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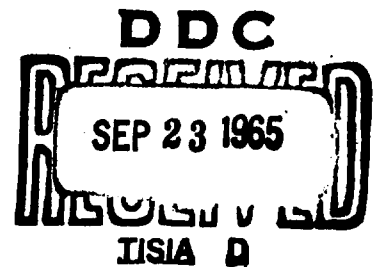
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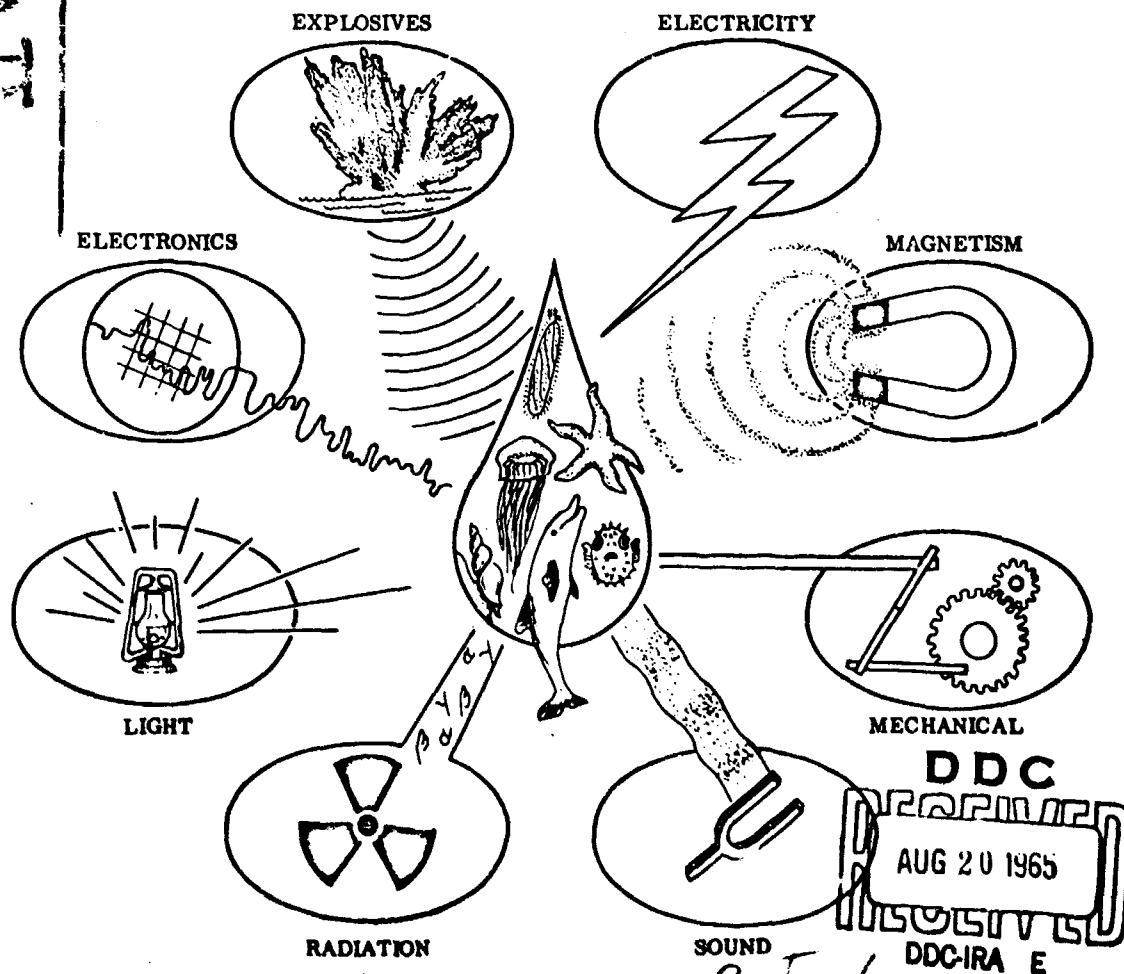


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A BIBLIOGRAPHY *Effects of External Forces on Aquatic Organisms*

FRANK J. SCHWARTZ



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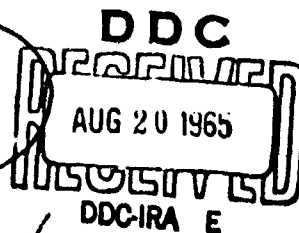
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(10) by FRANK J. SCHWARTZ,

STATE OF MARYLAND

J. MELLARD-TAWNE, Governor

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DEPARTMENT OF RESEARCH AND EDUCATION

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SOLOMONS, MARYLAND.

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THE COVER: The center represents a drop of water within which are shown a few of the wide range of animals covered by this bibliography: Paramecium, jellyfish, starfish, snail, burrfish and porpoise. The symbols in each of the ovals are those influences included in this bibliography: electricity (lightning bolt), magnetism and gravity (magnet), mechanics (gears and levers), sound (tuning fork), radiation (international radiation symbol), light (lantern), electronics (oscilloscope reading) and explosions (an underwater detonation) all of which are emitted or have some effects on the aquatic animals in the drop of water which may, in this case, be fresh or salt.

HOW TO USE THE BIBLIOGRAPHY: This bibliography lists 1216 references, grouped by subject matter: electricity, sound, etc. References marked with an asterisk (*) contained material on more than one topic and will be found in the section noted after such references. A second section lists species alphabetically by the scientific, common or general names that were used in the original article. No attempt to correct published spelling errors or the systematic status of names was made. Thus one should check all possible ways that a species could be included (i.e.) Catfish, Amelurus, Amiurus, Ictalurus, Silurus. The final section is an alphabetical listing of all the authors cited.

