlined.

144. GROVER, N. C., and G. L. PARKER. 1940. Summary records of surface waters of Washington, 1919-1935. U.S. Geol. Surv. Water Supply Pap. 870. 456 p. KEYWORDS: FLOW, TEMPERATURE, WASHINGTON, WATER

Data are abstracted from 48 water supply papers. A bibliography is included with more detailed information.

145. HANSEN, G., G. CARTER, W. TOWNE, and G. O'NEAL. 1971. Log storage and rafting in public waters. Pac. Northwest Pollut. Control Council, Task Force Rep. 56 p. KEYWORDS: LOG STORAGE, WATER

Review of log storage in the Northwest and recommendations for implementing improved log handling practices that will benefit water quality. The Seattle harbor area including Commencement and Salmon Bays, Lake Union, Lake Washington, and the Lake Washington Ship Canal handles approximately 100,000 to 1 million tons of rafted logs annually.

146. HANSEN, R. 1970. Some fish species available from benthic gill net sets in Pontiac Bay, Lake Washington. Unpubl. MS (Fish. 499--Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 13 p. (Typewritten) KEYWORDS: FISH, GILL NET, LAKE WASH, SAMPLING

Summary of sampling during April and May 1970 in Pontiac Bay of Lake Washington, using bottom gill net sets with eight mesh sizes.

147. ———. 1972. The selectivity of vertical and horizontal monofilament gill nets for peamouth, yellow perch, and northern squawfish in Lake Washington. M.S. thesis, Univ. Washington, Seattle. 87 p. KEYWORDS: FISH, FRESHWATER, GILL NET, SAMPLING

Summarizes the selectivity of gill nets that are being used in a systematic sampling scheme to determine the distribution and relative abundance of benthic and littoral fishes in lakes.

148. HANSLER, D. D. 1958. Some effects of artificial selection upon a stock cutthroat trout, *Salmo clarkii clarkii*, with related hybridization studies. M.S. thesis, Univ. Washington. 102 p. KEYWORDS: BREEDING, FISH, FRESHWATER

University of Washington stock of cutthroat trout that were originally obtained from Thornton (Matthews) Creek, a western tributary to Lake Washington, were used in breeding experiments.

149. HANSON, H. A. 1957. More land for industry--A story of flood control in the Green River Valley. Wash. Hist. Q. 48(1):1-7. KEYWORDS: FLOOD, WATERSHED

Brief look into the changes in the flow patterns of the tributaries and streams of the Lake Washington watershed.

150. HARSTAD, H. T. 1965. Report and comprehensive drainage plan, May Creek Flood Control Zone District. Harstad Associates, Inc., 2512 2d Ave., Seattle, Wash. 32 p. KEYWORDS: FLOOD, MANAGEMENT, STREAM

Report to Board of King County Commissioners with a general flood control plan that allows freedom of development within the area but also sets certain minimum standards for developing the entire drainage system. May Creek is a southeastern tributary to Lake Washington.

151. HASLAN, A. W. 1945. Cedar River stream survey. Unpubl. MS, Lake Wash.--Cedar River file, 1936-1969, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: CEDAR RIVER, FISH, STREAM, SURVEY

Water rights, stream obstruction, and pollution are briefly covered. Four small tributaries to the Cedar River occur below the diversion dam at Landsburg. Three tributaries (Webster, Downs, and Madson Creeks) have spawning runs of silver salmon. The fourth tributary (Rock Creek) is blocked by beaver dams. The Cedar River is considered ideal for salmon spawning. Large numbers of nongame fish also spawn in the river. Because the tributaries are very small, it was recommended that water permits be granted until their low flows can be determined.

152. HASLER, A. D. 1969. Cultural eutrophication is reversible. BioScience 19(5):425-432. KEYWORDS: ALTERATION, EUTROPHIC, LAKE, WATER

Historical background and development in the cultural eutrophication of waters. Uses Lakes Washington as an example of control of eutrophication.

153. HATHEWAY, W. H., P. MACHNO, and E. HAMERLY. 1972. Modeling water movement within the upper rooting zone of a Cedar River soil. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 95-101. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: WATER, MOVEMENT, SOIL, CEDAR RIVER, MODEL

Presents a model that provides a satisfactory representation of actual soil water flow despite variability in forest soil properties. Predicted values were compared with values that were measured in the field at the Thompson Research Center.

154. HAW, F., and R. M. BUCKLEY. 1962. Prolonged freshwater residence of juvenile fall chinook salmon. Wash. State Dep. Fish. 72d Ann. Rep. Year 1962:25-26. KEYWORDS: AGE-DISTRIBUTION, LAKE WASH, SALMON

Scale analysis of spent chinook carcasses from the major spawning streams of the Lake Washington system revealed that 12% were in their third year when they entered saltwater, 18% were in their second year of life, and 66% were in their first year of life.

155. HAW, F., H. O. WENDLER, and G. DESCHAMPS. 1967. Development of Washington salmon sport fishery through 1964. Wash. State Dep. Fish. Res. Rep. 7. 192 p. KEYWORDS: FISH, FISHERY, RECREATION, SALMON

Short description of the salmon sport fishery in Lake Washington on pages 55-56. Since 1952 annual catch estimates for chinook salmon varied from 15 to 134 while the annual catch estimates for coho salmon ranged from 155 to 2196.

156. HEG, R. T. 1953. Report on coal mine pollution on Tibbetts Creek. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 5 p. KEYWORDS: FISH, SPAWNING, SALMON, POLLUTION, STREAM, LAKE SAMM

Tibbetts Creek, a tributary to Issaquah Creek, is a stream with a gravel bottom that was once suitable for the spawning and rearing of silver salmon. Light penetration became much reduced in the creek below the source of coal mine pollution. This report indicates that the pollution from the coal mines has become detrimental to fish and probably decreases food production within the stream.

157. HEISER, D. H. 1969. Fecundity of Cedar River sockeye salmon (*Oncorhynchus nerka*), 1968 and 1969. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 7 p. KEYWORDS: CEDAR RIVER, FECUNDITY, FISH, SALMON

The fecundity of sockeye salmon was studied during the spawning runs in 1968 and 1969. The mean fecundity was determined to be 3588 eggs. No relationship was found between size of the female and fecundity. Summary tables give fork length and number of eggs for individual fish.

158. HIGHSMITH, R. M., Jr. (ed.). 1953. Atlas of the Pacific Northwest--Resources and development. Dep. Nat. Resour., Oreg. State Univ., Corvallis. 124 p. KEYWORDS: CLIMATE, POPULATION, RESOURCES, ATLAS

General review and summary of landforms, climate, farming, electric power facilities, transportation, manufacturing development, retail and wholesale trade, population, and resources including water, rail, forest, fishery, mineral, and recreation.

159. HIGMAN, H. W. 1951. Union Bay--Life of a city marsh. Univ. Washington Press, Seattle. 315 p. KEYWORDS: FAUNA, ECOLOGY, LAKE, PLANT

Description of the harmonious living of animals and plants with humans in the City of Seattle at a marsh along the eastern portion of the University of Washington campus where the sounds of automobile traffic, the activities of a university, a ship canal, a commercial district, and a community of homes are always present.

160. HOAGLUND AND FINDLAY, CONTRACTORS. 1952. Diversion of Thornton (Matthews) Creek. Unpubl. MS, Lake Wash.--Thornton Creek file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: ALTERATION, STREAM

Describes an agreement to the diversion of Thornton Creek.

161. HOPPE, G. N. 1934. Plecoptera of the State of Washington. M.S. thesis, Univ. Washington, Seattle. 57 p. KEYWORDS: AQUATIC, INSECT, DISTRIBUTION

Keys are given for the families and species of these aquatic insects. Some of the collectios were from the Lake Washington drainage.

162. HORTON, M. A. 1972. The role of the sediments in the phosphorus cycle of Lake Sammamish. M.S. thesis, Univ. Washington, Seattle. 220 p. KEYWORDS: LAKE SAMM, MINERAL CYCLE, PHOSPHORUS, SEDIMENT

Sediments in Lake Sammamish have shown a tremendous capacity for phosphorus sorption under aerobic conditions. Under anaerobic conditions, they have shown a similar capacity to release phosphorus. Levels of oxygen, iron, and phosphorus were found to be intimately related in the lake.

163. IKUSEMIJU, K. 1967. The life history and ecology of *Cottus* sp. in Lake Washington. M.S. thesis, Univ. Washington, Seattle. 145 p. KEYWORDS: ECOLOGY, LIFE HISTORY, PELAGIC, FISH, FRESHWATER, LAKE WASH

Life history of a pelagic sculpin in Lake Washington. The taxonomy of this species is uncertain.

164. IRBY, J. F. 1967. A study of the sampling variability of total nitrogen, bulk density and gravel content in two forest soils. M.F. thesis, Univ. Washington, Seattle. 52 p. KEYWORDS: CONIFEROUS, FOREST, NITROGEN, SOIL, SAMPLING, MODEL

The variability in total soil nitrogen, bulk density, and gravel content from field sampling was examined for forested soils of the Everett and Alderwood Series, two common soils in western Washington.

The number of core samples required to estimate means of total nitrogen in kilograms per hectare on 0.04-ha plots (pounds per acre on 0.1-acre plots) within 20% of the true value with 95% probability on the soils varied between 4 and 31, depending on the soil depth at which sampling is made. Approximately three to four times as many samples are required to estimate means within 10% of their true values. Prediction equations for total nitrogen are presented for both soils, where percentage of nitrogen is the independent variable.

165. ISAAC, G. W., R. I. MATSUDA, and J. R. WELKER. 1966. A limnological investigation of water quality conditions in Lake Sammamish. Munic. Metro. Seattle Water Qual. Ser. 2. 47 p. KEYWORDS: LAKE SAMM, LIMNOLOGY, WATER QUALITY

Water quality in Lake Sammamish affects Lake Washington's water quality because they are directly connected. A 1964/1965 study of Lake Sammamish indicated that it was in the early stages of eutrophication and was in worse condition than Lake Washington was in 1950.

166. ISAKSSON, A. 1970. Discrimination of Fraser River and Lake Washington sockeye salmon by means of scale characters. M.S. thesis, Univ. Washington, Seattle. 94 p. KEYWORDS: FISH, LAKE WASH, POPULATION, SALMON

A comparative study of the scales of Lake Washington sockeye salmon of the 1960/1966 brood years and the scales of Fraser River sockeye of corresponding brood years. Lake Washington sockeye from the 1960/1964 brood years could be separated from Fraser River stock by a false annulus on the scales, but this prominent characteristic was not present in the 1965 and 1966 brood years.

167. JENSEN, J. D. (Planning Director). 1964. Utilities report: Renton urban area. Planning Commission, City Hall, City of Renton, Wash. 47 p. KEYWORDS: MANAGEMENT, URBAN

A study of all public and privately owned electrical, water, and sewage systems in the City of Renton area.

168. JEWELL, E. D. 1966a. Research and management: Puget Sound commercial salmon fisheries. Wash. State Dep. Fish. Ann. Rep. 75(1965):9-10. KEYWORDS: ESCAPEMENT, LAKE WASH, SALMON

The total sockeye escapement to the Lake Washington system was estimated to be in excess of 40,000 fish. No commercial net fishery was permitted in 1965.

169. ———. 1966b. Status of marine research on Puget Sound salmon runs. Wash. State Dep. Fish. Ann. Rep. 75(1965):12-13. KEYWORDS: ESCAPEMENT, LAKE WASH, SALMON

Summarizes escapement of sockeye salmon to the Cedar River. Research has been limited to monitoring returns on the spawning grounds.

170. ———. 1966c. Research and management: Puget Sound commercial salmon fisheries. Wash. State Dep. Fish. Ann. Rep. 76(1966):119-120. KEYWORDS: ESCAPEMENT, LAKE WASH, SALMON

Estimated escapements of Lake Washington sockeye since 1960 had ranged widely, but an overall increase was apparent. The Department of Fisheries indicated concern about the damaging effects of over-escapement. Test fishing was to commence in 1968.

171. ———. 1967. Puget Sound commercial salmon fisheries. Wash. State Dep. Fish. Ann. Rep. 77(1967):10. KEYWORDS: ESCAPEMENT, LAKE WASH, SALMON

The estimated escapement of approximately 200,000 sockeye into Lake Washington was principally to the Cedar River, where it reached three times the previous counts.

172. ———. 1968. Research and management: Puget Sound commercial salmon fisheries. Wash. State Dep. Fish Ann. Rep. 78(1968):9-11. KEYWORDS: ESCAPEMENT, LAKE WASH, SALMON, HARVEST

The estimated total catch of 25,200 Lake Washington sockeye by all fisheries left an escapement of approximately 160,000 in the Cedar River and 3000 throughout the remainder of the system.

173. JEWELL, E. D., and G. I. FISCUS. 1969a. 1969 Lake Washington sockeye run. Wash. State Dep. Fish. Ann. Rep. 79(1969):15-19. KEYWORDS: FISHERY, LAKE WASH, SALMON, HARVEST

Describes the commercial fishery for Lake Washington sockeye in Puget Sound and the test fishery in Lake Washington. Several figures show the distribution of commercial gill net and purse seine fishing in Puget Sound with the species composition of the catch by area. Another figure shows the timing of the sockeye run that is based on catches by all gear.

174. ———. 1969b. Strait of Juan de Fuca preserve test fishery. Wash. State Dep. Fish. Ann. Rep. 79(1969):20-26. KEYWORDS: FISHERY, LAKE WASH, SALMON, HARVEST

Four tables summarize the commercial and test fishing for Lake Washington sockeye during 1960. Catches are listed by the area in

Puget Sound and by gear. Several photographs of Lake Washington sockeye are included.

175. ———. 1969c. Management and research: Puget Sound commercial salmon fisheries. Wash. State Dep. Fish. Ann. Rep. 79(1969):27-29, 32. KEYWORDS: FISHERY, LAKE WASH, SALMON, HARVEST

Discusses improvement in sockeye catches during 1969 over 1968 with emphasis on the Lake Washington stock.

176. ———. 1970. Reasons for not proposing a fishery on the 1970 sockeye run. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 3 p. KEYWORDS: SALMON, FISHERY, MANAGEMENT, LAKE WASH

Gives reasons for not proposing a fishery on the Lake Washington sockeye: (1) Optimum number of spawners still not present in Cedar River, (2) forecast of return may not be completely accurate, (3) most efficient mesh size has not been determined, and (4) fishing restrictions must be determined.

177. JEWELL, E. D., G. I. FISCUS, and C. PRATT. 1969. A review of the 1969 Lake Washington sockeye run. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 30 p. KEYWORDS: CEDAR RIVER, ESCAPEMENT, FISHERY, SPAWNING, SALMON

The 1969 commercial fishery harvested 14.5% of the spawning run of sockeye in comparison with a harvest of 7.9% for 1968. An estimated 190,000 of 260,000 sockeye escaped to the Cedar River in 1969 and an undetermined number escaped into other tributaries of Lakes Washington and Sammamish. A substantial purse seine commercial fishery would be justified between Discovery Bay and Seattle.

178. ———. 1971. Management and research: Puget Sound commercial salmon fisheries. Wash. State Dep. Fish. Ann. Rep. 80(1970):9-14. KEYWORDS: REVIEW, SALMON, HARVEST, FISHERY

Description of the commercial fishery and gill net test fishery for the Lake Washington sockeye salmon in 1970.

179. JOHNSON, R. 1968. Sonar counter investigations. Wash. State Dep. Fish. Ann. Rep. 78(1968):29-30. KEYWORDS: ABUNDANCE, CEDAR RIVER, SALMON, SAMPLING

Initial trials to count salmon were made in the Cedar River with a sonar device developed by the Bendix Corporation and the State of Alaska.

180. JOYNER, T. 1959. The exchange of zinc between catfish and environmental solutions. M.S. thesis, Univ. Washington, Seattle. 40 p. KEYWORDS: FISH, FRESHWATER, LAKE WASH

A radioactive tracer technique was used to study the exchange of zinc between the catfish *Ameiurus nebulosus* and environmental solutions of zinc chloride. These fish were collected from Union Bay.

181. KATZ, M. 1951. Two new hemoflagellates (genus *Cryptobia*) from some western Washington teleosts. J. Parasitol. 37(3):245-250. KEYWORDS: FISH, PARASITE

Describes two new species of hemoflagellates. *Cryptobia salmositica* Katz was discovered in coho salmon *Oncorhynchus kisutch*, and *C. lynchi* Katz was discovered in the coastrange sculpin *Cottus aleuticus*, from Swamp Creek, a northern tributary to Lake Washington.

182. KATZ, M., and W. HENRY. 1967. Trends in the steelhead sport fishery in the State of Washington with emphasis on the fishery in streams of the Puget Sound, Hood Canal, and Grays Harbor areas. Unpubl. MS (Prof. Katz), Coll. Fish., Univ. Wash., Seattle. 43 p. KEYWORDS: FISH, RECREATION

Summarizes the steelhead plants and estimated catch in the Lake Washington area (ship canal, Sammamish River) from unpublished data provided by the Washington State Department of Game in Olympia from 1945 through 1966.

183. KATZ, M., J. C. WOODEY, C. D. BECKER, P. T. K. WOO, and J. R. ADAMS. 1966. Records of *Cryptobia salmositica* from sockeye salmon from the Fraser River drainage and from the State of Washington. J. Fish. Res. Board Can. 23(12):1965-1966. KEYWORDS: FISH, PARASITE

This flagellate was recorded for the first time in sockeye salmon. Some sockeye from the Cedar River were found to contain the organism.

184. KEMMERER, G., J. R. BOVARD, and W. R. BOORMAN. 1924. Northwestern lakes of the United States: Biological and chemical studies with reference to possibilities in production of fish. Bull. U.S. Bur. Fish. 39:51-140. KEYWORDS: LAKE WASH, LAKE SAMM, LIMNOLOGY

A study of northwestern lakes including Lakes Washington and Sammamish, during the summers of 1911, 1912, and 1913. Depth, temperature, dissolved gases, and transparency of water is given for each lake. Other information includes maps and data on soundings, water samples, net plankton samples, fish in small lakes, and fish food.

185. KEMMERICK, J. 1945. A review of the artificial propagation and transplantation of the sockeye salmon of the Puget Sound area in the State of Washington, conducted by the federal government from 1896 to 1945. Unpubl. MS, Lake Wash.--Cedar River file, 1936-1969, Manage. Res. Div., Wash. State Dep. Fish., Olympia, p. 43-46, 55-57, and 78-84. KEYWORDS: BREEDING, SPAWNING, STOCKING, SALMON, LAKE WASH, HISTORY

An unpublished report by the U.S. Fish and Wildlife Service in Portland that summarizes the history of sockeye salmon propagation in Puget Sound. Specific information on each brood year of sockeye in the Lake Washington watershed is given on the pages listed for the years 1934 through 1945.

186. KEMPF, R. J., and R. Y. SLOAN. 1969. Study of variability of forest floor properties. Unpubl. MS (NSF Secondary Sci. Train. Program), Coll. For. Resour., Univ. Wash., Seattle. 21 p. (Typewritten) KEYWORDS: CONIFEROUS, FOREST, SOIL, DESCRIPTION, SAMPLING

Forest floor and two soil horizons were intensively sampled beneath a second-growth Douglas-fir stand at the Cedar River research site. Good estimates of chemical and physical properties were provided by this study. Relationships between and within horizons were analyzed and interpreted. Data presented also provide a means of anticipating the coefficient of variation of various properties as a function of sample size and number.

187. KERSNAR, F. J. 1961. Small plants in metropolitan Seattle. J. Water Pollut. Control Fed. 33(9):909-913. KEYWORDS: ECONOMY, SEWAGE

In the metropolitan Seattle area, several small sewage treatment plants that were designed to serve small urban developments and that were topographically isolated from the remainder of the area were found to be more economical than transmission of sewage flow to a major treatment and disposal site.

188. KING COUNTY SOIL AND WATER CONSERVATION DISTRICT, BOARD OF SUPERVISORS. 1968. An appraisal for outdoor recreational developments in King County, Washington. King County, Wash. 20 p. KEYWORDS: RECREATION, KING COUNTY, WASHINGTON, WATER

An appraisal of the potential of 12 outdoor recreation developments in the King County Soil and Water Conservation District, Washington. The report considers the county as a unit. The 12 types are: vacation homesites; camping, picnic, and sport areas; fishing waters; golf courses; hunting areas; natural, scenic, and historical areas; riding stables; shooting preserves; vacation farms and ranches; water sports areas; and winter sports areas.

189. KIRKPATRICK, L. W. 1967. A preliminary investigation of the projected effects of urbanization upon water resources within the Lake Sammamish watershed. M.S. thesis, Univ. Washington, Seattle. 84 p. KEYWORDS: LAKE SAMM, RESOURCES, URBAN, WATERSHED

Summarizes the water budget on a monthly and yearly basis and the flushing time (1.5 years) for Lake Sammamish. Zoning, land uses, and population data from local agencies and the literature are reviewed and applied to the watershed.

190. KNUTSEN, S. T. 1965. Hydrologic processes in thirty to thirty-five year old stands of Douglas-fir and alder in western Washington. M.F. thesis, Univ. Washington, Seattle. 167 p. KEYWORDS: CEDAR RIVER, WATERSHED, DECIDUOUS, CONIFEROUS, FOREST, HYDROLOGY, SOIL

The hydrologic properties of a Douglas-fir and an alder stand at the Cedar River watershed were compared. A Poisson distribution of rainfall intensities was among the characteristics of the precipitations and microclimates observed. Patterns of soil moisture percolation as determined by hydrographs are a function of rainfall intensity and duration and the soil moisture status upon onset of rain. Preliminary data indicate that evapotranspiration from the three Douglas-fir plots averaged 70% of gross precipitation; conversely, about 30% of rainfall percolated beneath the effective rooting zone. Evapotranspiration from the clearcut was 48% of gross precipitation and about 52% of rainfall percolated to 1 m.

191. KOBLER, T. 1971. Loss of nitrogen through volatilization of ammonia after surface application of urea to forest soils. Unpubl. MS (NSF Secondary Sci. Train. Program), Coll. For. Resour., Univ. Wash., Seattle. 17 p. + 8 p. of appendixes. (Typewritten) KEYWORDS: CONIFEROUS, FERTILIZATION, FOREST, NITROGEN, SOIL

Study was done at the Allen E. Thompson Research Center in the Cedar River watershed. Data are provided on the influence of grain size of urea, rate of application, and temperature on the volatilization of ammonia from urea-fertilized forest soils.

192. KOLB, R. 1971. A review of Lake Washington sockeye (*Oncorhynchus nerka*) age and racial characteristics as determined by scale analysis. Wash. State Dep. Fish. Suppl. Prog. Rep. 9 p. KEYWORDS: FISH, LAKE WASH, POPULATION, SALMON

Provides circuli counts of sockeye salmon scales that can be used to separate stocks that are returning to Lake Washington and to Stuart Lake of the Fraser River system. Also presents a table that summarizes the history of the Lake Washington sockeye runs.

193. KRAEMER, C. 1969. A study of the brown bullhead (*Ictalurus nebulosus*) of Lake Washington. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 26 p. KEYWORDS: AGE-GROWTH, REPRODUCTION, FISH, FRESHWATER, LAKE WASH

Presents data on age composition, growth rate, length-weight relationship, and size at maturity for brown bullhead in Lake Washington.

194. KUNTZ, E. 1942. The Rotatoria of Washington. M.S. thesis, Univ. Washington, Seattle. 161 p. KEYWORDS: AQUATIC, DISTRIBUTION, ROTIFER

Provides keys for the order, family, and genus of rotifers from Washington State. Descriptions of species are provided under the section on genera. Some collections were taken from the Lake Washington drainage.

195. LAMPHERE, H. G. 1936. The aquatic and semi-aquatic Heteroptera of western Washington. M.S. thesis, Univ. Washington, Seattle. 61 p. KEYWORDS: AQUATIC, DISTRIBUTION, FRESHWATER, INSECT

Describes all families, genera, and species of these insects that were found in western Washington until 1936. Many localities are given as Seattle area. Some are found in all of the freshwaters in the Seattle area, including the Lake Washington watershed.

196. LAMPMAN, B. H. 1946. The coming of the pond fishes. Benford and Mort Publ., Portland, Oreg. 177 p. KEYWORDS: FISH, FRESHWATER, HISTORY, NORTHWEST

Provides a history of the introduction of some spiny-rayed and exotic fishes into the Columbia River region and Pacific coast waters.

197. LANICH, J. S. 1972. Mineralogy and cation exchange capacity of surface sediments from selected lakes of Lake Washington drainage. M.S. thesis, Univ. Washington, Seattle. 104 p. KEYWORDS: LAKE, MINERAL CYCLE, SEDIMENT

Summarizes the physical and mineralogical properties of the surface sediments from Lakes Washington and Sammamish, Chester Morse Reservoir, and Findley Lake.

198. LARAMIE, R. M. 1969. Lake Washington, the Cedar River, and salmon production potential. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 6 p. KEYWORDS: CARRY-CAPACITY, CEDAR RIVER, LAKE WASH, SALMON

Provides a brief background of the Lake Washington watershed drainage with regard to its fish inhabitants. The Lake Washington system has

increased production without any artificial propagation or fish enhancement. The ultimate rearing and production potential has not been reached and rearing capacity will be the eventual limiting factor in sockeye production. Future demand for salmon production is reviewed and ways are suggested to increase salmon production.

199. LA ROCK, R. G. 1967. Some moisture characteristics of an Everett soil. M.S. thesis, Univ. Washington, Seattle. 88 p. KEYWORDS: CONIFEROUS, FOREST, WATER, FLOW, SOIL

By use of a tension lysimeter system, tensiometers, and a soil moisture neutron probe, moisture characteristics of a glacial outwash soil were determined during periods of soil moisture flow resulting from rainfall. At a depth of 41 cm lateral flow was found during periods of rapid soil moisture flow in spite of coarseness of the soil texture.

200. LARRISON, E. J. 1947. Field guide to the birds of King County, Washington. The trail side series, Seattle Audubon Soc., Wash. 66 p. KEYWORDS: BIRD, DISTRIBUTION

Biotic description of King County, methodology of observing birds, and a description of characteristics, habits, and location of each bird found in the county.

201. LARSON, K. M. 1972. The systematics of a population of sculpins (*Cottus*) in Lake Washington. M.S. thesis, Univ. Washington, Seattle. 76 p. KEYWORDS: LAKE WASH, FRESHWATER, FISH

This study was focused on the pelagic sculpin population described by Ikusemiju (1967). This sculpin resembles *Cottus aleuticus* in morphology and osteology. In addition, starch-gel electrophoresis studies indicated that several isozymes could not be separated from *C. aleuticus*. The lake sculpin population appears distinct from *C. aleuticus* in a few, apparently polygenic characters and it appears to be reproductively isolated; however the taxonomic status is still unclear.

202. LASSOIE, J. P., and D. R. M. SCOTT. 1972. Seasonal and diurnal patterns of water status in *Acer circinatum*. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 265-271. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: WATER, MOVEMENT, DECIDUOUS, TREE, CEDAR RIVER

Diurnal patterns of water status were monitored in vine maple on clear days during the summer of 1971. The water status was determined by studying sap velocity, branch water potential, and relative leaf resistance to water vapor diffusion.

203. LEGEAR, C. E. 1950. United States atlases: A list of national, state, county, city, and regional atlases in the Library of Congress. The Library of Congress, Ref. Dep., Washington, D.C. 445 p. KEYWORD: ATLAS

Lists atlases of Seattle and vicinity under King County, Washington. A supplement of 301 pages was published in 1953 as Volume 2.

204. LEON, K. A. 1970. Some aspects of the comparative biology of an interracial hybrid rainbow trout and the two parental stocks. Ph.D. thesis, Univ. Washington, Seattle. 111 p. + appendixes. KEYWORDS: FISH, LAKE WASH, HYBRID

Describes the planting of rainbow, hybrid, and steelhead trout into Portage Bay in the Lake Washington drainage and returns of these fish to the hatchery pond at the University of Washington.

205. LESTELLE, L. 1972. The effect of urbanization on the fish populations of a small stream. Unpubl. MS (Fish. 499--Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 50 p. (Typewritten) KEYWORDS: LAKE WASH, STREAM, URBAN, ALTERATION, FISH, POPULATION, BIOMASS

Provides population estimates (number) and biomass (kilograms per hectare) of trout (cutthroat and rainbow) and coho salmon in McAleer Creek, a northeastern tributary of Lake Washington. Two 107-m sections (one undisturbed and one altered by urbanization) were sampled five times between February 1971 and February 1972.

206. LIGHTHART, B., and P. E. TIEGS. 1972. Exploring the aquatic carbon web. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 289-300. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: CARBON, MINERAL CYCLE, LAKE

Describes methods of studying the aquatic carbon web, which contains six compartments: dissolved inorganic carbon (DIC), phytoplankton, zooplankton, dissolved organic carbon (DOC), detritus, and chemoorganotrophic bacteria. These methods would be applicable to the lakes in the Lake Washington watershed.

207. LINDSEY, R. J. 1972. Availability and distribution of fish in selected benthic areas of Lake Washington during the summer (June/August) 1971. Unpubl. MS (Fish. 499--Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 25 p. (Typewritten) KEYWORDS: BENTHIC, DISTRIBUTION, FISH, FRESHWATER, LAKE WASH

Summary of sampling shallow areas (0-18 m) in Lake Washington using horizontal gill nets with eight mesh sizes.

208. LOWTHIAN, K. M. 1968. Long-range water supply plan of King County. Water Dep., City of Seattle, Wash. 39 p. KEYWORDS: DEMAND, KING COUNTY, WATER

An areawide plan for the future development of a water supply for King County, Washington. Includes historical data trends (1920/1968) and projections (1968/2000) of water supply and demand and proposed improvements of water supply facilities.

209. LYNCH, J. E. 1936. New species of *Neoechnorhynchus* from the western sucker, *Catostomus macrocheilus* Girard. Trans. Am. Microsc. Soc. 55(1):21-43. KEYWORDS: FISH, PARASITE

Describes two new species of Acanthocephala from fish that were collected in an unnamed tributary of Lake Washirgton.

210. MARTIN, S. G. 1965. Environmental factors influencing the entry of chinook salmon and silver salmon into the University of Washington holding pond. M.S. thesis, Univ. Washington, Seattle. 70 p. KEYWORDS: BEHAVIOR, BREEDING, SALMON

This study was a part of Dr. Lauren Donaldson's selective breeding program at the University of Washington.

211. MATHEWS, S. B., and F. HAW. 1970. Lake Washington sockeye sport harvest. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 9 p. KEYWORDS: SALMON, RECREATION, FISHERY, LAKE WASH

Presents results of a questionnaire sent to sport fishermen who had returned tags taken from sockeye salmon that were caught in Lake Washington.

212. MATHISON, J. M. 1970. Investigation into the establishment of minimum flows for Cedar River, King County, Washington. Wash. State Dep. Water Resour., Div. Plann. Dev. 28 p. KEYWORDS: CEDAR RIVER, FISH, FLOW, WATER

A review of the Washington State Department of Water Resources authority in establishing water flows or levels for the state. The Cedar River minimum-flow investigation was concerned with protecting the fishery resource, the city's water and power, the locks, recreation, etc. The requested flows by the Department of Fisheries are available 80% of the time for eight months of the year, and 50% of the time during August, September, and October.

213. McCOLL, J. G. 1969. Ion transport in a forest soil: Models and mechanisms. Ph.D. thesis, Univ. Washington, Seattle. 214 p. KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, ION, MOVEMENT, SOIL, MODEL

This investigation deals specifically with the transport of mineral elements in ionic form in a forest soil profile, during short periods of rapid flux, that is associated with the movement of wetting fronts. It goes beyond earlier descriptive studies by providing models of some dynamic processes occurring in the soil system. The field study was conducted in a glacial outwash soil supporting a uniform stand of second-growth Douglas-fir in the Cedar River watershed. Comparisons between field solutions and laboratory equilibrium solutions show that water moving downward through the soil profile does not reach chemical equilibrium with the exchange complex of any given horizon. A simple, rational, mathematical model was developed for the forest floor that related the ion amount transported to the main controlling environmental factors.

214. ———. 1972a. Factors influencing ion transport in a Douglas-fir forest soil in western Washington. J. Ecol. (in press). KEYWORDS: CONIFEROUS, ENVIRON-FACTOR, FOREST, ION, TRANSPORT

Characteristics of solutions resulting from natural precipitation were studied as they passed downward through the tree canopy, the forest floor, and the 8-cm, 50-cm, and 120-cm depths in the soil profile at the Thompson Center on the Cedar River. Dependent variables studied for each horizon and wetting front include total ions transported, mean solution conductivity, maximum solution conductivity change, mean solution pH, and maximum pH change of solution.

215. ———. 1972b. Dynamics of ion transport during moisture flow from a Douglas-fir forest floor. Soil Sci. Soc. Am. Proc. (in press). KEYWORDS: CONIFEROUS, DYNAMICS, FOREST, ION, MOISTURE, TRANSPORT

Ion transport from the forest in relation to the temperature regime, the duration of time before flow, and the amount of moisture flow at the Thompson Center on the Cedar River. Seasonal changes, the dynamics of individual wetting fronts, and the mechanism of transport that relates carbon dioxide production and dissolution are discussed.