FOREWORD

Most biologists can readily think of references and organisms that have or can influence their environment. Fishes, such as the electric ray (Torpedo, Narcine), electric skate (Raia), electric eel (Electrophorus), American knife fish (Gymnotus), closely related Eigenmanni and Sternopygus, Mormyrids (Gnathonemus, Mormyrus), the Nile catfish (Malapterus) and the stargazer (Astroscopus) all can produce varying degrees of electrical impulses that stun, kill or attract other organisms to them as potential food. Many are familiar with the growing realization that the waters of the world are a noisy place. Porpoises, grunts, trigger fishes, catfishes, toadfishes, snappers, snapping shrimp and even seahorses are beeping, grunting, tooting, chattering or snapping a crescendo of noise at passing objects either as defense mechanisms, a courting ritual or as a means of food gathering. Familiar also are the glows that emit from jellyfishes (Liriope, Obeha, Cyanea, Aurelia) Ctenophora (Mnemiopsis), luminescent squid, Ectoproct Bryozoans, annelids, brittle starfish, lantern fishes (Myctophids), wide mouths (Stomiatooids), sharks, deep-sea anglers (Ceratioids) and rattail fishes (Macrurids). Whether this luminescence is used to dazzle, attract or confuse its enemy or prey, a soft white light from these sources glows from the surface of our waters down to a known depth of two and one-half miles (Galatheathuana axeli).

Few researchers consider the reverse aspect of the results of the effects of various external forces on aquatic organisms. What effects do electricity, explosions, light, magnetism, radiation and sound have on aquatic organisms whether in salt or fresh water? What species have been studied and how do they react to such stimulæ? These questions are the basis of this bibliography. Its scope is broad to encompass all groups of aquatic organisms so studied in the world's waters. In spite of the oddity to most biologists of such an approach a wealth of information was uncovered and is presented herein. I have, because of the broad nature of this bibliography, undoubtedly missed many references that exist on some group of animals or species. This is a beginning that can be made more complete in the future. Many "weighty" decisions had to be made: was it an effecting agent, was the species aquatic, etc. Such influences as chemicals, pollutants and temperature are obviously omitted as they are enormous bibliographic giants in themselves. I bear full responsibility for inclusion or exclusion of certain references in this list. Your additions and suggestions will be most welcome.

A task of this order could not have been performed without the generous efforts and support of many people. To mention a few, thanks are due: Dr. Sidney Galler, Head Biology Branch, and his aide Mrs. Helen Hayes, Office of Naval Research, for support of this project; Dr. L. Eugene Cronin, Director, Maryland Department of Research and Education, for making my time available to complete this study; Drs. Mary Sears and Bostwick Ketcham of Woods Hole Oceanographic Institute for bibliographic assistance; Mr. Halstead Wells, visiting student of the Antioch College Cooperative Student Program, Yellow Springs, Ohio, for assisting with the design and executing the cover drawing; the tireless work of Mrs. Gloria Lankford for having the monumental task of deciphering the hundreds of handwritten reference cards and patiently expediting the completion and final typing of the manuscript; and finally the many libraries and librarians, too numerous to mention, who searched diligently to uncover, obtain or make available the references cited in this bibliography. Without the efforts of all these people or agencies, this report would still be in its infancy. To all my heartiest thanks for their interest and aid.

Maryland Department of Research and Education

Frank J. Schwartz
January 1, 1961

A BIBLIOGRAPHY

Effects of External Forces on Aquatic Organisms

Electricity

A

- 1 Abe, N. 1935. Galvanotropism of the catfish: *Parasiluris asotus* (Linne). The Sci. Repts. of the Tohoku Imp. Univ. (Sendai, Japan), 4th Ser. (Biol.) 9(4):393-406.
In an electrical field the catfish's, *Parasiluris asotus*, barbels react before the body and orient toward the positive pole.
- 2 Adler, P. 1932. Die Beeinflussung der Galvanotaxis und Gabanonarkose bei fischendurch Narkotica und Coffein. Pflügers Arch f. d. ges. Physiol. Bd 230:113-128.
A study of the effects of an organism when under influence of drugs.
- 3 Allurand, C. and Fr. Viés. 1911. Electrocutation des poissons et stabilité hydrostatique. Comptes Rendus Hebdom. Acad. des. Sci. (Paris), Tome 152:1627-1629.
A study of six species of fish in relation to the amount of electrical current necessary to produce death.
- 4 Andrew, F. J., I. R. Kerseny and P. C. Johnson. 1955. An investigation of the problem of guiding downstream migrant salmon at dams. Internat. Pac. Salmon Fish. Comm. Bull. 8:65 pp.
Use of electricity to guide salmon past dams.
- 5 Anon. 1921. An electric fish barrage. Pacif. Marine Rev. 18(10):575.
Use of electricity to save salmon and sardines near fishways.
- 6 _____. 1921. Electric fish barrage. Literary Dig. 71(9):23.
Discusses use of electricity to guide fish to fishways.
- 7 _____. 1922. Electric fish screen. Calif. Fish and Game 8(2):120.
The use of a fish screen of electricity and its effects on fish.
- 8 _____. 1923. Electric fish stops. Wash. Dept. of Fish and Game, 1st Bien. Rept. of State Supervisor of Game and Game Fish 1921-1922, pp. 23-24.
Another paper discussing use of electricity to keep out undesirable fishes.
- 9 _____. 1926. Electricity forces fishes to use safety ladders. Pop. Mech. 46(5):733.
Electrical fields help direct fish into fish ladders.
- 10 _____. 1926. A recent experiment with electric fish screens. Pacif. Fisherman 24(12):13-14.
Notes the effects of electrical fish screens as barriers to fish.
- 11 _____. 1929. Shocking fish as a hydro-plant aid. Power Plant Eng. 33(1):75.
Power plants are using electrical fields to keep fish out of intake pipes.
- 12 _____. 1930. Angle Elektrisch! Aber nur mit erlaubnis. Allg. Fischerei-Zeitung, Jahrg 55(22):364.
Electrical fishing for minnows.
- 13 _____. 1930. Fish screen research sees further progress. Pacif. Fisherman 28(4):17-18.
New electrical fish screen is developed to keep out migratory salmon.
- 14 _____. 1932. Electric fish screen gives effective protection. Electrical West 68(5):250.
Same annotation as 13.
- 15 _____. 1934. Versuche mit elektrischem fischen. Allg. Fischerei-Zeitung Bd 37(43):729.
Exploratory use of shocking as a fishing method.
- 16 _____. 1936. Are we coming to this. Prog. Fish. Cult. (16):19.
Hatching fish eggs with electricity produces a 100 percent hatch.
- 17 _____. 1936. Trapping eels by electricity; experiments in Northern Ireland. Fish Trades Gaz. 54(2763):25.
Electricity is used to guide eels into weirs.

- 18 _____. 1942. Burkey electric fish screen installed by Sierra Pacific. *Electrical West* 89(3):92.
Electric fish screen repels fish.
- 19 _____. 1945. Electric fence for fish. *Electronics Dig.* (2):34.
Same annotation as 18.
- 20 _____. 1945. Fence for fish. *Westinghouse Newsfront* 1(4):1.
Same annotation as 18.
- 21 _____. 1945. An electronic fence for fish. *Westinghouse Eng.* 5(5):147.
Same annotation as 18.
- 22 _____. 1945. Electronic fence keeps fish out of power canal. *Power* 89(5):322.
Electric field as a fence keeps fish out of intake canal.
- 23 _____. 1946. Electronic control of fish fence. *Electronics* 19(3):164.
Electric fish screen repels fish.
- 24 _____. 1947. Charged screens prevent mass destruction of fish. *Civil. Eng.* 17(9):33.
Same annotation as 23.
- 25 _____. 1947. Accident electrocutes fish. *The Aquarium* 16(6):137.
A short circuit accidentally kills a number of aquarium fishes.
- 26 _____. 1949. Electric method prospects for herring operations. *The Fishing News (Aberdeen Jour. Ltd.)* 37(1906):12.
Fishing for herring at sea by means of an electric field.
- 27 _____. 1949. Revolution in fishing techniques; electric method prospects for herring operations. *The Fishing News (Great Britain)* 37(1906):12.
Same annotation as 26.
- 28 _____. 1949. Norwegians develop new electric whale gun. *Foreign Commerce Weekly* 36(11):34.
Use of an electric harpoon to kill whales.
- 29 _____. 1949. Om at Lohke Fisk i Garnet. *Fiskeribladet* 41st yr. (8):164. (In Danish).
Employs electricity to attract fish into nets.
- 30 _____. 1949. Electric screen diverts fish from hydro plant. *Electrical World* 131(1):56.
A general article on the use of electric fish screens to repel fish from hydro electric plant intakes.
- 31 _____. 1950. Electrical fishing experiments without a net. *Comm. Fish. Rev.* 12(7):51-52.
Discusses the use of electro-shocking as a method of fishing.
- 32 _____. 1950. Electrical fishing experiments without a net. *Comm. Fish. Abstr.* 3(12):9.
Same annotation as 31.
- 33 _____. 1950. The application of electro-physiological effects for fishing in the sea; a new method now being tested in Germany. *Peruvian Times, Spec. Fish No.*, Dec. 1-8, pp. 32.
Fishing at sea by means of an electrical field proves successful.
- 34 _____. 1950. Electric control of fish behavior. *Pacif. Fisherman* 48(13):49-50.
A way of guiding fish by means of electricity.
- 35 _____. 1950. Catching fish by electricity. *Discovery (London)* 11(1):29.
Catching fish by means of an electrical field.
- 36 _____. 1950. Elektrofischerei im Meere. *Fischereiwelt, Jahrg* 1(3):33-37.
Discusses problem of electrical fishing at sea and the effects on fishes.
- 37 _____. 1950. Fish population is tabulated scientifically (with "electric shocking machine"). *Pop. Mech.* 93(5):78.
Fish were shocked and sampled by means of electricity.
- 38 _____. 1951. Catching tuna with electrified hooks. *Comm. Fish. Rev.* 13(10):25.
The catch of tuna increased when electrocuted as well as the hooks could be sampled in a shorter period of time.
- 39 _____. 1951. Electro-fishing used to reduce coarse roughfish in Emmer River. *Comm. Fish. Rev.* 13(1):54-55.
Coarse fish were easily removed from portions of the Emmer River as a reclamation effort.
- 40 _____. 1951. Status of electrical fishing experiments. *Comm. Fish. Rev.* 13(1):51-52.
Tuna were captured by use of electricity.
- 41 _____. 1951. Use of shielding cable in electric fish-shocking devices. *Prog. Fish Cult.* 13(2):98.
Discusses the added preventive measures to protect the operator as well as certain zones around the gear when in operation for better results.
- 42 _____. 1951. Fishing with electric current. *Fish. Newsletter (Australia)* 10(6):11-13.
A general article on the use of electro-fishing.
- 43 _____. 1951. Electric fishing net is predicted. *Sci. Dig.* 30(5):44.
The electric fish net helps herd fish into the capture zone and keeps them in better condition when landed.
- 44 _____. 1951. Vessel equipped with deep-sea electrical fishing device. *Comm. Fish. Rev.* 13(1):53-54.
Describes the operation and effects of an electrical field on fish at sea.