216. ———. ----. A model of ion transport during moisture flow from a Douglas-fir forest floor. (Submitted to Ecology.) KEYWORDS: CONIFEROUS, FOREST, HYDROLOGY, ION, MODEL, TRANSPORT

Temperature, electrical conductivity, and flow rate of solution in a forest floor were continuously monitored in the field using a tension-lysimeter system coupled with automated recording instruments at the Thompson Center on the Cedar River. The total ion amount that was released from the forest floor during movement of individual wetting fronts resulting from natural precipitation was calculated. (Copy available through D. W. Cole, College Forest Resources, Univ. Washington, Seattle.)

217. McCOLL, J. G., and D. W. COLE. 1968. A mechanism of cation transport in a forest soil. Northwest Sci. 42(4):134-140. KEYWORDS: CONIFEROUS, FOREST, CARBON, ION, MOVEMENT, SOIL

One probable factor controlling cation leaching in a mineral forest soil is the anion level of the soil solution. The bicarbonate ion, which constitutes a large portion of the total anions present in the soil solution, is formed from carbon dioxide dissolved in percolating water. It is proposed that hydrogen ions associated with the bicarbonate ions replace exchangeable cations from the soil complex. During periods of moisture flow, these cations are transported along with the mobile bicarbonate ions. Experimental results indicate that this mechanism may play a significant role in the transport and leaching of cations in the soil.

218. McLAUGHLIN, P. J. 1961. Some observations on encystment of a protistan ectocommensal on Cladocera. M.S. thesis, Univ. Washington, Seattle. 56 p. KEYWORDS: ARTHROPOD, PROTOZOA

Some of the samples used in this study were collected from Union Bay and ponds in the Seattle area.

219. McMANUS, D. A. 1963. Postglacial sediments in Union Bay, Lake Washington, Seattle, Washington. Northwest Sci. 37(2):61-73. KEYWORDS: GLACIAL, LAKE WASH, SEDIMENT

Sediment profile in Union Bay from Foster Island to Lake Washington.

220. MELDER, F. E. 1938. History of the discoveries and physical development of the coal industry in the State of Washington. Wash. Hist. Q. 29(2):151-165. KEYWORDS: HISTORY, RESOURCES, WASHINGTON

Brief insight into role of the Lake Washington watershed in the growth of the coal industry in the area for about 100 years, beginning in 1833.

221. MERRIMAN, D. S. 1935. The effect of temperature on the development of the eggs and larvae of the cutthroat trout (*Salmo clarkii clarkii* Richardson). J. Exp. Biol. 12(4):297-305. KEYWORDS: FISH, FRESHWATER, REPRODUCTION, TEMPERATURE

Describes a laboratory experiment of the effect of temperature (6.35°, 8.25°, and 11.3°C) on the growth of cutthroat trout embryos and larvae. The trout were collected in Thornton (Matthews) Creek, a northwestern tributary to Lake Washington.

222. MEYERS, W. 1969. Washington Water Pollution Control Commission. Water quality investigations--Lake Washington Ship Canal study.

Unpubl. MS, Lake Wash.--Ship Canal file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: WATER QUALITY, POLLUTION, LAKE WASH, CANAL

Description of water quality investigations in the ship canal.

223. MILLER, D. W., J. J. GERAGHTY, and R. S. COLLINS. 1962. Water atlas of the United States. Water Information Center, Inc., Port Washington, Long Island, N.Y. 40 plates with explanations. KEYWORDS: ATLAS, WATER, RESOURCES

The atlas portrays by maps many aspects of water resources, including areas of water surplus and deficiency, rivers and principal drainage basins, mean annual lake evaporation, average temperature of groundwater, groundwater use, total withdrawal of water by state, population distribution, per capita water use, and per capita water consumption.

224. MILLER, J. F. (Mayor of Seattle). 1909. The City of Seattle. Coast 18:129-334. KEYWORDS: DESCRIPTION, HISTORY, URBAN

An entire magazine containing articles about the City of Seattle--history, buildings, parks, land, transportation, shipping, public utilities, public schools, etc.

225. MILLER, S. 1970. Small mammal populations in a Douglas-fir forest: Cedar River, Washington. M.S. thesis, Univ. Washington, Seattle. 102 p. KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, MAMMAL, POPULATION, SURVEY, BIOMASS

Summary of population and biomass estimates of small mammals on the Thompson Research Center on the lower Cedar River watershed. Also provides appendixes with a species list of mammals for the Cedar River watershed, vegetation analysis of the study areas, biology of selected species, and assumptions used in calculating energy flows.

226. MILLER, S., C. W. ERICKSON, R. D. TABER, and C. H. NELLIS. 1972. Small mammal and bird populations on Thompson site, Cedar River: Parameters for modeling. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on Coniferous Forest Ecosystems--A symposium, p. 199-207. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) KEYWORDS: CEDAR RIVER, WATERSHED, BIRD, MAMMAL, POPULATION

Summary of preliminary estimates of small-mammal and bird populations that were made on the Cedar River watershed. Also provides an estimate of biomass for the most abundant birds and mammals. A list of the birds and mammals on the Thompson site is presented with a summary of the foraging strata and consumer role by species.

227. MILLS, D. 1969. A population study of the Lake Washington yellow perch, *Perca flavescens*. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 17 p. KEYWORDS: AGE-GROWTH, FOOD, FISH, FRESHWATER, LAKE WASH

General notes on the food habits, fecundity, maturity, parasitism, and growth of the yellow perch in Lake Washington.

228. MINYARD, P., and C. H. DRIVER. 1972a. Basidiomycetes in the primary decomposition of forest floor litter. Intern. Rep. 15, US/IBP Coniferous For. Biome, Univ. Wash. AR-10, Seattle. 6 p. KEYWORDS: CONIFEROUS, FOREST, DECOMPOSITION, FUNGI

Describes a preliminary study to determine the role of fungi (Basidiomycetes) as primary decomposers in the floor of a coniferous forest.

229. ———. 1972b. Initial steps in decomposition of Douglas-fir needles under forest conditions. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 261-263. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: CONIFEROUS, FOREST, DECOMPOSITION

A study of the decomposition of Douglas-fir needles that were exposed to forest floor conditions for 6 and 12 months.

230. MORSE, R. W. 1964. Water--Seattle's great heritage. Control Rep., Water Dep., City of Seattle, Wash. KEYWORDS: HISTORY, WATER, WATERSHED

A comprehensive study of the history, development, and present operation of Seattle's water supply and the water department. A description is included of the Cedar River watershed and its facilities.

231. MOULTON, L. 1969. A study of the longfin smelt spawning grounds in the Cedar River. Unpubl. MS (Fish. 499--Prof. DeLacy), Coll. Fish., Univ. Wash., Seattle. 15 p. + appendix tables. KEYWORDS: CEDAR RIVER, FISH, FRESHWATER, SPAWNING

An extension of Sommani's study of 1968 that was pursued by Moulton as an M.S. thesis. (See Moulton, 1970, for a more complete review.)

232. ———. 1970. The 1970 longfin smelt spawning run in Lake Washington with notes on egg development and changes in the population since 1964. M.S. thesis, Univ. Washington, Seattle. 84 p. KEYWORDS: EMBRYO, FISH, FRESHWATER, LAKE WASH, SPAWNING

Additional features on the life history of the longfin smelt and changes in the population since 1964 when treated sewage was diverted from the lake causing physical and biological changes in the lake.

233. MUNN, J. H. 1965. Chinook salmon returns to the University of Washington during the year 1953 through 1961. M.S. thesis, Univ. Washington, Seattle. 156 p. KEYWORDS: ESCAPEMENT, FECUNDITY, SALMON

A study of chinook salmon returns at the University of Washington from 1953 to 1961. Sex, mark, fork length, and date of arrival are recorded for each fish. In addition, after 1959, records of body weight, fecundity, and average egg size were kept.

234. OGLESBY, R. T., and W. T. EDMONDSON. 1966. Control of eutrophication. J. Water Pollut. Control Fed. 28(9):1452-1460. KEYWORDS: EUTROPHIC, NUTRIENT, LAKE WASH

Dilution and diversion of nutrients show success toward decreasing eutrophication. Lake Washington was used as an example of nutrient diversion for control of eutrophication.

235. OLNEY, F. 1971. Contributions to the life history of the northern squawfish (*Ptychocheilus oregonensis*) in Lake Washington. Unpubl. MS (Fish. 499--Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 16 p. + appendix. KEYWORDS: AGE-GROWTH, DISTRIBUTION, FOOD, FISH, FRESHWATER, LAKE WASH

Summarizes data on distribution, food habits, and growth of the squawfish in Lake Washington.

236. OLSON, P. R., D. W. COLE, and R. R. WHITNEY. 1972. Findley Lake--The study of a terrestrial-aquatic interface. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 15-20. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: TERRESTRIAL, AQUATIC, LAKE, WATERSHED, ECOSYSTEM

Describes the initial program and long-term objectives of linking the terrestrial processes and the limnological properties of Findley Lake in the Cedar River watershed.

237. PACIFIC NORTHWEST RIVER BASINS COMMISSION. (Various dates--current). Punch card file. Pacific Northwest River Basins Comm., Vancouver, Wash. KEYWORDS: BIBLIOGRAPHY, LAKE WASH, WATERSHED, FISH, FLOOD, POWER, RECREATION, WILDLIFE

A comprehensive retrieval system. Key to punch cards includes the following topics: State 4 Washington; County 033 King; Drainage Basins 11 Puget (Cedar River and Sammamish River); Organizations 4 Washington; Suborganizations 1 Dep. Agriculture, 2 State Canal Commission, 3 Dep. Commerce and Economic Development, 4 Dep. Fisheries, 5 Dep. Game, 6 Dep. Health, 7 Interagency Committee for Outdoor Recreation, 8 Dep. Natural Resources, 9 Dep. Parks and Recreation, 10 Water Pollution Control Commission, 11 Planning and Community Affairs Agency, 12 Dep. Water Resources, 13 Univ. Washington and Washington State Univ., 14 other; U.S. Departments 6 Agriculture, 7 Army, 8 Commerce, 9 Federal Power Commission, 10 Health, Education, and Welfare, 11 Housing and Urban Development, 12 Interior, 13 Transportation, 14 U.S. Entity; Study Purpose 1 Flood control, 2 Irrigation, 3 Water supply, 4 Water quality, 5 Navigation, 6 Sedimentation, 7 Land and channel stabilization, 8 Multiple land use, 9 Fish and wildlife, 10 Power, 11 Recreation, 12 Watershed management, 13 Drainage, 20 other; Level of Study 1 Reconnaissance, 2 Feasibility, 3 Design, 4 other; Status 1 Proposed, 2 Underway, 3 Completed. Each card contains the following annotations: 1 Study title, 2 Location, 3 Responsible state, federal department or other organization, 4 Field office conducting study, 5 Study purpose, 6 Level of study, 7 Status, 8 Narrative.

238. ———. 1968-1969. Climatological handbook, Columbia basin states. Meteorol. Comm., Pac. Northwest River Basins Comm., Vancouver, Wash. KEYWORDS: CLIMATE, NORTHWEST

Summaries of following climatological data: Vol. I (parts A & B)--Temperature, 1969, 540 p. + appendix tables; Vol. II--Precipitation, 1969, 262 p. + appendix tables; Vol. III (parts A & B)--Hourly data, 1968, 641 p. + appendix tables. This handbook brings together in one publication practically all of the available summarized surface climatological information for the Northwest. Approximately 90% of the information had not been published previously. Data include ceiling, cloudiness, degree days, dew point (°F), evaporation, precipitation, barometric pressure, relative humidity, sky cover, snowfall, solar radiation, temperature (°F), visibility, weather types, and wind. The number of years of records for various stations in the Lake Washington drainage are provided with the summaries.

239. ———. 1969. River mile index--Lake Washington, Puget Sound Basin p. 30-38. Hydro. Hydraul. Comm., Pac. Northwest River Basins Comm., Vancouver, Wash. KEYWORDS: DESCRIPTION, STREAM, WATERSHED

River location, miles from source, list of all tributaries, drainage area, water elevation, and description of basin.

240. ———. 1970-1971. Comprehensive study of water and related land resources: Puget Sound and adjacent waters. Puget Sound Task Force, Pac. Northwest River Basins Comm., Vancouver, Wash. 98660. KEYWORDS: MANAGEMENT, NORTHWEST, WATER, WATERSHED, RESOURCES

The contents have been published as separate appendixes: (1) Digest of public hearings; (2) Political and legislative environment; (3) Hydrology and natural environment; (4) Economic environment; (5) Water-related land resources; (6) Municipal and industrial water supply; (7) Irrigation; (8) Navigation; (9) Power; (10) Recreation; (11) Fish and wildlife; (12) Flood control; (13) Water quality control; (14) Watershed management; (15) Plan formulation. Each appendix is a detailed report on one of the various components of water and land resources of Puget Sound. These reports were prepared by the task force, established in 1969, consisting of ten members representing major state and federal agencies. Information pertinent to the Lake Washington drainage is included under the section of the appendixes entitled "Cedar--Green River Basins."

241. PATTEN, B. G. 1971. Spawning and fecundity of seven species of Northwest American *Cottus*. Am. Midl. Nat. 85(2):493-506. KEYWORDS: FISH, FRESHWATER, REPRODUCTION

Documents the spawning and fecundity of sculpins in Washington State. Records the occurrence and reproduction of *Cottus confusus* from Swamp Creek, a tributary to the Sammamish River.

242. PAUTZKE, C. F. 1938. Studies on the effect of coal washings on steelhead and cutthroat trout. Trans. Am. Fish. Soc. 67(1937):232-233. KEYWORDS: CEDAR RIVER, FISH, POLLUTION, STREAM

Describes a single field experiment to determine the effects of coal washings on steelhead trout. Experiment was done in the Cedar River because of the debris from coal mining that was going into the river.

243. PETERSON, D. R. 1955. An investigation of pollutional effects in Lake Washington. Wash. State Pollut. Control Comm. Tech. Bull. 18. 18 p. KEYWORDS: ALGAE, EUTROPHIC, LAKE WASH, SEWAGE

Study of algal growths in Lake Washington from June 1952 to July 1953 showed the lake to be in the early stages of eutrophication. During periods of precipitation 32 overflow structures discharged storm water and raw sewage into the lake. Treated and untreated sewage was also introduced into the lake by individual household disposal systems. Algae bloom was maximum in May with increased amounts of nitrates, phosphates, and light.

244. PETERSON, D. R., K. R. JONES, and G. T. ORLOB. 1952. An investigation of pollution in Lake Washington. Wash. State Pollut. Control Comm. Tech. Bull. 14. 29 p. KEYWORDS: LAKE WASH, POLLUTION, SEWAGE, STREAM

Summary of a pollution study of Lake Washington watershed from 6 May to 26 August 1952 by the Washington State Pollution Control Commission.

Seven sewage treatment plants (serving 46,000 people) discharged chlorinated effluent into the lake. Six of the nine tributary streams to the watershed were polluted.

245. PURVIS, N. H. 1934. History of Lake Washington Canal, Washington. Wash. Hist. Q. 25(2):114-127; 25(3):210-213. KEYWORDS: DESCRIPTION, HISTORY, LAKE WASH, CANAL

A history of the ship canal covers the Seattle and Lake Washington region: the building, history, location controversy, costs, hydraulics, features of the two locks and dam, saltwater intrusion, and the salt-water basin.

246. RAHMAN, A. H. M. M. 1964. A study of the movement of elements from tree crowns by natural litterfall, stemflow and leaf wash. M.F. thesis, Univ. Washington, Seattle. 118 p. KEYWORDS: CEDAR RIVER, WATERSHED, DECIDUOUS, CONIFEROUS, FOREST, CARBON, NITROGEN, PHOSPHORUS, MINERAL CYCLE, FERTILIZER, SOIL

Collections were made on a monthly basis from both red alder and Douglas-fir stands at the Cedar River and from plots under various species and treatments at Pack Forest. Stemflow, leaf wash, and the individual components of litterfall (leaves, twigs, branches, and flowers) were analyzed for percentage of nitrogen, phosphorus, potassium, calcium, and magnesium. Soils from the study plots were analyzed for their chemical and physical properties. Annual litterfall at Cedar River was 252 kg ha^{-1} (1369 lb/acre) in Douglas-fir and 293 kg ha^{-1} (1593 lb/acre) in red alder stands. Fertilizer application increased litterfall. The nitrogen, potassium, and calcium content of red alder litterfall is higher than that of Douglas-fir litterfall.