- 45 _____. 1952. Electric tuna fishing. Atl. Fisherman 33(9):9.
Scandinavians are now fishing for tuna with electric hooks.
- 46 _____. 1952. Electrical tuna fishing. Nat. Canners Assoc. Fish. Information Bull., Sept. 19, 1952, pp. 217-218.
Tuna are effectively captured in a shorter period of time by means of electric hooks.
- 47 _____. 1952. Electric tuna fishing. Comm. Fish. Abstr. 6(1):1.
Same annotation as 46.
- 48 _____. 1952. Method for electric catching of salt water fish. Atl. Fisherman 32(12):18, 38.
Same annotation as 46.
- 49 _____. 1952. Method for electric catching of salt water fish. Comm. Fish. Abstr. 5(4):11.
Same annotation as 46.
- 50 _____. 1952. Electric harpoon new development. Fish. Newsletter (Australia) 11(2):23.
Whales are easily captured by means of electric harpoon.
- * _____. 1952. See Light.
- 51 _____. 1952. Guiding salmon. Fish. Newsletter (Australia) 12(5):15.
Salmon guiding with electricity around dams and fishways are discussed.
- 52 _____. 1952. Método para la captura eléctrica de los peces de agua salada. España Pesquera 3(26):14-15. (In Spanish).
Same as Comm. Fish. Abstr. 5(4):11.
- 53 _____. 1952. Electric fishing. Pop. Mech. 97(2):96.
This article likens electrical fishing to that of electric organ in fishes.
- 54 _____. 1952. German electrofishing trials. World Fishing (London) 1(5):165.
A short article on the use of electricity to catch herring.
- 55 _____. 1952. Russia claims fishing without nets, using a pump, is possible. Fishing Gaz. 69(12):47, 48.
Russian vessels are using a suction pump in combination with an electrical field with good results and catches of fish.
- 56 _____. 1952. Method for electric catching of salt water fish. Atl. Fisherman 32(12):18, 38-39.
- 57 _____. 1952. Atomic fish magnet. World Fishing (London) 1(2):51.
The use of an electrical field acts as a "magnet" in directing fish movements, especially salmon.
- 58 _____. 1952. Electro-fishing opens to commercial fisheries. Can. Fisherman 39(3):14.
A general article on electro-fishing.
- 59 _____. 1952. Tests on electro-fishing. Atl. Fisherman 33(8):8.
Discusses electro-fishing as an easy means of fishing.
- 60 _____. 1952. Behavior (of sardines) in an electrical field. Calif. Dept. Fish and Game, Mar. Res. Comm., Calif. Coop. Sardine Res. Progr. Prog. Rept. 1 Jan. 1951 to 30 June 1952, pp. 22-23.
Sardines exhibit a positive-negative orientation to an electrical current.
- 61 _____. 1952. Electrical fish guiding tests reach 2nd phase. Pacific Fisherman 50(11):55.
Same annotation as 51.
- 62 _____. 1952. Electric tuna fishing successful. Comm. Fish. Rev. 14(10):75.
Tuna were captured faster and in a shorter period of time by means of electric hooks.
- 63 _____. 1952. First tests of German vessels equipped for electro-fishing. Comm. Fish. Rev. 14(6):39.
Vessels equipped with electric poles found fishing for herring and cod profitable.
- 64 _____. 1953. Electrical devices for controlling the movements of anadromous fish. Nature 171(4353):591-592.
Salmon are easily directed past dams with electricity.
- 65 _____. 1953. Herring test. Fish. Newsletter 12(5):15.
Same annotation as 57.
- 66 _____. 1953. Electric control of salmon and sea trout. Salmon and Trout Mag. (139):189-191.
Electric fields aid salmon and sea trout when migrating upstream to bypass dams easier.
- 67 _____. 1953. New claims for electro-fishing. Fish. Newsletter (Australia) 12(5):12-13, 15.
Fish are led into trawls by means of an electrical field around its mouth.
- 68 _____. 1953. Fishing by electricity; excellent results in Hungary. The Fishing News (Great Britain) (2074):10.
Shocking fish in Hungary is a recent fishing development.
- 69 _____. 1953. Fresh water electrical fishing experiments. Comm. Fish. Rev. 15(3):50.
A discussion of shockers and their effects on animals in fresh-water.
- 70 _____. 1953. Experimenting with electrical fishing. Atl. Fisherman 34(3):26.
The effects of electrical fields on fish are discussed.
- 71 _____. 1953. Electrical control of fish movements. Engineering (London) 175(4542):203.
Since fish react to an electrical current, their movements can be controlled easier, especially near obstructions.
- 72 _____. 1953. Export of electrical tuna-fishing units planned. Comm. Fish. Rev. 15(11):50-51.
Discussed use of electricity to catch tuna.

- 73 _____. 1953. Fishing by electricity. Fish Trades Gaz. (London) (3663):27.
Fresh-water shocking of pike and bream are possible with electric shockers.
- 74 _____. 1954. Electric fishing in fresh water. Fish. Newsletter (Australia) 13(1):9.
Australia now finds fishing is made easier by means of shocking.
- 75 _____. 1954. Electrical diversion weir proves practicable at Entiot. Prog. Fish Cult. 16(4):152.
Salmon and steelhead trout are diverted at Entiot by electrical fields.
- 76 _____. 1954. Electrical diversion weir proves practical for salmon. Comm. Fish. Rev. 16(11):40.
Chinook salmon are diverted by electrical fields.
- 77 _____. 1954. Reproduction of fish subjected to electric current. Prog. Fish Cult. 16(3):130.
Large mouth bass were not rendered sterile by electro shocking in a strip mine pond.
- 78 _____. 1955. Essai d'une pompe à poisson combinée avec un système électrique pour attirer et guider les poissons. La pêche Maritime, la pêche fluviale et la pisciculture 34(929):947. (In French).
This paper discusses the positive-negative orientation of fish in an electrical field.
- 79 _____. 1955. A direct-current fish-shocking technique. Prog. Fish Cult. 17(1):75.
The use of a direct current shocker and its effects on fish are discussed.
- 80 _____. 1955. Progress made in developing electrofishing for tuna. Prog. Fish Cult. 17(11):38.
Yellowfin tuna are easily captured when fishing with electric hooks.
- 81 _____. 1956. Norveau procédé de pêche électrique. La pêche Maritime, la pêche fluviale et la pisciculture. Translated from Rybnoe Khozjaistvo (Fundamentalnaya Biblioteka SSSR UI. Frunze 11, Moscow). No.2. (In Russian).
A discussion of effects of direct current on fishes.
- 82 _____. 1956. Electrical weirs to control sea lampreys must remain in operation eight years. Comm. Fish. Rev. 18(8):27.
Reduction of sea lampreys is believed possible by means of an electrical fence-weir.
- 83 _____. 1956. Electronic devices utilized in fishing research and management. Comm. Fish. Rev. 18(8):19-22.
Salmon and sea lamprey movements are tracked by electrical transmitting devices attached to the fish.
- 84 _____. 1956. Fischfang mit elektrizität. Deutsche Fischerei Zeitung (Dresden, West Germany) (11):352. (In German).
Salmon are readily caught by use of electric currents.
- 85 _____. 1956. Means of tracking individual fish. Prog. Fish Cult. 18(4):192.
Fish were tracked by a signal transmitting device attached to the fish near the dorsal fin.
- 86 _____. 1956. New techniques in ocean electro-fishing developed. Comm. Fish. Rev. 18(12):32-33.
A discussion of effects of electrical fields and oceanic fishing.
- 87 _____. 1957. Use of electric fish diversion weirs at northwest salmon-cultural stations. U. S. Bur. Sport Fish and Wildl. Region (1) Pacific, Portland, Oregon, 31 pp.
Migrating salmon are diverted by means of electrical weirs.
- 88 _____. 1958. Electrical fishing gear has good potential. Nat. Fisherman 3(9):9-10, 31.
A general article on aspects of electrical fishing.
- 89 _____. 1958. Vorschriften für die Errichtung und den Betrieb von elektrofischereianlagen in Binnengewässern. (Regulations for the installation and operation of electrical fishing gear in fresh water areas). Allgemeine Fischerei Zeitung (Munich, West Germany), 83(15):293. (In German).
A number of fish species are affected by electrical shockers.
- 90 _____. 1960. Electric mid-water trawl. Trade News 13(3):10, 13.
Electric fields will attract a fish. Fore part of trawl is wired and the idea is that it will be selective by size and species of cod.
- 91 _____. 1960. Push the button - the fish is dead. Can. Fisherman 47:17.
Electric harpoons are used to catch swordfish.
- 92 _____. 1960. Push the button - the fish is dead. Comm. Fish. Rev. 13(11):3.
Review of 91.
- 93 Applegate, V. C., P. T. Macy and V. E. Harris. 1954. Selected bibliography on applications of electricity in fishery science. U.S. Fish & Wildl. Serv., Spec. Sci. Rept. 127:1-55.
A bibliography of uses of electricity in biology, especially fishes.
- 94 _____. B. R. Smith and W. L. Nielsen. 1952. Use of electricity in the control of sea lampreys: electromechanical weirs and traps and electrical barriers. U.S. Fish & Wildl. Serv., Spec. Sci. Rept. 92:1-52.

- 95 Arnold, I. N. 1931. Kak ispol'zovat' ozero i prudy v kolkhozakh. Gosudarstvennoe Izdatel'stvo Sel'sko-Khoziaistvennoi i Kolkhozno-Koolenationoi Literatury (Selkolkhozgiz), Leningrad, pp. 88-91.

Use of electrical fishing in Russia.

- 96 _____. 1933. K praktike primeneniia elektrolova (On the practice of electrofishing). Izvestiia vsesjuzoginanchno-Issledovatel'skogo Instituta Ozerinova i Rechnozo Rybnozo Khoziaistva. Bull. of Inst. Freshwater Fish. (Leningrad) 16(18-21). (In Russian).

Use of electro-fishing in Russia.

B

- 97 Bahr, K. 1957. Die intensivierung des Aalfanges mit Hilfe der Elektrofischerei. Der Fischwirt (Hamburg, West Germany) 7(3):63. (In German).

A study of the effects of electricity on eels.

- 98 Bailey, J. E. and J. C. Spindler. 1955. A direct current fish-shocking technique. Prog. Fish Cult. 17(2):75.

Shocking gear is used to sample fishes.

- 99 Baker, Shirley. 1928. Fish screens in irrigating ditches. Tr. Am. Fish. Soc. 58(1928):80-82.

Electrical fish screens are used to keep trout out of irrigation ditches.

- 100 _____. 1932. Fish refuse to be shocked. Electrical West 68(7):577.

Problems of shocking fish in water of low conductivity.

- 101 _____ and U. B. Gilroy. 1929. The investigation of methods and means of conserving fish life by means of proper fish screens and fish ladders. Wash. St. Dept. Fish and Game Bull. 6:8 pp.

Migrating fish are repelled from dams and screens to prevent jamming and death.

- 102 _____ and _____. 1930. The investigation of methods and means of conserving fish life by means of proper fish screens and fish ladders for period Dec. 1, 1928 to Dec. 31, 1929. Wash. St. Dept. Fish and Game Bull. 17:18 pp.

An extension of 101.

- 103 _____ and _____. 1933. Problems of fishway destruction: fish ladders, elevators, mechanical, screens and electrical fields at dams and intakes. Civil Eng. 3(12):671-675.

A discussion of the use of electrical gear at fishways and their values or detriment to fish life.

- 104 _____ and _____. 1934. Problems of fishway construction in relation to migration of fish. Proc. 5th Pac. Sci. Cong. Div. Biol. Sci. 5:3609-3615.

It is believed the use of electrical fields at dams prevents fish from adequately passing the structure.

- 105 Bancroft, F. W. 1904. Note on the galvanotropic reactions of the medusa *Polyorchis penicillata*, A. Agassiz. Jour. Exp. Zool. 1:289-292.

P. penicillata responds by turning its bell toward the electrical current.

- 106 _____. 1907. The mechanism of the galvanotropic orientation in *Volvox*. Jour. Exp. Zool. 4:157-163.

Electrical fields changes activity of this euktenoid at the poles.

- 107 Band, C. L. and A. Fleisch. 1947. Action biologique de différentes formes et fréquences de courants alternatifs. Helvetica Physiol. et Pharmacol. Acta 5(1):8-9.