247. RATTRAY, M., Jr., G. R. SECKEL, and G. A. BARNES. 1954. Salt budget in the Lake Washington Ship Canal system. J. Mar. Res. 13(3):263-275. KEYWORDS: FLOW, SALTWATER, LAKE WASH, CANAL

Saltwater enters and accumulates in the freshwater system of Lake Washington, Montlake Canal, Lake Union, Fremont Canal, and Salmon Bay during the summer when heavy lock operation and small runoff occur. Lake Union is flushed corresponding to the rates of flow during periods of high runoff; Lake Washington is flushed only during the winter overturn. Stagnation may occur with increased chlorinity since the water may be so dense that overturn and flushing may not occur. Approximately 25% of the saltwater is flushed from Lake Washington annually.

248. REDMOND PLANNING DEPARTMENT. 1970. Optimum land use plan. City of Redmond Planning Office, Redmond, Wash. 75 p. KEYWORDS: MANAGEMENT, WATERSHED, URBAN

A summary of studies and staff reports needed to guide future development in the City of Redmond on the following subjects: population, employment, land use growth, city zoning, subdivision, land use planning, sewer plan, land for recreation use, transportation, and watershed. Its goal is to maintain an economic balance and natural beauty.

249. REED, K. L., and W. L. WEBB. 1972. Criteria for selecting an optimal model: Terrestrial photosynthesis. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 227-236. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: MODEL, TERRESTRIAL, PHOTOSYNTHESIS

Discusses a linear regression model, an energy budget model, and models based on a theory of enzyme kinetics and gas exchange, and suggests criteria to be used in the selection of models as related to terrestrial photosynthesis.

250. REES, W. H. 1959. Effects of stream dredging on young silver salmon (*Oncorhynchus kisutch*) and bottom fauna. Wash. State Dep. Fish., Fish. Res. Pap. 2(2):52-65. KEYWORDS: ALTERATION, FAUNA, FISH, STREAM

A study of the biological changes occurring from rechanneling about 1.6 km of Little Bear Creek, a tributary to the Sammamish River. Following channeling a drastic reduction in the bottom fauna and fish populations resulted, but both groups of organisms recovered within one year.

251. RIEKERK, H., and S. P. GESSEL. 1968. The movement of DDT in forest soil solutions. Soil Sci. Soc. Am. Proc. 32(4):595-596. KEYWORDS: CONIFEROUS, FOREST, PESTICIDE, MOVEMENT, SOIL

DDT was sprayed at two rates on a gravelly forest soil. Periodic leachate collections from tension lysimeters placed under the forest floor and surface soil have been analyzed by gas chromatography.

252. ROBERSON, K. 1967. An occurrence of chinook salmon beach spawning in Lake Washington. Trans. Am. Fish. Soc. 96(4):423-424. KEYWORDS: LAKE WASH, SPAWNING, SALMON

In 1965, 50 chinook salmon spawned on three Lake Washington beaches, Juanita, Windermere, and Seward Park, where there was gravel, sand, and groundwater seepage. Spawning occurred in 15 to 91 cm of water. No lake spawning of chinook occurred in 1964 or 1966.

253. ROBERTS, E. H. 1936. The quality of Washington waters. Wash. Agric. Exp. Stn., Pullman. 35 p. (Mineographed) KEYWORD: WATER QUALITY

A review of water sources in Washington, including selected areas from each county. The sources, chemical properties and hardness, ownership, and plant processes are included.

254. ROBERTSON, F. 1957. Geology and ground water resources of Rock Creek, King County, Washington. The City of Kent, Wash. 14 p. + appendix. KEYWORDS: GEOLOGY, WATER, RESOURCES, STREAM

The southern quarter of Rock Creek has large quantities of water-bearing gravel and sands of high porosity and permeability, which contain sufficient water to meet the demands of the development program of Kent.

255. ROBINSON, R. J. 1938. The chemical data of Lake Washington. Unpubl. MS, Sci. Reading Room, Univ. Wash., Seattle. 64 p. (Typewritten) KEYWORDS: LAKE WASH, WATER QUALITY

Temperature, circulation, dissolved solids and chlorides, gases and hydrogen-ion concentrations, plant nutrients, and organic materials in Lake Washington.

256. ROELLIG, T., and D. STRICKMAN. 1970. Effects of fertilization on the forest. Unpubl. MS (NSF Secondary Sci. Train. Program), Coll. For. Resour., Univ. Wash., Seattle. 32 p. (Typewritten) KEYWORDS: CONIFEROUS, FOREST, FERTILIZATION, NITROGEN, MOVEMENT, SOIL

An experiment on the Cedar River watershed was designed to examine the effects of two variables, the amount of urea applied and the character of precipitation following fertilization. Nitrogen transformations and movement following treatment were studied throughout the soil profile down to and including a 102-cm depth. Upward movement of nitrogen in the form of ammonia volatilization also was measured.

257. ROYAL, L. A., and A. SEYMOUR. 1940. Puget Sound sockeye plantings show varying degrees of success. Prog. Fish-Cult. 52:1-7. KEYWORDS: DISTRIBUTION, FISH, REPRODUCTION, SALMON

Prior to 1940, only an occasional sockeye salmon was reported south of the Skagit River. Documents the introduction of sockeye fry into the Cedar River, Bear Creek, and Issaquah Creek during 1937 and the first spawning of the fish that returned from this year class in 1940.

258. SALO, D. J., J. A. RINGO, J. H. NISHITANI, and R. B. WALKER. 1972. Development and testing of an inexpensive thermoelectrically cooled cuvette. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium,

p. 273-277. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print, Off., Washington, D.C.) 322 p. KEYWORDS: ASSIMILATION, RESPIRATION, CONIFEROUS, FOREST, CEDAR RIVER

Describes an economical temperature-controlled cuvette system to monitor carbon dioxide assimilation and dark respiration in the crowns of Douglas-fir trees.

259. SCATTERGOOD, L. W. 1948. Autumn census of Lake Washington waterfowl in 1937. Murrelet 29(1):5-8. KEYWORDS: ABUNDANCE, BIRD, LAKE WASH

An October 1937 census determined the numbers and species of ducks present at two areas on Lake Washington. At Kenmore and at Andrews Bay, respectively, there were 93% and 99% mallards, baldpates, and coots. The amount of food present was a major factor in the large concentrations of ducks in these two areas. A table lists the species and numbers of waterfowl counted.

260. SCHEFFER, V. B. 1936. The plankton of Lake Washington. Ph.D. thesis, Univ. Wash, Seattle. 110 p. KEYWORDS: LAKE WASH, LIMNOLOGY, PLANKTON

A general description of the plankton of Lake Washington, the relationship of the plankton to that of other United States lakes, and a comparison of the physics and chemistry of the water and plankton of the lake to environmental conditions. Concluded that Lake Washington was a temperate lake with all the principal characteristics of an oligotrophic lake with a phytoplankton population typical to those conditions.

261. SCHEFFER, V. B., and R. J. ROBINSON. 1939. A limnological study of Lake Washington. Ecol. Monogr. 9(1):95-143. KEYWORDS: LAKE WASH, LIMNOLOGY

Brief account of previous limnological studies of Lake Washington: the geography of the lake and region; the physical and chemical characteristics of the water such as temperature, circulation, dissolved solids and chlorides, dissolved gases and pH, plant nutrients, and organic material; the quantity, species, distribution, and function of plankton; and the shore and bottom life. Concluded that the lake was oligotrophic.

262. SCHLICHTE, A. K. 1968. The mineralogy of the Everett soil series at the Cedar River watershed. M.S.F. thesis, Univ. Washington, Seattle. 59 p. KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, ELEMENT, DESCRIPTION, SOIL

The mineralogy of the Everett soil series at the Cedar River research area was investigated. Particle size distribution, bulk density, and pebble lithology were determined from samples. Microscopic, X-ray diffraction, and X-ray spectroscopic methods were used to determine the mineralogy of the soil.

263. SCHMOE, F. W. 1933. A wildlife review of Lake Washington. Seattle Grade Club Mag. 14(3):17, 40. KEYWORDS: DISTRIBUTION, LAKE WASH, MAMMAL, WILDLIFE

An elementary review of the mammal life found at the north end of Lake Washington.

264. SCHNEIDER, R. L. 1971. A comparison of tetracycline marks with pectoral fin clips in returning chinook salmon males. M.S. thesis, Univ. Washington, Seattle. 70 p. KEYWORDS: FISH, MARKING, SALMON

Describes the successful marking of chinook salmon with tetracycline (TM-50) that was placed in the food mixture for fry. Returning salmon were checked for marks at the University of Washington ponds.

265. SCHULTZ, L. P. 1930a. The life history of *Lampetra planeri* Block, with a statistical analysis of the rate of growth of the larvae from western Washington. Univ. Mich., Mus. Zool. Occas. Pap. 221. 35 p. KEYWORDS: FISH, FRESHWATER, LIFE HISTORY, SAMM RIVER

Life history notes on the western brook lamprey. Two year classes in the larvae can be distinguished definitely. Some evidence that lampreys are about four years old at spawning. Larvae abundant in eddies with rich deposits of silt mixed with a little sand. Collections in the Lake Washington drainage were made in Evans Creek, a tributary to the Sammamish River at Redmond.

266. ———. 1930b. Miscellaneous observations on fishes in Washington. Copeia 1930(4):137-140. KEYWORDS: ABUNDANCE, DISTRIBUTION, FISH, LAKE WASH

Reported that the western brook lamprey is abundant in all the lowland streams in the vicinity of Lake Washington. Also reported a single adult specimen of the river lamprey from Lake Washington. Spot checking in suitable spawning areas did not reveal any additional lampreys. The black crappie was also reported as abundant in Lakes Washington and Union.

267. ———. 1934. Species of salmon and trout in northwestern United States. Proc. Fifth Pac. Sci. Congr. p. 3777-3782. KEYWORDS: DESCRIPTION, NORTHWEST, SALMON

A key to the species of Salmonidae in northwestern United States. A short discussion of their characteristics, along with a discussion of problems in identification and classification.

268. ———. 1935. The spawning habits of the chub, *Mylocheilus caurinus*, a forage fish of some value. Trans. Am. Fish. Soc. 65:143-147. KEYWORDS: BEHAVIOR, FISH, FRESHWATER

First description of the spawning behavior of peamouth. The fish were observed spawning along specific beaches of Lake Washington.

269. ———. 1937. The breeding habits of salmon and trout. Ann. Rep. Smithson. Inst. 1937:365-376. KEYWORDS: BEHAVIOR, FISH, FRESHWATER

Describes the spawning habits of kokanee (*Oncorhynchus nerka*) from Swamp Creek, a tributary to the Sammamish River. Much of the information from Schultz and students (1935) is repeated.

270. SCHULTZ, L. P., and A. C. DELACY. 1935/1936. Fishes of the American Northwest: A catalogue of fishes of Washington and Oregon with distributional records and a bibliography. J. Pan-Pac. Res. Inst. 10(4):365-380; 11(1):62-78; 11(2):127-142; 11(3):211-226; 11(4):275-290. KEYWORDS: DISTRIBUTION, FISH, FRESHWATER, NORTHWEST

Summarizes distributional records of fishes, including the Lake Washington drainage.

271. SCHULTZ, L. P., and STUDENTS. 1935. The breeding activities of the little redfish, a landlocked form of the sockeye salmon, *Oncorhynchus nerka*. J. Pan-Pac. Res. Inst. 10(1):67-77. KEYWORDS: BEHAVIOR, SALMON, FRESHWATER

Detailed description of spawning behavior of landlocked salmon in Swamp Creek (northeastern tributary to Lake Washington).

272. SEABLOOM, R. W. 1969. Bacteriological effect of small boat wastes on small harbors. Unpubl. MS, Coll. Eng., Univ. Wash., Seattle. 20 p. KEYWORDS: BACTERIA, POLLUTION, RECREATION, LAKE WASH

A potential health problem existed because of the overboard discharge of fecal wastes from small recreational craft. Federal regulations seemed to be ineffective in solving the problem. Data are presented from a study of small pleasure craft pollution in Meydenbauer Bay of Lake Washington. Concluded that systems for handling sewage from small craft were inadequate and that technology should be improved.

273. SEALE, A. 1895. List of freshwater fishes collected in the vicinity of Seattle, Washington, by Edwyn C. Starks. Proc. Calif. Acad. Sci. Ser. 2(5):852-854. KEYWORDS: DISTRIBUTION, FISH, FRESHWATER, NORTHWEST, LAKE WASH

A list of nine fish species taken from Lake Washington and Green Lake, with information on characteristics and observed abundance. The sockeye salmon was reported to be an abundant species in 1895.

274. SEATTLE AND LAKE WASHINGTON WATERWAY COMPANY. 1902. History and advantages of the canal and harbor improvement project now being executed by the Seattle and Lake Washington Water Company. Seattle and Lake Washington Waterway Co., Seattle, Wash. (available at the Washington State Library in Olympia). KEYWORDS: HISTORY, LAKE WASH, CANAL

History of the Lake Washington Ship Canal and harbor improvement project of the Seattle and Lake Washington Waterway Company before and to 1895. Includes an appendix with pertinent historical documents that helped to determine future decisions on location and advantages of the canal.

275. SEATTLE, MUNICIPALITY OF METROPOLITAN. 1964. Water quality control. Report of engineers' operations, 1 July 1962--31 Dec. 1963, p. 32-36. Municipality of Metropolitan Seattle, Wash. KEYWORDS: POLLUTION, WATER, WATER QUALITY, SEWAGE

Major responsibility of METRO is to protect water from pollution and contamination. Industrial waste control and receiving-water quality control programs have been established to ensure control of raw sewage and treatment of plant effluent.

276. ———. 1969. A brief summary of water quality findings in the Sammamish River. Water Qual. Div., Munic. Metrop. Seattle, Wash. 4 p. KEYWORDS: BACTERIA, NUTRIENT, SAMM RIVER, WATER QUALITY

Summaries of the total and fecal coliform bacteria and nutrients (nitrites, nitrates, phosphates) for various stations in the Sammamish River for the two-year period between March 1967 and February 1969. See Dalseg and Hansen (1969) for a detailed report.

277. SECKEL, G. R. 1953. Salt intrusion and flushing of Lake Washington Ship Canal. M.S. thesis, Univ. Washington, Seattle. 97 p. KEYWORDS: FLOW, SALTWATER, LAKE WASH, CANAL

A siphon on the freshwater side of the Hiram M. Chittenden Locks was designed as the major saltwater catch basin. Salmon Bay and Lake Union are deeper than Fremont Canal and Montlake Canal and act as additional catch basins. Computed volumes of saltwater intrusion show the siphon and Salmon Bay to be inadequate in preventing lake contamination on the basis of volume capacity. Only 25% of the chlorinity flushes out of Lake Washington annually during the period of overturn. Tables of chlorinity and water discharge are provided for 1951, 1952, and 1953.

278. SECKEL, G. R., and M. RATTRAY. 1953. Studies on Lake Washington Ship Canal. Dep. Oceanogr., Univ. Wash., Tech. Rep. 15. 101 p. KEYWORDS: SALTWATER, OXYGEN, LAKE WASH, CANAL

Because the lock's saltwater siphon and Salmon Bay basin are inadequate on the basis of volume capacity during a period of little rainfall in the summer and fall, a complete overturn of Lake Washington could be prevented and a zone of anaerobic decomposition would be created in the bottom layers. Oxygen would disappear from these layers and cause the normal plant and animal life to disappear. Also, saltwater flowing lakeward out of the locks moves like a jet into Lake Union, where it is no longer subject to the siphon's flushing action. When runoff through the ship canal is at a minimum, the level of saltwater rises above the sill so that saltwater intrudes into Lake Washington.

279. SHAPIRO, J. 1960. The cause of a metalimnetic minimum of dissolved oxygen. Limnol. Oceanogr. 5(2):216-227. KEYWORDS: EUTROPHIC, OXYGEN, PLANKTON, LAKE WASH

Lake Washington, which was undergoing eutrophication, was showing an increase in the magnitude of a metalimnetic depletion of dissolved oxygen. This increase was due to the respiration of a metalimnetic population of nonmigrating copepods, which were increasing in numbers. Chemical properties of the metalimnetic depletion are compared with those of a hypolimnetic depletion due to morphometric causes.