A general discussion of the effects of alternating currents on aquatic organisms.

- 108 Barnes, T. C. and H. Z. Gaw. 1935. The chemical basis for some biological effects of heavy water. Jour. Am. Chem. Soc. 57(3):590-591.

Heavy water often produced when an electrical field is passed through water definitely affects activities of protozoans.

- 109 Bary, LCdr. McK. B. 1956. The effect of electric fields on marine fishes. Mar. Res. Ser. Scottish Home Dept. (1):32 pp.

The amount of alternating and direct current has little effect on three marine fishes, however, an increase in potential is necessary as the length of fish increases.

- 110 Bennett, R. D. 1947. Report of conference on the effect of explosions on marine life. Naval Ordnance Laboratory (unclassified) 9424:1-15.

- 111 Bentz, T. 1953. Electric shocking of lampreys proves effective. Atl. Fisherman 34(8):16-17.

A popular article discussing that sea lampreys are being controlled by use of electric fields.

* Bernoulli, A. L. 1910. See Sound.

- 112 Bernstein, J. 1912. Elektrobiologie. Die Lehre von den elektrischen Vorgängen im Organismus auf moderner Grundlage dargestellt. Friedr. Vieweg und Sohn, Braunschweig, 135 pp.

- 113 Birnkoff, A. 1899. Untersuchungen über galvanotaxis. Archiv. f. ges. Physiol. lxxvii: 555-585.

A study of the reaction of protozoans to an electric field.

- 114 Blasius, E. and F. Schweizer. 1893. Elektrotropismus und verwandte Erscheinungen. Pflügers Arch. f. d. ges. Physiol. Bd 53: 493-543.
Various fresh and salt water species are affected in an electrical field as a function of the water temperature.
- 115 Bordier, H. 1932. Expériences sur les effets biologiques de la d'arsonvalisation à ondes comtes. Comptes Rendus hebdom Acad. des Sci. (Paris), Tome 194:1191-1193.
- 116 Bowman, C. A. M. 1951. Sorting fish by electricity, summary of results and conclusions obtained by the Guash Group. Fishing Gaz. 113(3857):226-227.
Various species can be selectively sampled due to their body-electric potential requirements as a function of size.
- 117 _____. 1951. Electrical fishing. Fishing Gaz. 133(3889):974-976.
A general paper on use of electricity for fishing.
- * Bramsnaes, F., Jul Mogens and C. V. Otterstrøm. 1945. See Mechanical.
- 118 Brand, D. J. and D. Hey. 1951. The electrical fish catcher as an instrument for fisheries research. Union of So. Africa Prov. Admin. of the Cape of Good Hope, Inland Fish. Dept. Rept. (8):6-7.
Describes use of electrical fishing in South Africa.
- 119 Brasch, J., J. McFadden and S. Kmiotek. 1958. The eastern brook trout, its life history, ecology and management. Wisc. Cons. Dept. Publ. 226:6 pp.
Trout can be collected using electric shockers.
- 120 Breuer, J. 1905. Über den galvanotropismus (Galvanotaxis) bei fischen. Sitzungsberichte d. Kaiserlichen Akad. d. Wissensch. (Wien), Mathemat.-Naturwiss. Klasse. Bd 114 Abt. III(2):27-56.
A study of positive-negative orientation of fishes in an electric field.
- 121 _____. 1905. Über den galvanotropismus (Galvanotaxis) der fische. Anzeiger d. Kaiserlichen Akad. d. Wissensch. (Wien), Mathemat.-Naturwiss. Klasse, Jahrg 42:81.
Abstract of 120.
- 122 Brown, F. A., Jr. 1945. Elektrophysiologie. Vol. I: Allgemeine Elektrophysiologie. Vol. II: Spezielle Elektrophysiologie, by Hans Schaefer. Physiol. Zool. 18(4):433-435.
(A review in English).
- 123 Brown, O. H. 1903. The immunity of Fundulus eggs and embryos to electrical stimulation. Am. Jour. Physiol. 9(3):111-115.
Eggs are neutral to electric current; if it is high liquification occurs on the positive side of the egg.
- 124 Brünings, W. 1903. Beiträge zur Elektrophysiologie I. Mittheilung Vorbemerkungen. - Ueber den Rubestrom des Froschmuskels I. Pflügers Arch. f. d. ges. Physiol. Bd 98: 241-283.
Thirty-two experiments and physiological effects on the physiology on frog muscles.
- 125 _____. 1903. Beiträge zur Elektrophysiologie II. Mittheilung. Ueber Rubestrom und Reizung. Pflügers Arch. f. d. ges. Physiol. Bd 100:367-427.
A study of electrical fields, potential and nerve reactions to these stimulæ.
- 126 Bull, H. O. 1935. Studies on conditioned responses in fishes Pt. V. on the controlling influence of normal behavior traits upon capacity to form experimental conditioned motor responses under certain conditions. Jour. Mar. Biol. Assoc. U.K. 20:365-370.
Effects of electricity on sharks were studied.
- * Bull, H. O. 1935. See Light.
- 127 Burge, E. L. 1939. Demonstration of electrical polarity in the fish and in the human. Am. Jour. Physiol. (Proc.) 126(3):450-451.
A poor discussion of the reactions of a goldfish in an electrical field. Head orients to positive pole, tail to negative pole.
- 128 Burge, W. E. 1939. Further study on the electrical theory of anesthesia. Am. Jour. Physiol. (Proc.) 126(3):45.
An etherized fish caused a reverse flow of electricity through it, but the direction was normal when the fish revived.
- 129 Burnet, A. M. R. 1952. Studies on the ecology of the New Zealand freshwater eels. 1. The design and use of an electric fishing machine. Austr. Jour. Mar. and Freshwater Res. 3(2): 111-125.
Shocking eels in New Zealand is studied using different powered shockers.
- 130 _____. 1953. Fishing by electricity. Can. Fisherman 40(8):21.
A general discussion of shocking fish with electricity.
- 131 _____. 1953. Electricity captures eels for life studies. Sci. Newsletter 63(7):105.
A review of 129.
- 132 Burr, J. G. 1930. Killing garfish with electricity. Texas Cons. pp. 82-91.
An experiment in rough fish removal using electric shockers.
- 133 _____. 1931. Electricity as a means of garfish and carp control. Tr. Am. Fish. Soc. 61(1931):174-182.
Use of alternating current to shock gars and carps as a rough fish control measure.
- 134 Burrows, R. E. 1957. Diversion of adult salmon by an electrical field. U.S. Fish & Wildl Serv. Spec. Sci. Rept. 246:1-11.