280. SHAPIRO, J., W. T. EDMONDSON, and D. E. ALLISON. 1971. Changes in the chemical composition of sediments in Lake Washington, 1959-1970. Limnol. Oceanogr. 16(2):437-452. KEYWORDS: EUTROPHIC, LAKE WASH, SEDIMENT

Comparisons were made among three cores taken in deep water in different parts of Lake Washington in 1958 and 1959, and two cores taken at one of these locations in 1968 and 1970. During the interval between the two sets of cores, the sewage effluent that had been causing eutrophication of the lake was diverted and the lake began to return to relatively unproductive condition. Because the lake was in a state of rapid change, this paper documents the transition between two quite different conditions.

281. SHEARER, K. 1971. Catch per effort of a fyke net used to capture catfish in Lake Washington. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 9 p. (Typewritten) KEYWORDS: FYKE NET, FISH, FRESHWATER, LAKE WASH, SAMPLING

Preliminary analysis of data that were collected on brown bullhead by Kenneth Imamura, an M.S. candidate with the Washington Cooperative Fishery Unit, College of Fisheries, University of Washington.

282. SHEW, D. M. 1972. Some aspects of the life history of the largescale sucker, *Catostomus macrocheilus* (Girard). Unpubl. MS (Fish. 499--Prof. Wydoski), Coll. Fish., Univ. Wash., Seattle. 25 p. + appendix. (Typewritten) KEYWORDS: AGE-GROWTH, BENTHIC, FRESHWATER, FISH, LAKE WASH

Summarizes age and growth of the largescale sucker in Lake Washington. Also provides information on the fecundity of this species.

283. SMITH, E. V. 1921. Report on the little red fish, locally known as the silver trout. State Game Warden, 7th and 8th Ann. Rep., p. 18-20. KEYWORDS: FISH, FRESHWATER, LAKE SAMM, LAKE WASH

The silver trout of Lake Washington and Lake Sammamish is a small variety of the sockeye salmon which does not migrate out to saltwater.

284. SMITH, E. V., and T. G. THOMPSON. 1925. The control of sea water flowing into Lake Washington Ship Canal. Ind. Eng. Chem. 17(10):1084-1087. KEYWORDS: FLOW, SALTWATER, LAKE WASH

After the completion of the Lake Washington Ship Canal in 1917, seawater invaded Lake Union to the extent that its waters were unfit for industrial purposes. A study that was undertaken concluded: (1) The concentration of seawater in the freshwater is dependent on rainfall, number of lockages, the saltwater drain, and surplus water disposal. (2) The volume of saltwater in the freshwater could be lessened by conducting surplus water through the lock valves instead of letting it run over the spillway, draining surplus water during the dry season instead of during the period of surplus gain, and enlarging the saltwater basin. (3) Lake Union serves as a secondary basin, thus preventing saltwater from entering Lake Washington.

285. ———. 1927a. Occurrence of hydrogen sulfide in the Lake Washington Ship Canal. Ind. Eng. Chem. 19(7):822-826. KEYWORDS: BACTERIA, POLLUTION, LAKE WASH, CANAL

In 1925 hydrogen sulfide was noted in the deeper portions of the Lake Washington Ship Canal where quantities of brackish water had accumulated. The hydrogen sulfide was caused by bacterial action.

286. ———. 1927b. Salinity of Lake Washington Ship Canal. Eng. Exp. Sta. Univ. Wash. Bull. 41. 104 p. KEYWORDS: HISTORY, SALTWATER, LAKE WASH, CANAL

Lake Washington Ship Canal's geographic location and historical background are explained. A description of the canal, locks, and methods for saltwater removal are given. Conditions affecting the flow and concentration of saltwater in the canal are explained. Includes tables, maps, and drawings of the Lake Washington Ship Canal area.

287. SMITH, R. T. 1941. Lake Sammamish temperatures. Unpubl. MS, Lake Wash.--Lake Samm. file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: LAKE SAMM, TEMPERATURE

Temperatures taken at various depths from three locations. Data indicated that a thermocline becomes established between 8 and 11 m during late summer. Tables and graphs are given.

288. SOMMANI, P. 1968. Characteristics of the eggs and larvae of the longfin smelt (*Spirinchus thaleichthys*) and *Cottus* sp., and some aspects on their spawning ground in the Cedar River. Unpubl. MS (Fish. 499--Prof. DeLacy), Coll. Fish., Univ. Wash., Seattle. 12 p. KEYWORDS: EMBRYO, FISH, FRESHWATER, SPAWNING

Descriptions and sketches of the eggs of the longfin smelt and a cottid. Notes of the spawning area of the smelt in the Cedar River are given.

289. SPAHR, M. D. 1972. An evaluation of the spray irrigation facilities in the Lake Washington basin. M.S. thesis, Univ. Washington, Seattle. 83 p. KEYWORDS: LAKE WASH, WATERSHED, IRRIGATION, NUTRIENT

This study reviewed the feasibility of disposing of wastewater by spray irrigation in facilities at Lake Hills, northeast Lake Washington, Watstine Lake, Newport Hills, Hazelwood Terrace, Cascade, and Timberline. The purpose of the analysis was to set more specific numerical guidelines on important parameters and thereby ensure a greater chance of success in future operations. A "checklist" or general design procedure was developed to offer the design engineer the guidelines necessary for a successful spray irrigation system from an operational and environmental standpoint.

290. STEIN, J. N. 1970. A study of the largemouth bass population in Lake Washington. M.S. thesis, Univ. Washington, Seattle. 69 p. KEYWORDS: AGE-GROWTH, DISTRIBUTION, FOOD, MOVEMENT, REPRODUCTION, FISH, FRESHWATER, LAKE WASH

Samples of largemouth bass were collected from seven areas in Lake Washington. Bass habitat was summarized in four categories for the lake. Summarizes age and growth, length-weight relationship, reproduction, food habits, and movements for this species.

291. STOBER, Q. J., and J. G. MALICK. 1972. Aquatic production in a sockeye salmon river. Intern. Rep. 26, US/IBP Coniferous For. Biome, Univ. Wash. AR-10, Seattle. 10 p. KEYWORDS: CEDAR RIVER, BENTHIC, FAUNA, PRODUCTION

Describes the general survey of invertebrate populations at six stations on the Cedar River for the first three months of study. Presents two tables of water quality analyses at each of the stations.

292. STOCKNER, J. G., and W. BENSON. 1967. The succession of diatom assemblages in the recent sediments of Lake Washington. Limnol. Oceanogr. 12(3):513-532. KEYWORDS: EUTROPHIC, PLANKTON, SEDIMENT, LAKE WASH

Diatom remains in the recent sediment of Lake Washington reveal correlations with the pattern of sewage enrichment over the past 80 years. In the deeper sediment deposited prior to cultural enrichment, the relative composition of the diatoms was constant. The considerable change in species ranking, diversity, and redundancy values in the upper 30 cm of sediment is the result of the interaction between the various species and the degree of cultural enrichment. The percentages of Araphidinae and Centrales seemed to be more reliable indicators than independent species.

293. SYCK, J. M. 1964. Thermal convection in Lake Washington, winter 1962-1963. M.S. thesis, Univ. Washington, Seattle. 32 p. KEYWORDS: CURRENT, FLOW, LAKE WASH, TEMPERATURE

The bottom water of Lake Washington is of nearly uniform temperature because cold, dense water flows out of shallow bays and down the slope, mixing with and replacing the deep water. Thus sections with large shallow areas do not become as cold as expected when heat loss is computed with meteorological conditions. Deep sections become colder than expected because of influx of cold water from shallow areas and loss of warmer water to shallow areas. Estimate of the current flow is 2 cm sec^{-1}.

294. SYLVESTER, R. O. 1952. The sewage disposal problem in the Seattle metropolitan area: A study and recommendations. Wash. State Pollut. Control Comm. Tech. Bull. 13. 28 p. KEYWORDS: LAKE WASH, SEWAGE, URBAN, POPULATION

Outlines sewerage problems (1950/1951), facilities, natural drainage basin boundaries, then current and predicted population data, the need for sewer districts, and a suggested districting of the suburban area. Data well represented in tables and plates.

295. ———. 1957. Water pollution control, a report for the Association of Washington Industries. Dep. Civil Eng., Univ. Wash., Seattle. 18 p. KEYWORDS: LAKE WASH, POLLUTION

Water pollution control in the Seattle metropolitan area, its area, water uses, and its industries; the responsibilities of the Water Pollution Control Commission; the water pollution control philosophy; criteria for water quality; and recommendations for maintaining development in the field of water quality.

296. ———. 1960. Nutrient content of drainage of water from forested, urban, and agricultural areas. IN: U.S. Dep. Health, Education, and Welfare, Algae and Metropolitan Wastes, p. 80-87. Robert A. Taft Sanit. Eng. Cent., Cincinnati, Ohio. KEYWORDS: AGRICULTURAL, FOREST, URBAN, NUTRIENT, WATER

Provides some values for nitrogen and phosphorus from Thornton (Matthews) Creek, an eastern tributary of Lake Washington.

297. SYLVESTER, R. O., W. T. EDMONDSON, and R. H. BOGAN. 1956. A new critical phase of the Lake Washington pollution problems. Trend Eng. 8(2):8-14. KEYWORDS: URBAN, FERTILIZATION, POLLUTION, LAKE WASH

Aspects of the Lake Washington pollution are presented by university authorities: (1) the history and (then) present aspects of the problem along with several alternative solutions to the problem, (2) the biological changes and the effects increased fertilization would have on the lake, and (3) the sanitary chemistry involved in the conversion of domestic wastes to aquatic fertilizers and possible means of removing these fertilizers.

298. SYLVESTER, R. O., and K. R. JONES. 1955. The sewerage problem in the Everett-Seattle interurban area. Wash. State Pollut. Control Comm. Tech. Bull. 17. 20 p. KEYWORDS: LAKE WASH, SEWAGE, URBAN, POPULATION

Sewage disposal had not kept up with the increase in population. A plan should be devised for collection, treatment, and disposal of sewage. Report includes information on existing facilities, natural drainage basin data, (then) present and predicted populations, and sewerage needs. Recommended plans are given for individual drainage basins in the area and future sewerage facilities.

299. SYLVESTER, R. O., G. T. ORLOB, A. YOUNG, W. MONTGOMERY, and L. C. ORLOB. 1949. A survey of pollution, Seattle metropolitan area. Wash. State Pollut. Control Comm., Olympia. 32 p. KEYWORDS: BACTERIA, FISH, MOVEMENT, POLLUTION, LAKE WASH, SEWAGE

Describes fish migration and navigation in the ship canal, and sewage disposal of the combined storm and sanitary type that is primarily discharged into Lake Washington. The contamination of beaches was determined by coliform counts, evidence of sewage, and proximity of sewers. Lists sources of sewage.

300. TABER, R. D. 1972. Report on coordination project, terrestrial consumer group. Intern. Rep. 9, US/IBP Coniferous For. Biome, Univ. Wash. AR-10, Seattle. 2 p. KEYWORDS: CEDAR RIVER, WATERSHED, BIRD, MAMMAL

Outlines the plans for working on bird and mammal populations that inhabit the Cedar River watershed. During years 1 and 2, emphasis was to be placed on inventories of the fauna.

301. TABER, R. D. J. P. LASSOIE, and M. SMITH. 1970. Wildlife response to rights-of-way management--Report for March-June 1970. Unpubl. MS, Coll. For. Resour., Inst. For. Prod., Univ. Wash., Seattle. 13 p. (Typewritten) KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, MANAGEMENT, SURVEY, WILDLIFE

Survey, description, and summary of right-of-way management by various electric power, water, gas, and telephone companies possessing rights-of-way in western Washington. Includes the management of right-of-way from the Cedar River watershed by the City of Seattle Water Department.

302. TABER, R. D., D. R. M. SCOTT, C. H. NELLIS, K. RAEDEKE, C. ERICKSON, and L. HICKLING. 1971. Wildlife response to rights-of-way management--Report for July, 1970--June, 1971. Unpubl. MS, Coll. For. Resour., Inst. For. Prod., Univ. Wash., Seattle. 9 p. (Typewritten) KEYWORDS: CEDAR RIVER, WATERSHED, CONIFEROUS, FOREST, MANAGEMENT, BIRD, MAMMAL

Progress report outlining the study of wildlife response to rights-of-way management in the Cedar River watershed. Includes a list of birds and estimates of breeding birds in right-of-way, edge, and forest control habitat at the 274-m and 610-m elevations along the Raver-Monroe powerline in the Cedar River area.

303. TAUB, F. B., R. L. BURGNER, E. B. WELCH, and D. E. SPYRIDAKIS. 1972. A comparative study of four lakes. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 21-32. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) KEYWORDS: AQUATIC, LAKE, PRODUCTION, URBAN

Describes current studies of Lakes Washington, Sammamish, Chester Morse, and Findley to compare the aquatic productivity in an array of lakes that provide a spectrum of human disturbance and manipulation.

304. THOMAS, P., and W. F. WINTERS. 1964. Comprehensive plan for flood control. State of Washington, King County, Seattle. 67 p. + 17 plates. KEYWORDS: CEDAR RIVER, FLOOD, MANAGEMENT, SAMM RIVER

Plan for Cedar and Sammamish Rivers. Plates XVII *a* through *g* are particularly good maps of population, topography, sewer districts, water districts, fire districts, drainage districts, and existing land use by the Puget Sound Regional Planning Council.

305. THOMPSON, A. E. 1948. A city guards its water. Am. For. 54(6):248-251, 287-288. KEYWORDS: CEDAR RIVER, FOREST, HISTORY, RESOURCES, WATER

Seattle proves forestry to be good and profitable watershed management. The Cedar River supplies over a half million people in the area with domestic water. Controlled use of power resources and timber resources has also been developed. The history of the Cedar River watershed is covered from 1856.

306. THOMPSON, M. R. 1936. Water resources, State of Washington bibliography of publication 1869-1936, part 7, p. 701-751. Washington State Planning Council, Olympia. KEYWORDS: BIBLIOGRAPHY, NORTHWEST, STREAM, WATER

Bibliography of authors and subjects pertaining to streams in the Puget Sound basin, Pacific coast basin, middle Columbia River basin, Snake River basin, upper Columbia River basin and lower Columbia River basin.

307. THORNE, R. E. 1970. Investigations into the use of an echo integrator for measuring pelagic fish abundance. Ph.D. thesis, Univ. Washington, Seattle. 117 p. KEYWORDS: SAMPLING, PELAGIC, FISH, ABUNDANCE

Estimates the population of presmolt sockeye salmon in Lake Washington by use of an echo integrator.

308. ———. 1971. Investigations into the relation between integrated echo voltage and fish density. J. Fish. Res. Board Can. 28(1):1269-1273. KEYWORDS: ESTIMATE, FISH, POPULATION, LAKE WASH, SALMON

Summarizes the relation between integrated echo voltage and density of juvenile sockeye salmon in Lake Washington.

309. ———. 1972. Hydroacoustic assessment of limnetic-feeding fishes. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 317-322. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: POPULATION, ESTIMATE, FRESHWATER, LIMNETIC, FISH, LAKE

Describes a hydroacoustic technique to determine the number and biomass of limnetic fish in lakes.

310. THORNE, R. E., and J. C. WOODEY. 1970. Stock assessment by echo integration and its application to juvenile sockeye salmon in Lake Washington. Univ. Washington, Seattle. Sea Grant Publ. 70-2. 31 p. KEYWORDS: ESTIMATE, ABUNDANCE, LAKE WASH, SALMON

Two topics are discussed, (1) relationship between echo strength of the echo integrator and number of juvenile sockeye salmon, and (2) echo integrator estimation of presmolt sockeye salmon in Lake Washington. At night sockeye salmon are dispersed in a broad layer; peak density is in the center of the lake. Total population estimate is between 8.9×10^6 and 10.0×10^6. Sources of error are fully explained.

311. THUT, R. N. 1966. A study of the profundal bottom fauna of Lake Washington. M.S. thesis, Univ. Washington, Seattle. 145 p. (Also 1969, Geol. Monogr. 39(1):79-100.) KEYWORDS: BENTHIC, INSECT, FAUNA, LAKE WASH

Summarizes the benthic macrofauna of the profundal zone of Lake Washington; 24 species were recognized and 13 were Chironomidae. The Oligochaeta comprised 45% of the bottom fauna and 33% of the total biomass. The weighted mean dry weight was 8.03 kg ha^{-1}, which shows the benthic productivity of Lake Washington to be above average. The large presence of Oligochaeta is typical of other lakes that have undergone cultural eutrophication.

312. TILLEY, J. N., and S. B. SEMB. 1938. A study of the waters of the Lake Washington Ship Canal. B.S. thesis, Univ. Washington, Seattle. 65 p. KEYWORDS: LIMNOLOGY, POLLUTION, LAKE WASH, CANAL

Physical and chemical analysis of the waters of the Lake Washington Ship Canal are recorded. The flushing action is noted, and the effect of industrial pollution is discussed.