C

- 135 Canella, M. F. 1937. Si può parlare di galvanotropismo negli Ictiopaidei? Boll. della Società Italiana di Biologia Sperimentale (Naples) 12(10):680-682.
The orientation of various species of fish and amphibians are studied in an electrical field.
- 136 Carlander, K. K. 1957. A bibliography of electric shockers compiled in: symposium on evaluation of fish population in warm water streams, March 25, 1957. Iowa St. Coll. pp. 117-118.
A bibliographic compilation.
- 137 Case, J. O. 1938. An answer to fish screening. Electrical West 80(4):32-33.
A photographic presentation of fish avoiding an electrical screen.
- 138 Castle, E. S. 1944. Studies on the electrical control of fouling. Woods Hole Oceanog. Inst. Interim Rept. IV to Bur. Ships, July 8, 1944, pp. 1-32, 26 figs.
When attempting to keep fouling from hulls of ships, the negative electrode was heavy with encrustment. The experiment was not considered too successful.
- 139 _____. 1951. Electrical control of marine fouling. Ind. and Eng. Chem. 43:901-904.
Similar to 138.
- 140 Chanut, V. 1950. La pêche Électrique. La Pêche Maritime 30th yr. (869):347-348.
A general description of positive and negative responses in an electrical field.
- 141 Chernigin, M. F. 1949. Elektricheskii nevod (Electrical fishing net). Tekhnika Molodezki (Moscow) 17(10):15-18. (In Russian).
Russia is employing an electrically charged net to catch fish.
- 142 _____. 1949. Electrical fishing. Trans. from Tekhnika Molodezki 17(10):15-18 (at U.S. Fish & Wildl. Serv. Library, Washington, D. C.).
A translation of 141.
- 143 Chuman, M. 1952. Studies on the practicality of new fisheries by low frequency electric-shocks. IV. About the circumstances of paralysis of fish by electric-shocks. Mem. of the Fac. Fish. Kagoshima Univ. (Kagoshima, Japan) 2(1):45-48. (In Japanese with English summary).
Fish die at the peak impulse of $\frac{1}{100000}$ - $\frac{1}{100120}$ second.
- 144 Clarke, R. 1952. Electric whaling. Nature 169(4308):854-860.
The use of electric harpoons are making it easier to capture whales.

- 145 Cobb, J. N. 1922. Protecting migrating Pacific salmon. Tr. Am. Fish. Soc. 52(1922): 146-156.
Salmon migrations have been aided by the use of electrical fields which are leading these fish into fishways.
- 146 Collins, G. B., C. D. Volz and P. S. Trefethen. 1954. mortality of salmon fingerlings exposed to pulsating direct current. U.S. Fish & Wildl. Serv. Fish. Bull. 92(56):61-81.
Total voltage is effective mortality factor. It is equal to fish length X voltage gradient.

D

- 147 Dale, H. 1901. Galvanotaxis and chemotaxis in ciliate infusoria. Jour. Physiol. 26:291-361.
Electrical impulses were found to slow down the ciliate, *P. aurelia*.
- 148 Delov, V. E. and I. F. Tomashevskii. 1933. Problema elektricheskogo lova ryby (Problem of electrofishing). Inst. of Freshwater Fish. Bull. (Leningrad) 16:5-17. (In Russian).
A general discussion of electro shocking in Russian fresh waters.
- 149 Denzer, H. W. 1949. Experiences with electric fishing in inland waters. U.S. Fish & Wildl. Serv. Fish. Leaflet 348:8-10.
A review of electric fishing in fresh waters.
- 150 _____. 1950. Probleme der elektrofischerei. Archiv.f. Fischereiwiss Jahrg 2 Hefte 1-2:73-74.
A German version of 149.
- 151 _____. 1951. Elektrofischerei und sport fischerei. Der Kerscher. Pressehaus, Hamburg 1(2):32-35. (In German).
Problems facing the fisherman are discussed in the light of electro-shocking.
- 152 _____. 1952. Die Bedeutung der Leitfähigkeit des Wassers für die Elektrische Befischung der Binnengewässer. Der Fischwirt, Hamburg 2(11):411-415. (In German).
Water conductivity problems are discussed as one attempts to shock fish.
- 153 _____. 1953. Über die Frage der Schädi gung der Fischnährtiere durch den fließenden Gleichstrom. Der Fischwirt, Hamburg 3(5):159-163. (In German).
- 154 _____. 1954. Der Heutige Stand der Elektrofischerei in Binnengewässern. Fischereiwelt, Hamburg 4(10):301-305. (In German).
- 155 _____. 1956. Die Elektrofischerei. Handbuch der Binnenfischerei Mitteleuropas 5(3):141-233, Stuttgart.
A very good German review of electro-fishing methods.