313. UHTE, W. R. 1964. Metropolitan Seattle's Renton treatment plant. J. Water Pollut. Control Fed. 36(4):475-494. KEYWORDS: URBAN, POPULATION, SEWAGE, MANAGEMENT

The Renton treatment plant, located at the south end of Lake Washington adjacent to the Green River, is one of the two major plants in METRO. It serves the east side of Lake Washington drainage basin, the Lake Sammamish basin, and the Green River basin. Includes information on the growing population, disposal of waste solids, site development, hydraulic design, equipment design, and operation design. A map of the area and drawings of different aspects of plant design are included.

314. U.S. ARMY CORPS OF ENGINEERS. 1932. Lake Washington Ship Canal. House Document 140, 72d Congress, 1st session. 18 p. KEYWORDS: SURVEY, LAKE WASH, CANAL

Correspondence between the U.S. Secretary of War and the U.S. Army Chief of Engineers concerning the preliminary examination and survey of Lake Washington Ship Canal with respect to widening and deepening the channel.

315. ———. 1955. Sammamish River, Washington. House Document 157, 84th Congress, 1st session. 30 p. KEYWORDS: DESCRIPTION, FLOOD, SAMM RIVER, WATERSHED

Letter of transmittal from the Secretary of the Army to the Committee on Public Works, House of Representatives, that provides a description of the Sammamish River and drainage including topography, drainage areas, geology, soils, and so on, in relation to a flood control survey. Also provides a graph of spring hydrographs of Lake Sammamish from 1939 to 1948.

316. ———. 1969. Flood plain information: Cedar River, Renton, Washington. U.S. Army Corps Eng., Seattle, Wash. 33 p. + 26 plates. KEYWORDS: CEDAR RIVER, FLOOD, MANAGEMENT

Summarizes the local flood situation both past and present on the lower 14.5 km of the Cedar River. Contains maps, profiles, and cross sections indicating the extent of past and probable future flooding. (Available at the Library, Department of Ecology, Olympia, Wash.)

317. ———. (Various years). Water resources development by the U.S. Army Corps of Engineers. U.S. Army Corps Eng., N. Pac. Div., Custom House, Portland, Oreg. KEYWORDS: WATER, RESOURCES, MANAGEMENT, LAKE WASH, WATERSHED.

Yearly pamphlets containing short descriptions of each civil project assigned to the Corps of Engineers for investigation, survey, planning, construction, maintenance, or operation in the State of Washington. Projects pertinent to the Lake Washington drainage are listed under the Seattle District.

318. U.S. DEPARTMENT OF AGRICULTURE. 1941. Climate and man. U.S. Dep. Agric., Yearb. Agric. 1941. 1248 p. KEYWORD: CLIMATE

Provides 40-year averages of temperature, dates of killing frost, growing season, and precipitation. A summary for stations throughout the State of Washington is given on pages 1170-1181. Data for Seattle are summarized under King County on page 1171.

319. U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE. 1970. Outdoor recreation potential in Washington. Wash. State Soil Water Conserv. Comm., Olympia. 43 p. KEYWORDS: RECREATION, WASHINGTON

An appraisal of the potential for outdoor recreation in Washington State. Maps are provided that summarize various outdoor recreational activities as to high, medium, or low potential for each county.

320. U.S. DEPARTMENT OF COMMERCE, ENVIRONMENTAL DATA SERVICE. 1898-present. Climatological data--Washington. U.S. Dep. Commer., Natl. Oceanic Atmos. Adm., Environ. Data Serv., Asheville, N.C. KEYWORDS: CLIMATE, PRECIPITATION, TEMPERATURE

Provides daily information on temperature, precipitation, total snowfall, and number of days with 2.5 cm (one inch) or more of snow on the ground. See stations for the University of Washington, Seattle, and Seattle-Tacoma International Airport. Supplemental data for the airport station include windspeed and direction, average relative humidity, percentage of possible sunshine, and average sky cover. Volumes from March 1898 to June 1965 issued by U.S. Weather Bureau; volumes from July 1965 to present issued by U.S. Environmental Data Service.

321. ———. 1950-present. Climatological data: National summary. U.S. Dep. Commer., Natl. Oceanic Atmos. Adm., Environ. Data Serv., Asheville, N.C. KEYWORDS: CLIMATE, PRECIPITATION, TEMPERATURE, STORM

Monthly summaries of barometric pressure, temperature, precipitation, wind, cloud cover, percentage of possible sunshine, heating and cooling in degree days, and storm summary. Climatological data are given in both metric and English units.

322. ———. 1961. Climatic guide for Seattle, Washington, and adjacent Puget Sound area. IN: U.S. Dep. Commer., Weather Bur., Climatography of the United States, No. 40-45. 48 p. KEYWORD: CLIMATE

Data in this publication were compiled primarily during 1959/1960 and in general include observations for the period of record through 1959. "Normal" values given in the reference are for the 30-year period of 1921-1950. Includes stations at the Federal Office Building in Seattle, at Boeing Field, and at the Seattle-Tacoma International Airport.

323. ———. 1963. Local climatological data with comparative data. U.S. Dep. Commer., Weather Bur., Asheville, N.C. KEYWORD: CLIMATE

Provides meteorological data by month for 1963 and compares monthly averages for other years. The station summary that is most applicable to the Lake Washington drainage is the Seattle-Tacoma International Airport.

324. ———. 1968. Climatic atlas of the United States. U.S. Dep. Commer., Environ. Sci. Serv. Adm., Environ. Data Serv., Washington, D.C. 80 p. KEYWORDS: CLIMATE, EVAPORATION, PRECIPITATION, RADIATION, TEMPERATURE, WIND, ATLAS

Comprehensive summary with climatic maps showing the national distribution of mean, normal, and/or extreme values of temperature, precipitation, wind, barometric pressure, relative humidity, dew point, sunshine, sky cover, heating degree days, solar radiation, and evaporation.

325. U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, PUBLIC HEALTH SERVICE. 1951. Pacific Northwest drainage basins. U.S. Public Health Serv., Fed. Secur. Agency, Water Pollut. Ser. 6. 79 p. KEYWORDS: WATER, RESOURCES, POLLUTION, NORTHWEST

A report on the Pacific Northwest drainage basin that presents information about the ways our water resources were used, the pollution going into the water resources and the resulting damage, the benefits that might result from pollution prevention, and the pollution prevention measures then in effect and those required. Lake Washington was no longer suitable as a domestic water supply. Nine tables include information about sources and amounts of pollution, existing treatment facilities, and project requirements.

326. ———. 1969. Summary report of the northwest watershed project. U.S. Dep. Health, Educ., Welfare, Public Health Serv., Bur. Water Hyg., Cincinnati, Ohio. 60 p. KEYWORDS: CEDAR RIVER, BACTERIA, POPULATION

Summary of microbiological water quality of three streams with different human population levels on the watersheds. Estimates the increase in human population densities, game animal population densities, and fecal coliform bacterial densities for the Cedar River watershed. Copy available at Wash. State Dep. Ecol. Library, Olympia, Wash.

327. U.S. DEPARTMENT OF THE INTERIOR. 1964. Lake Washington Ship Canal locks. Unpub. MS, Lake Wash. Ship Canal file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: ANADROMOUS, FISH, MOVEMENT, LAKE WASH, CANAL

Provides approximate numbers of anadromous fish by species that pass through the ship canal. Estimates that only 10% of the fish use the existing fishway. Recommends that a new fishway be constructed that will use the saltwater drain for the attraction of flow.

328. U.S. DEPARTMENT OF THE INTERIOR, GEOLOGICAL SURVEY. (Various years). Surface water supply of United States, Pacific slope basins in Washington and upper Columbia River basin. U.S. Geol. Surv. Water Supply Pap. KEYWORDS: WATER, RESOURCES, WASHINGTON

For each drainage basin, a general description is given covering area, source, tributaries, topography, geology, forestation, rainfall, irrigation, storage, power, etc. At each gaging station data collected are as follows: a list of discharge measurements; a table of daily gage heights; a table of daily, monthly, and yearly discharges; runoff; and the relation of gage height to discharge with respect to ice, logging, shifting channels, and backwater.

329. ———. 1913. Water powers of the Cascade Range. U.S. Geol. Surv. Water Supply Pap. 313 (part 2):98-121. KEYWORDS: CEDAR RIVER, WATER, RESOURCES, POWER

The Cedar River drainage basin encompasses 528 km^2, and was formed through glaciation. Gage reading records for monthly estimates of discharge and runoff are maintained at Vaughn Bridge near North Bend, Cedar Lake near North Bend, Ravensdale, and Renton. The power possibilities of Cedar Lake are described. A table shows amount of water available for storage if the river is to maintain a discharge of 11.3 m^3 sec^{-1} (400 second-feet). Storage required for different minimum discharges from Cedar Lake are given. Maximum feasible storage development is near 92.5 x 10^6 m^3 (75,000 acre-feet) with a discharge of 11.3 m^3 sec^{-1} (400 second-feet). A brief description of the physical conditions and limitations of three potential power sites on the river are described: (1) tailrace of Seattle municipal power plant, (2) intake of Seattle water supply system, (3) Maple Valley.

330. ———. 1955. Monthly and yearly summaries of hydrographic data in the State of Washington to September 1953. U.S. Geol. Surv. Water Supply Bull. 6. 836 p. KEYWORDS: HYDROLOGY, STREAMFLOW, WASHINGTON

Mean freshwater discharge in all the streams of Washington State river basins from the start of monitoring to September 1953.

331. ———. 1956a. Stream flow in Fifteen Mile Creek. Unpubl. MS, Lake Wash.--Lake Samm.--Issaquah Creek file, Manage. Res. Div., Wash. State Dep. Fish, Olympia. KEYWORDS: STREAMFLOW, LAKE SAMM, WATERSHED

Provides streamflows for Fifteen Mile Creek, a tributary of Issaquah Creek, from 1945 to 1955. Includes a graph for estimating low-flow frequency curves and the maximum number of consecutive days within this period when flows were less than 0.07-0.17 $m^3 sec^{-1}$ (2.5-6.0 cfs).

332. ———. 1956b. Report on surface water investigations in Lake Washington basin and adjacent basins, October 1945 to September 1956. U.S. Geol. Surv., Tacoma, Wash. KEYWORDS: TEMPERATURE, STREAMFLOW, LAKE WASH, WATERSHED

Location, temperature, discharge, and other remarks about streams and tributaries of the Lake Washington watershed from October 1945 to September 1956. (See Appendix Table 1, this volume.)

333. ———. 1961-present, a. Water resources data for Washington. Part 1. Surface water records. U.S. Dep. Inter., Geol. Surv., Water Resour. Div., Tacoma, Wash. KEYWORD: STREAMFLOW

Data collected at U.S. Geological Survey stations for various locations in the Lake Washington basin. Streamflows are given by water year (October of one year through September of the following year). The data provided include daily flow in cubic feet per second, monthly runoff in inches, and monthly quantity of water in acre-feet.

334. ———. 1961-present, b. Water resources data for Washington. Part 2. Water quality records. U.S. Dep. Inter., Geol. Surv., Water Resour. Div., Tacoma, Wash. KEYWORDS: ELEMENT, STREAM, WATER QUALITY

Data collected at U.S. Geological Survey stations for various locations in the Lake Washington basin. Water quality data were collected on a regular basis for some locations but on a spot check basis for others, and include temperature, silica, iron, calcium, magnesium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, fluoride, nitrate, boron, dissolved solids, hardness, specific conductance, pH, and color.

335. ———. 1970a. The national atlas of the United States. U.S. Dep. Inter., Geol. Surv., Washington, D.C. 417 p. KEYWORDS: ATLAS, ECONOMY, HISTORY, POPULATION

A comprehensive atlas designed to present the principal characteristics of the country, in cartographic format, including the physical features, historical evolution, economic activities, sociocultural conditions, administrative subdivisions, and place in world affairs.

336. ———. 1970b. Index of Pacific Northwest streamflow records available on magnetic tape as of June 1970. U.S. Dep. Inter., Geol. Surv., Northwest Water Resour. Data Cent., Portland, Oreg., in cooperation with N. Pac. Div., U.S. Army Corps Eng. and Bonneville Power Adm. 37 p. KEYWORDS: STREAMFLOW, NORTHWEST

Tapes are available on loan, free of charge, on application to the Northwest Water Resources Data Center of the Geological Survey (telephone 503-234-3361, ext. 4773, or write to Box 3202, Portland, Oreg. 97208). The data center can provide data printouts or punched cards for small volumes of data (not more than 1000 station years). The cards would be standard USGS 3-card-per-month format. Tapes generally include records (for existing stations) through water-year 1968 for U.S. Geological Survey stations.

337. VAN WINKLE, W. 1914. Quality of the surface waters of Washington. IN: U.S. Geol. Surv. Water Supply Pap. 339, p. 40-45. KEYWORDS: CEDAR RIVER, WATER QUALITY

Mineral analysis, color, and alkalinity determinations were made in the Cedar River at Ravensdale, 1910/1911. Results are summarized in tables.

338. WALDEN, S. 1969. A survey of the fish populations of Yarrow Bay, Lake Washington. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 10 p. KEYWORDS: DISTRIBUTION, FYKE NET, GILL NET, LAKE WASH

Description of survey in Yarrow Bay using gill nets and fyke nets during March through May 1969. Species composition, lengths and weights by species, and condition factors of selected species are given.

339. WALDRON, K. D. 1953. A new subspecies of *Pontoporeia affinis* in Lake Washington, with a discussion of its morphology and life cycle. M.S. thesis, Univ. Washington, Seattle. 78 p. KEYWORDS: ARTHROPOD, LIFE HISTORY, LAKE WASH

A study of this amphipod in Lake Washington has demonstrated that it is different from the European form. Includes a general description of its two-year life cycle.

340. WALKER, R. B., D. R. M. SCOTT, D. J. SALO, and K. L. REED. 1972. Terrestrial process studies in conifers: A review. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 211-225. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: REVIEW, MINERAL CYCLE, PHYSIOLOGY, CONIFEROUS, FOREST

Reviews the following principal processes and subjects of coniferous forests: (1) assimilation of carbon dioxide and respiration; (2) transpiration, water conduction, and water deficits; (3) translocation of photosynthates; and (4) mineral nutrition.

341. WANG, FING-HUI. 1955. Recent sediments in Puget Sound and portions of Washington Sound and Lake Washington. Ph.D. thesis, Univ. Washington, Seattle. 160 p. KEYWORDS: LAKE WASH, SEDIMENT

Reviewed here are the bottom characteristics, sediment distribution, analytic properties of the sediments, and related concepts of Puget Sound, parts of the San Juan Islands, and the central-northern part of Lake Washington.

342. WASHINGTON STATE DEPARTMENT OF FISH AND GAME. 1903-1904. Statement of fish and eggs furnished the State of Washington by the U.S. Bureau of Fisheries for the years 1895 to 1904, inclusive. Wash. State Fish Game Ann. Rep. 14-15(1903-1904):72-77. KEYWORDS: SALMON, STOCKING, LAKE WASH

Water stocked, point of deposit, species, and numbers planted.

343. ———. 1929-1930. Summary of stream surveys for biennium 1929-1930. Wash. State Fish Game Ann. Rep. 40-41(1929-1930):145. KEYWORDS: SALMON, STOCKING, LAKE WASH

344. WASHINGTON STATE DEPARTMENT OF FISHERIES. (Various years, a). Stream improvement and hydraulics. IN: Wash. State Dep. Fish. Ann. Rep. 59(1949):12; 63(1953):53; 67(1957):31; 72(1962):60; 73(1963):60; 74(1964):68; 75(1965):55-56; 76(1966):184; 77(1967):85-86; 78(1968):83; 79(1969):119; 80(1970):84-85. KEYWORDS: HYDROLOGY, STREAM, LAKE WASH

Lists stream clearance, improvements, surveys, and miles of stream opened for tributary streams in the Lake Washington drainage. Listed under King County. (Surveys and reports are available in central files of the Department of Fisheries in Olympia.)

345. ———. (Various years, b). Information about Washington State salmon hatcheries. Wash. State Dep. Fish. Ann. Rep. 58(1948):75; 64(1954):20; 67(1957):23; 68(1958):107-108. KEYWORDS: FISH, FECUNDITY, BREEDING, SALMON, LAKE WASH

Various hatchery information such as history, location, operations, statistics on total fecundity, hatching capacity, and rearing pond capacity.

346. ———. (Various years, c). Construction projects. IN: Wash. State Dep. Fish. Ann. Rep. 58(1948):78-79; 67(1957):30, 61; 68(1958): 24, 193; 69(1959):65, 130; 71(1961):109; 72(1962:31, 87; 73(1963:75, 123; 74(1964):141; 77(1967):71; 78(1968):136; 79(1969):111; 80(1970): 97-98. KEYWORDS: ALTERATION, STREAM, LAKE WASH

List of various construction projects that are being done in the Lake Washington drainage.

347. ———. (Various years, d). Fish planted from state salmon hatcheries during various years. IN: Wash. State Dep. Fish. Ann. Rep. 58(1948): 73; 59(1949):52; 60(1950):62; 62(1951,1952):90-91; 64(1954):53-56; 67(1957):50-53; 68(1958):200, 204; 69(1959):138; 71(1961):89; 72(1962): 102; 73(1963):105; 74(1964):124; 75(1965):95; 76(1966):202; 77(1967):120; 78(1968):126; 79(1969):153; 80(1970):127. KEYWORDS: FISH, STOCKING, SALMON, LAKE WASH

348. ———. (Various years, e). Egg take of individual hatcheries of various brood years. IN: Wash. State Dep. Fish Ann. Rep. 58(1948): 72; 59(1949):51; 60(1950):63; 62(1951,1952):88; 63(1953):61, 62; 64(1954):56; 67(1957):49; 68(1958):194; 69(1959):132; 71(1961):83; 72(1962):96; 73(1963):98; 74(1964):116; 75(1965):88; 76(1966):95; 77(1967):113; 78(1968):119; 79(1969):145; 80(1970):119. KEYWORDS: FISH, BREEDING, FECUNDITY, SALMON, LAKE WASH

349. ———. (Various years, f). Plantings of salmon by major watersheds. IN: Wash. State Dep. Fish Ann. Rep. 67(1957):54; 68(1958):206; 69(1959):143; 70(1960):131; 71(1961):95; 72(1962):110; 73(1963):113; 74(1964):132; 75(1965):103; 76(1966):211; 77(1967):127; 78(1968):133; 79(1969):163; 80(1970):135. KEYWORDS: FISH, STOCKING, SALMON, LAKE WASH

350. ———. (Various years, g). Escapement to hatchery racks. IN: Wash. State Dep. Fish. Ann. Rep. 59(1949):68-69; 60(1950):61-66; 62(1951,1952):92; 63(1953):63; 64(1954):57; 68(1958):195-197; 69(1959):133-135; 71(1961):84-86; 72(1962):97-99; 73(1963):100-102; 74(1964):118-120; 75(1965):90-92; 76(1966):197-199; 77(1967):115-117; 78(1968):121, 123; 79(1969):148, 150; 80(1970):122. KEYWORDS: FISH, ESCAPEMENT, SALMON, LAKE WASH

351. ———. (Various years, h). Report on the salmon escapement in the State of Washington. Manage. Res. Div., Wash. State Dep. Fish., Olympia. 1965(1964):7, 10, 15; 1966(1965):9, 12, 16; 1968(1967):8, 10, 14; 1969(1968):8, 10, 14; 1970(1969):PS-2, PS-4, PS-7. KEYWORDS: ESCAPEMENT, SALMON, LAKE WASH, WATERSHED

Provides yearly index counts for salmon in the Lake Washington drainage.

352. ———. 1931. Outline of biological survey for the season 1929 and 1930. IN: Wash. State Dep. Fish. Ann. Rep. 40-41(1929-1930):141. KEYWORDS: ABUNDANCE, SURVEY, FISH, SALMON, LAKE WASH, STREAM

Lists the six main tributaries of the Lake Washington watershed. Gives migration distance of salmon. Shows chum and sockeye to be absent; chinook, pink, and steelhead were present in all streams. The silver was scarce in all streams.

353. ———. 1949. Report on the condition of spawning tributaries of the Lake Washington watershed. Unpubl. MS, Lake Wash. file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: SALMON, SPAWNING, STREAM, LAKE WASH, LAKE SAMM, WATERSHED

Information concerning numbers and species of spawners and problems encountered by these fish, such as pollution, culverts, etc., in Thornton, Lions, Swamp, North Bear (Woodinville), Bear (Redmond), Issaquah, May, Coal, and Juanita Creeks, Mercer Slough, the Sammamish and Cedar Rivers, and Lake Sammamish.

354. ———. 1956. Freshwater research--Puget Sound salmon escapement. Wash. State Dep. Fish. Ann. Rep. 66(1956):22, KEYWORDS: CEDAR RIVER, FISH, ESCAPEMENT, SALMON

During 1956 salmon escapement varied from very high to very low depending on the species. Escapement of fall chinook salmon in the Cedar River was very high.

355. ———. 1958. Report on the salmon escapement in the State of Washington, 1958. Wash. State Dep. Fish. Ann. Rep. 68(1958):67-70. KEYWORDS: CEDAR RIVER, FISH, ESCAPEMENT, SALMON

Refers to chinook salmon, Puget Sound area; sockeye salmon, Puget Sound area; and to the Lake Washington area.

356. ———. 1967. Sockeye salmon to Cedar River record size this year. Wash. State Dep. Fish. Newsl. 66:2-3. KEYWORDS: CEDAR RIVER, FISH, ESCAPEMENT, SALMON

Short review of sockeye salmon plant in the Cedar River in the 1930s. Experiment was considered unsuccessful until 1960, when the return was 12,000; 1964 was 50,000-75,000; 1966 was 60,000; and 1967 was expected to be over 100,000.

357. ———. 1968a. Lake Washington sockeye salmon investigations. Wash. State Dep. Fish. Newsl. 69:1-2. KEYWORDS: CEDAR RIVER, FISH, ESCAPEMENT, SALMON

The Washington State Department of Fisheries was operating a test-fishing net at the Hiram M. Chittenden Locks to monitor escapement and gather biological data on Lake Washington sockeye salmon.

358. ———. 1968b. Lake Washington sockeye fishery. Wash. State Dep. Fish. Newsl. 71:1. KEYWORDS: SALMON, FISHERY, LAKE WASH, HARVEST

The first season of fishing for Lake Washington sockeye salmon in Puget Sound ended in July 1968; 26,000 out of a total run of 100,000 to 125,000 fish were caught. Incidental catch of maturing chinook and coho salmon was less than 8%.

359. ———. 1969a. Review of Lake Washington sockeye run. Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 3 p. KEYWORDS: REVIEW, SALMON, ESCAPEMENT, LAKE WASH

Reviews the history of the sockeye run from 1935, when sockeye from the Skagit River hatchery at Birdsview were planted in Issaquah Creek and the Cedar River, to 1968. Predictions of the 1969, 1970, and 1971 runs of returning adults are given.

360. ———. 1969b. Lake Washington sockeye habitat protection. Unpubl. MS, Stream improvement--Lake Wash. sockeye, 1964-1969 file, Manage.

Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: SALMON, SPAWNING, MANAGEMENT, STREAM, LAKE WASH

Recommends habitat protection of spawning areas for Lake Washington sockeye. Discusses existing and anticipated problems that will affect the salmon, such as flood control, gravel removal, and other alterations of the stream bottom.

361. ———. 1969c. Studies needed--Lake Washington sockeye run. Unpubl. MS, Lake Wash. file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 2 p. KEYWORDS: REVIEW, SALMON, MANAGEMENT, LAKE WASH

Lists priority of study needs to achieve effective management of Lake Washington sockeye salmon run.

362. ———. 1970a. Minimum flows for the Cedar River (statement for public hearing). Unpubl. MS, Lake Wash.--Cedar River file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. 22 p. KEYWORDS: CEDAR RIVER, FLOW, SALMON, SPAWNING

Outlines the increased need for salmon production and the minimum water flows that are necessary for the spawning and rearing of salmon in the Cedar River.

363. ———. 1970b. City of Seattle Water Department hearing relative to minimum flows of the Cedar River. Unpubl. MS, Lake Wash.--Cedar River 1970 file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: CEDAR RIVER, FLOW, SALMON, SPAWNING

Summarizes a hearing relative to the minimum flows of the Cedar River. Presents proposals that will be needed to obtain rigid regulation of streamflow.

364. ———. 1970c. Lake Washington: Production information necessary to manage the resource. Unpubl. MS, Lake Wash. sockeye study file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: MANAGEMENT, PRODUCTION, SALMON, LAKE WASH

Provides a list of projects that should be initiated so that successful management of the Lake Washington sockeye can be maintained. Information on spawning potential, fry production for the Cedar River, smolt production in Lake Washington, smolt-adult survival, and adult studies.

365. ———. 1970d. Minimum flows for the Cedar River (statement for a press conference). Unpubl. MS, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: CEDAR RIVER, FLOW, SALMON, SPAWNING

Statement pointing out the need for adequate water flow in the Cedar River to maintain the salmon runs. Includes a graph that shows the minimum flows desired at different times of the year for salmon propagation.

366. ———. 1970e. Potential coho salmon production--Coal Creek. Unpubl. MS, Lake Wash.--Coal Creek file, Manage. Res. Div., Wash. State Dep. Fish., Olympia. KEYWORDS: STREAM, ALTERATION, SALMON, PRODUCTION

Estimates the potential productivity of Coal Creek for coho salmon. The estimate was made on this southeastern tributary to Lake Washington because a canyon in which the stream was located was proposed as a site for a sanitary fill for garbage from the City of Seattle. This manuscript is concerned with: (1) the maximum anadromous fish potential of Coal Creek after elimination of barriers, (2) an evaluation of the stream as it then existed, and (3) a projected estimate of potential for fish production after the fill.

367. ———. 1970f. Sockeye salmon. News release, 23 Dec. 1970, Wash. State Dep. Fish., Olympia. 2 p. KEYWORDS: SALMON, RECREATION, FISHERY, LAKE WASH

During the late summer of 1970, approximately 5000 salmon were caught by sportsmen in Lake Washington. Most were caught by trolling near the mouth of the Cedar River.

368. WASHINGTON STATE POLLUTION CONTROL COMMISSION. 1953. Industrial dispersion. Issaquah Proj. Area, Wash. State Pollut. Control Comm. Rep. 35:6-8. KEYWORDS: ALTERATION, STREAM, URBAN

Report to the King County Planning Commission regarding the Commission's response to the rezoning for heavy industry of land along Issaquah Creek.

369. ———. 1955. Lake Washington and the Seattle metropolitan area. Wash. State Pollut. Control Comm. Inf. Ser. 9. 4 p. KEYWORDS: BACTERIA, NUTRIENT, SALTWATER, POLLUTION, LAKE WASH

Discusses the nature of three water quality problems then developing in Lake Washington: bacterial contamination, nutrient enrichment, and salt intrusion from Puget Sound. A metropolitan sewer system would be the answer to solving the first two problems. The third problem should be solved by engineers at the locks.

370. ———. 1956. Facts . . . about the Seattle sewerage problem. Wash. State Pollut. Control Comm. Inf. Ser. 10. 4 p. KEYWORDS: SEWAGE, POLLUTION, POPULATION

All waters in the Seattle metropolitan area were contaminated by untreated sewage because sewage facilities had not kept pace with

industrial and population growth. The proposed Seattle sewer system is outlined.

371. ———. 1958. Statement of policy with respect to sewage discharge into Lake Washington. Unpubl. MS, Wash. State Pollut. Control Comm. 3 p. KEYWORDS: SEWAGE, MANAGEMENT, LAKE WASH

The policy of the Washington State Pollution Control Commission when approving plans for sewage treatment plants in the Lake Washington drainage basin. (Available at Library, Washington State Dep. Ecology, Olympia.)

372. ———. 1969. Summary statement on water quality investigations--Lake Washington Ship Canal study. Wash. State Pollut. Control Comm., Olympia. 12 p. KEYWORDS: WATER QUALITY, LAKE WASH, CANAL

Results show that corrective measures had been undertaken for all water quality problems. Outlined are then current and future needs for additional water supply, adequate minimum levels for Lake Washington, improved methods for the passage of anadromous fish, and control of saltwater intrusion. Also outlines necessary flows to maintain water quality, temperature problems, proposed diversion of the Cedar River, and possible low-flow augmentation.

373. WASHINGTON STATE UNIVERSITY. 1968. Washington climate. Coop. Ext. Serv., Coll. Agric. Wash. State Univ., Pullman. 66 p. KEYWORDS: CLIMATE, WASHINGTON

Provides information on temperature, precipitation, snow depth, and water content by month for various stations in the Lake Washington drainage (see King County). Also provides hourly and daily averages of solar radiation (in langleys) by month and hourly averages of wind by month, as well as readings of sky cover and relative humidity at varying intervals at the Seattle-Tacoma airport.

374. WATER RESOURCES ENGINEERS, INC. 1968. Applications of mathematical models for prediction of the thermal and quality behavior of Lake Washington. Report prepared for the Wash. State Pollut. Control Comm., Olympia, by Water Resources Engineers, Inc., Seattle, Wash. 86 p. KEYWORDS: TEMPERATURE, WATER QUALITY, MODEL, LAKE WASH

Lake Washington is representative of the benefits, problems, and confusion that come with the development and use of large lakes in proximity to population centers. The dominant characteristics and problems of Lake Washington can be described by five major elements: Lakes Washington and Sammamish, Sammamish and Cedar Rivers, and the Lake Washington Ship Canal. All the elements reveal an involved and highly interdependent hydrologic and water quality situation. The

system's response to any action will depend on many interrelated factors. This paper tries to determine the subtle responses of the system; quality and temperature techniques and tools are demonstrated and developed for comprehensive investigations and management of the aquatic resources. (Copies are available from Water Resources Engineers, Inc., 1900 Olympic Blvd., Walnut Creek, Calif. 94596 at $5.00 each.)

375. WEAVER, D. 1971. Lake Washington temperature studies for spring 1971. Unpubl. MS (Fish. 499--Prof. Whitney), Coll. Fish., Univ. Wash., Seattle. 48 p. (Typewritten) KEYWORDS: WATER, TEMPERATURE, LAKE WASH

Summarizes vertical temperature profiles for the south end of Lake Washington during April through June of 1971.

376. WEAVER, H. L. 1967. Differences in subordinate vegetation composition with varying overstories and soil. Unpubl. MS (Undergrad. Res. Program--Prof. Cole), Coll. For. Resour., Univ. Wash., Seattle. 30 p. (Typewritten) KEYWORDS: CONIFEROUS, FOREST, VEGETATION, DISTRIBUTION, RADIATION, SOIL

The study evaluated the responses of subordinate vegetation to several environmental factors: soil, species and cover of the overstory trees, and solar radiation. The single measure of cover percentage of subordinate species appeared adequate for this evaluation. Indianola and Barneston soils showed considerable similarities in understory communities, while Alderwood soil was more distinct.

377. WELANDER, A. D. 1940. A study of the development of the scale of the chinook salmon (*Oncorhynchus tschawytscha*). M.S. thesis, Univ. Washington, Seattle. 59 p. KEYWORDS: FISH, GROWTH, SALMON

The scales of chinook salmon up to 108 mm in length were studied in relation to growth at the University of Washington hatchery.

378. WELCH, E. B., R. M. EMERY, C. E. MOON, and D. SPYRIDAKIS. 1972. Nutrient income change related to plankton algae. (Job completion rep., Off. Water Resour. Res., project no. A-045-Wash.) Unpubl. MS, Dep. Civil Eng., Univ. Wash., Seattle. (Dittoed) KEYWORDS: ALGAE, EUTROPHIC, NUTRIENT, PLANKTON, LAKE SAMM

Diversion of sewage from Lake Sammamish was completed in 1968. The mean winter phosphorus content and plankton response did not change significantly in Lake Sammamish, however, in contrast to the changes reported by Edmondson for Lake Washington. The mean winter phosphorus in the water column appeared to be controlled to a great extent by iron precipitation. Urban runoff apparently was adding little enrichment to Lake Sammamish, and therefore is probably not a cause of that lake's retarded recovery.

379. WELCH, E. B., and D. E. SPYRIDAKIS. 1972. Dynamics of nutrient supply and primary production in Lake Sammamish, Washington. IN: J. F. Franklin, L. J. Dempster, and R. H. Waring (eds.), Proceedings--Research on coniferous forest ecosystems--A symposium, p. 301-315. USDA For. Serv., Portland, Oreg. (U.S. Gov. Print. Off., Washington, D.C.) 322 p. KEYWORDS: DYNAMICS, LAKE, NUTRIENT, PRIMARY PROD

Lake Sammamish was judged to be mesotrophic and ranked third in productivity of the four lakes in the Lake Washington drainage. While diversion of over one-half the phosphorus from nearby Lake Washington during 1963/1967 was followed by reduction in mean phosphorus content during the winter, measured characteristics of plankton responses had not changed in Lake Sammamish following a diversion of similar magnitude.

380. WELLS, J. W. 1970. Pelagic fish community studies in Lake Sammamish, King County, Washington. Unpubl. MS (Fish. 499--Prof. DeLacy), Coll. Fish., Univ. Wash., Seattle. 4 p. (Typewritten) KEYWORDS: PELAGIC, FRESHWATER, FISH, SURVEY, LAKE SAMM

Preliminary one-evening survey using the echo sounder and a midwater trawl. Two fish species (sockeye fry and cottids) and a mysid were captured with the trawl.

381. WELLS, M. E. 1930. A study of western Washington Trichoptera. M.S. thesis, Univ. Washington, Seattle. 73 p. KEYWORDS: AQUATIC, INSECT, DISTRIBUTION

Provides a key to the genera of the Limnephilidae and descriptions of all species that are known from western Washington. The locations of many species are given as Seattle, and presumably some were collected from the Lake Washington drainage.

382. WEST, W. Q. B. 1965. A general survey of the monthly distribution of kokanee (*Oncorhynchus nerka*) in Lake Washington from August 1963 to July 1964. Unpubl. MS (Fish. 499--Prof. DeLacy), Coll. Fish., Univ. Wash., Seattle. 74 p. (Typewritten) KEYWORDS: FISH, DISTRIBUTION, SURVEY, LAKE WASH, SALMON

Survey of diel horizontal and vertical distribution of kokanee in Lake Washington from August 1963 through July 1964. A source of error may be the problem of distinguishing anadromous sockeye from the landlocked kokanee.

383. WHETTEN, J. T. 1966. Lake Washington's third dimension. Pac. Search 1(3):5-6. KEYWORDS: GLACIAL, SEDIMENT, LAKE WASH

The seismic profile shows the original basin and the older sediment to be of glacial origin. The last glacier was 14,000 years ago, but 13,500 years ago organic material began to be deposited. Since then

organic deposition has continued slowly, punctuated 6700 years ago by volcanic ash from the eruption of Mount Mazama (Crater Lake).

384. WINDSOR, G. J. 1969. Dynamics of phosphorus, silicon, iron and aluminum movement in gravitational rainwater in a Douglas-fir ecosystem. Ph.D. thesis, Univ. Washington, Seattle. 188 p. KEYWORDS: CONIFEROUS, FOREST, IRON, PHOSPHORUS, MINERAL CYCLE, SOIL

A modified, all plastic, tension lysimeter was used to collect the phosphorus silicon, iron, and aluminum moved by mass transport in the gravitational rainwater of the soil. The study spanned the complete rewetting of the soil after a very dry summer. All these elements showed flushes during rewetting flows, with concentration peaks far above average values, which thus lose some of their significance in relation to soil chemical and biological reactions of these elements. Phosphorus concentrations declined rapidly with time and with depth in the soil to 50% at 1-2 cm and to 5% at 10 cm. Silicon levels were more stable in the mineral soil and indicated net translocation from the A to the B horizon. Iron and aluminum patterns were similar to each other, though aluminum molarities were up to 10 times higher.

385. WINKENWERDER, H. A., and A. E. THOMPSON. 1924. Reforestation of Cedar River watershed. Rep. Supt. Water, Water Dep., City of Seattle, Wash. 76 p. KEYWORDS: CEDAR RIVER, FOREST, WATERSHED

Detailed report of the upper Cedar River watershed, which includes a description, importance of reforestation for watershed protection, the fire protection program, the reforestation situation, the planting program, and cost analysis. An appendix includes 10 maps and figures on standing timber.

386. WOLCOTT, E. E. 1961. Lakes of Washington. Vol. 1--Western Washington. Wash. State Dep. Conserv. Water Supply Bull. 14. 619 p. KEYWORDS: DESCRIPTION, LAKE

Provides elevation, area, maximum depth, use, and location of western Washington lakes. Lakes in the Lake Washington drainage are listed under King County.

387. WOLMAN, A. (chairman), C. E. GREEN, and B. L. GRONDAL. 1944. Report on the water supply and the Cedar River watershed of the City of Seattle, Washington. Unpubl. MS, Cedar River Watershed Comm., City of Seattle, Wash. 79 p. KEYWORDS: CEDAR RIVER, WATER, WATERSHED

A report to the mayor and city council of Seattle on the water supply of Seattle and the Cedar River watershed. Provides information on the history of the watershed, quality of the water, ownership and

use of the watershed, effect of logging on the water supply, and the proposed policy and program for control of water quality and watershed land use.

388. WOODEY, J. C. 1966. Sockeye salmon spawning grounds and adult returns in the Lake Washington watershed, 1965. M.S. thesis, Univ. Washington, Seattle. 101 p. KEYWORDS: FISH, ESCAPEMENT, SPAWNING, SALMON, LAKE WASH, LITTORAL

No anadromous sockeye salmon were present in Lake Washington in 1937 when the Baker River stock was planted. Sockeye now spawn in the Cedar River, in Issaquah Creek, and along the shore of Lake Washington. There are two types of lake spawning areas: littoral areas supplied with upwelling groundwater, and exposed beach areas devoid of groundwater seepage. Cedar River spawners and lake spawners are separate stocks. An increased lacustrine residence time was found for both lake spawners and river spawners when compared with parental stocks.

389. ———. 1972. Distribution, feeding, and growth of juvenile sockeye salmon in Lake Washington. Ph.D. thesis, Univ. Washington, Seattle. 207 p. KEYWORDS: FISH, PELAGIC, DISTRIBUTION, LIFE HISTORY, LAKE WASH, SALMON

Provides a detailed summary of the freshwater life history for sockeye salmon in Lake Washington.

390. WYDOSKI, R. S. 1972a. Checklist of fishes occurring in the Lake Washington drainage. Intern. Rep. 34, Coniferous For. Biome, Univ. Wash. AR-10, Seattle (in press). KEYWORDS: ABUNDANCE, DISTRIBUTION, FISH

Documents the species of fishes in the drainage and provides information as to their occurrence in streams or lakes and their relative abundance.

391. ———. 1972b. The extent of the thermal plume from the Shuffleton power plant in the south end of Lake Washington in January 1972. Unpubl. MS, Coll. Fish., Univ. Wash., Seattle. 20 p. (Typewritten) KEYWORDS: LAKE WASH, TEMPERATURE, WATER

Provides a summary of water temperatures in the south end of the lake during the period of 26-31 January 1972 when the Shuffleton plant was in operation.

392. ZADOROJNY, C. 1971. Chemical water quality of Lake Sammamish. M.S. thesis, Univ. Washington, Seattle. 94 p. KEYWORDS: LAKE SAMM, WATER QUALITY

Summarizes the chemical quality (particularly nitrates and phosphates) of Lake Sammamish as related to the chemical quality of the inflow and outflow waters.

Appendix Table 1. List of streams in the Lake Washington watershed, the drainage area, and USGS station number. (Page numbers refer to USDI Geological Survey [1956]; GS = gaging station, MM = miscellaneous measurement.)

Stream	Tributary to:	Drainage area (km^2)	Station no.	Type	Page number Records	Page number Hydrograph
Bear Creek	Sammamish River	13.3	LW 53	MM	22	
do	do	35.2	LW 54	MM	23	
do	do	123.3	LW 55	GS	7	7
				MM	25	
do	do	21.5	LW 68	MM	25	
do	do	36.0	LW 69	MM	25, 26	
Bear Creek, East Fork	Bear Creek		LW 56	MM	22	
Carey Creek	Lake Sammamish	12.4	LW 30	MM	17	
Cedar River	Lake Washington	510.2	CD 7	GS	1	1
Cherry Creek	Snoqualmie River	51.5	SQ 40	MM	31	
do	do	51.5	SQ 41	MM	31	
Coal Creek	Lake Washington	5.2	LW 6	MM	13	
do	do	17.4	LW 7	MM	13	
Cottage Lake Creek	Bear Creek	28.8	LW 58	GS	8	8
Unnamed stream	Cottage Lake Creek		LW 61	MM	23	
Daniels Creek	Cottage Lake	11.1	LW 59	MM	23	
Etta Cartney Creek	May Creek	2.4	LW 5	MM	12	
Evans Creek	Bear Creek	7.5	LW 63	MM	24	
do	do	18.0	LW 64	MM	24	
do	do	23.2	LW 65	MM	24, 25	
do	do	33.7	LW 66	GS	9	9
				MM	25	
Unnamed stream	Evans Creek	6.4	LW 67	MM	24	

Appendix Table 1. (Continued)

Stream	Tributary to:	Drainage area (km^2)	Station no.	Type	Page number Records	Page number Hydrograph
Fifteen Mile Creek	Issaquah Creek	11.8	LW 40	MM	19	
Forbes Creek	Lake Washington		LW 16	MM	15	
Holder Creek	Issaquah Creek	15.4	LW 34	MM	17, 18	
Issaquah Creek	Lake Sammamish	51.3	LW 31	MM	18	
do	do	68.4	LW 32	GS	6	6
do	do	140.1	LW 33	MM	21	
Issaquah Creek, East Fork	Issaquah Creek	2.2	LW 44	MM	20	
do	do	15.2	LW 45	MM	20	
do	do	21.5	LW 46	MM	20, 21	
Issaquah Creek, North Fork	do	11.0	LW 47	MM	21	
Unnamed stream	do		LW 35	MM	18	
do	do		LW 36	MM	18	
do	do		LW 37	MM	18	
do	do	2.3	LW 39	MM	19	
do	do	1.0	LW 41	MM	19	
do	do	3.2	LW 42	MM	20	
do	do	3.2	LW 43	MM	20	
Juanita Creek	Lake Washington	9.5	LW 17	MM	18	
do	do	14.2	LW 18	MM	16	
Laughing Jacobs Creek	Lake Sammamish	13.0	LW 48	MM	21	
Little Brook	Thornton Creek		LW 89	MM	29	
Lyon Creek	Lake Washington	9.3	LW 83	MM	27	

Appendix Table 1. (Continued)

Stream	Tributary to:	Drainage area (km^2)	Station no.	Type	Page number Records	Page number Hydrograph
McAleer Creek	do	16.0	LW 84	MM	28	
do	do	17.8	LW 85	MM	28, 29	
do	do	13.0	LW 93	MM	28	
McDonald Creek	Issaquah Creek	13.1	LW 38	MM	19	
Mackey Creek	Bear Creek	3.7	LW 62	MM	24	
Maple Leaf Creek	Thornton Creek	7.5	LW 90	MM	29, 30	
do	do	9.6	LW 91	MM	30	
Unnamed stream	Maple Leaf Creek	0.5	LW 92	MM	30	
May Creek	Lake Washington	7.1	LW 2	MM	12	
do	do	18.1	LW 3	MM	12	
do	do	32.4	LW 4	GS	2	2
				MM	12	
Mercer Creek	do	2.7	LW 8	MM	13	
do	do	4.2	LW 9	MM	13, 14	
do	do	17.9	LW 10	MM	14	
do	do	31.1	LW 11	GS	3	3
Mercer Creek, North Branch	Mercer Creek	7.7	LW 12	MM	14	
Mercer Creek, South Fork	do	8.5	LW 13	MM	14, 15	
North Creek	Sammamish River	6.8	LW 71	MM	26	
do	do	17.8	LW 72	MM	26	
do	do	61.4	LW 73	GS	10	10
Unnamed stream	North Creek		LW 77	MM	26	
Patterson Creek	Snoqualmie River		SQ 19	MM	31	

Appendix Table 1. (Continued)

Stream	Tributary to:	Drainage area (km^2)	Station no.	Type	Page number Records	Page number Hydrograph
do	do	40.1	SQ 45	GS MM	11 31	11
Phantom Lake Creek	Lake Sammamish	4.4	LW 25	MM	16	
Raging River	Snoqualmie River	79.3	SQ 15	MM	31	
Sammamish River	Lake Washington	383.3	LW 19	GS	4	4
do	do	541.3	LW 20	GS	5	5
Scriber Lake Creek	Swamp Creek	11.5	LW 81	MM	27	
Seidel Creek	Bear Creek	6.2	LW 57	MM	22, 23	
Sturtevant Creek	Mercer Creek	3.2	LW 14	MM	15	
Swamp Creek	Sammamish River	28.2	LW 79	MM	26	
do	do	54.7	LW 80	MM	27	
Thomas Lake Creek	North Creek		LW 76	MM	26	
Thornton Creek	Lake Washington	14.9	LW 86	MM	29	
do	do	19.4	LW 87	MM	29	
do	do	31.3	LW 88	MM	30	
Tibbetts Creek	Lake Sammamish	10.1	LW 29	MM	17	
Unnamed stream	Lake Washington		LW 1	MM	12	
do	do	5.0	LW 15	MM	15	
do	Lake Sammamish	0.3	LW 21	MM	16	
do	do	1.5	LW 22	MM	16	
do	do	0.4	LW 23	MM	16	
do	do	0.9	LW 26	MM	17	
do	do	0.6	LW 27	MM	17	
do	do	4.0	LW 28	MM	17	

Appendix Table 1. (Continued)

Stream	Tributary to:	Drainage area (km^2)	Station no.	Type	Page number Records	Page number Hydrograph
do	do	5.3	LW 49	MM	21	
do	do	0.8	LW 50	MM	21, 22	
do	do	11.0	LW 51	MM	22	
Unnamed stream	Lake Sammamish		LW 52	MM	22	
do	Cottage Lake	3.4	LW 60	MM	23	
do	Lake Washington	4.3	LW 82	MM	27	

Appendix Table 2. Stations and locations of streams in the Lake Washington watershed that are listed in the USGS 1970 Index of Pacific Northwest streamflow records.[a]

Station N.	Begin		End		Months	Station (all in Washington State)
12.1135.00	1944	10	1963	12	231	N.F. Cedar R. near Lester
12.1140.00	1944	10	1968	9	288	S.F. Cedar R. near Lester
12.1145.00	1945	10	1963	12	219	Cedar R.bl. Bear Cr. near Cedar Falls
12.1150.00	1945	10	1967	9	264	Cedar R. near Cedar Falls
12.1155.00	1945	10	1968	9	276	Rex R. near Cedar Falls
12.1161.00	1945	10	1965	9	240	Canyon Cr. near Cedar Falls
12.1165.00	1914	4	1968	9	654	Cedar R. at Cedar Falls
12.1167.00	1960	10	1963	12	39	M.F. Taylor Cr. near Selleck
12.1168.00	1960	10	1963	12	39	N.F. Taylor Cr. near Selleck
12.1170.00	1956	10	1967	9	132	Taylor Cr. near Selleck
12.1175.00	1895	8	1895	11	4	Cedar R. near Landsburg
12.1184.00	1956	10	1962	9	72	Rock Cr. at Highway 5A near Ravensdale
12.1185.00	1945	7	1965	9	243	Rock Cr. near Maple Valley
12.1190.00	1960	10	1968	9	96	Cedar R. at Renton
12.1195.00	1945	7	1950	9	63	May Cr. near Renton
12.1196.00	1964	9	1968	9	49	May Cr. at mouth near Renton
12.1197.00	1964	1	1965	9	21	Coal Cr. near Bellevue
12.1200.00	1955	7	1967	9	147	Mercer Cr. near Bellevue
12.1205.00	1963	9	1968	9	61	Juanita Cr. near Kirkland
12.1210.00	1945	10	1964	9	228	Issaquah Cr. near Issaquah
12.1216.00	1963	10	1968	9	60	Issaquah Cr. near mouth near Issaquah
12.1217.00	1963	9	1965	9	25	Tibbetts Cr. near Issaquah
12.1225.00	1945	6	1949	10	53	Bear Cr. near Redmond
12.1230.00	1955	7	1965	9	123	Cottage Lake Cr. near Redmond
12.1240.00	1955	7	1967	9	147	Evans Cr. at mouth near Redmond
12.1250.00	1939	2	1957	4	219	Sammamish R. near Redmond
12.1252.00	1965	2	1968	9	44	Sammamish R. near Woodinville
12.1255.00	1965	1	1965	9	9	Bear Cr. at Woodinville
12.1260.00	1945	10	1967	9	264	North Cr. near Bothell
12.1265.00	1939	10	1963	9	288	Sammamish R. at Bothell
12.1271.00	1963	10	1968	9	60	Swamp Cr. at Kenmore
12.1273.00	1963	9	1968	9	61	Lyon Cr. at Lake Forest Park
12.1276.00	1963	9	1968	9	61	McAleer Cr. at Lake Forest Park
12.1280.00	1961	6	1965	9	52	Thornton Cr. near Seattle

[a]These are available on magnetic tape: USGS daily streamflow records, DS name = DUSG01, standard label tape 001315; see notation in bibliography under USDI Geological Survey. The number after each year designates the month.

INDEX BY KEYWORDS*

*Numbers refer to entry numbers, not pages.