- 156 Dethloff, J. 1959. Electro-fishing. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 583-585.
A review of electro-fishing for tuna in terms of a fishery for this species.
- 157 Dickson, W. 1954. Marine electrical fishing. World Fishing, pp. 148-151.
A good discussion of the physics behind electro fishing.
- 158 Dijkgraaf, S. and F. J. Varheijen. 1949. Neue versuche über das tonunterscheidungsvermögen der elritze. Z. Vergl. Physiol. 32:248-256.
Phoxinus laevis was conditioned to various signals in a study to determine if fish can hear.
- 159 Dittler, R. 1928. Messende versuche zur theorie der elektrischen Reizung. I. Allgemeine Problemstellung. Der Reizapparat. Zeitschr. f. Biol. Bd 87 (N. F. Bd 69) Heft 6:543-556.
A study of the effects of electricity on fish physiology.
- 160 _____ and H. K. Muller. 1928. Messende versuche zur theorie der elektrischen Reizung. II. Der Störungswert der Strompause in Abhängigkeit von ihrer Lage im Stromstross, gemessen durch "Kompensierung nach unten." Zeitschr. f. Biol. Bd 87 (N. F. Bd 69) Heft 6:557-572.
Similar to 159.
- 161 Dragesund, O. and H. Lewistad. 1959. A note on the effect of electric fields on Gadus virens. Fiskeridirekt Skrifter. Ser. Havundersøkelse 12(4):1-9.
As the current pulse increased the electrical axis potential had to be decreased.

E

- 162 Elder, D. E. 1954. Reproduction of fish subjected to electric current. Prog. Fish Cult. 16(3):130.
Largemouth bass were not sterile after shocking a strip mine pond.
- 163 Elson, P. F. 1949. Techniques for studying stream populations. Fish. Res. Bd. Can. Annual Rept. Atl. Biol. Sta. 1948, App. 71, pp. 87-89. Mimeo.
A general discussion of shocking fish in Canada for population studies.
- 164 _____ 1950. Usefulness of electrofishing methods. Can. Fish. Cult. (9):3-12.
A review of electrofishing methods.
- 165 Engelen, J. 1912. Die elektrische narkose bei fischen. Deutsche Medizinische Wochenschr. Jahrg 38, II Halbjahr. (33):1558.
General comments on the reactions of fish to electrical impulses.

- 166 Ewald, J. R. 1894. Ueber die wirkung des galvanischen stroms bei der Längsdurchströmung ganzer wirbelthiere. Pflügers Arch. f. ges. Physiol. Bd 55:606-621.
Fish larvae responded as do adults in an electrical field, head toward positive pole, tail toward negative pole.

F

- 167 Fessard, A. and H. Laugier. 1932. Appareil en vue de la réalisation d'excitations sélectives par la durée. Comptes Rendus hebdom. Soc. de Biol. (Paris), Tome 110:1232-1235.
A general discussion of shocking gear and its use to collect fish.
- 168 Fish, G. R. 1959. A electric shocking device as a lake aid to fish studies. Lab. Pract. 8:304-305.
In a lake 2 amps are required to stun fish.
- 169 Fisher, K. C. 1950. Physiological considerations involved in electrical methods of fishing. Can. Fish Cult. 9:26-33.
A review of the effects of electrical stimulations and fish physiology.
- 170 _____ and P. F. Elson. 1950. The selected temperature of Atlantic salmon and speckled trout and the effect of temperature on the response to an electrical stimulus. Physiol. Zool. 23(1):27-34.
Salmonid fishes at 10 and 15°C. would react to escape the electrical shock with a quick forward darting action.
- 171 Frenkel, Ia. I. and G. P. Vager. 1948. Deystvie elektricheskogo polia na struiu zhidkosti. (Effect of an electric field upon a stream of liquid). Izvestia Akad. nauk SSSR, Seriya Geograficheskaya i Geofizicheskaya. (Bull. Acad. Sci. USSR, Geo. and Geophys. Series), Tom 12(1):3-6. (In Russian).
The electrical field is dependent on the liquid conductivity.
- 172 Fritzache, H. 1927. Fang mittels elektrizitat. Mitteil. d. Fischerei-Verein f. d. Prov. Brandenburg usw., Bd 31 (N. F. Bd 19), pp. 352.
Describes shocking fish in German streams.
- 173 Froloff, J. P. 1928. Bedingte reflexe bei fischen II. Pflüg. Archiv. ges. Physiol. 220:339-349.
Good kymograph illustrations are presented of the Tench's reactions to electrical stimuli.
- 174 Fujita, M. 1906. Kanden denki no gyomi ni oyobosuhano jikken. (Experiment on the reaction of fishes towards induction currents of electricity). Zool. Mag. (Tokyo), 18:153-155. (In Japanese).

- 175 Funk, J. L. 1949. Wider application of the electrical method of collecting fish. Tr. Am. Fish. Soc. 77(1947):49-60.

Many freshwater species of fish can be collected using shocking gear.

G

- 176 Gallois, M. and M. de Drouin de Bonville. 1933. L'action de l'électricité sur le poisson et la technique des grilles électriques; d'après les travaux du Docteur Holzer. Francois de Piscicult Bull. 5th yr. (56):254-260.

Early experiments on effects of electricity.

- 177 _____ and _____. 1933. Grilles tournantes et grilles électriques aux Etats-Unis en 1931. Francois de Piscicult Bull. 6th yr. (63):63-69.

Review of use of electrofishing in United States.

- 178 Gerard, R. W. 1942. Electrophysiology. Ann. Rev. Physiol. 4:329-358.

Review of effects of electricity on frogs, worms and other animals.

- 179 Gilroy, U. B. 1931. Alfalfa, killowatts and fish. Outdoor Am. 9(10):14-15, 27.

A discussion of the use of electricity at dams to divert fish.

- 180 Godfrey, H. 1956. Catches of fish in New Brunswick streams by direct current electrofishing. Can. Fish Cult. 19:1-8.

Many freshwater species were captured by electro-shocking.

- 181 Gradinesco, Ar. E. and A. E. (E.) Pora. 1935. Influence du courant électrique continu sur la perméabilité branchiale, chez quelques poissons d'eau douce. Bull. Soc. Chimie Biologique, Tome 17(6):1054-1057.

Positive or negative electrode responses of fishes in an electrical field.

- 182 _____ and _____. 1937. L'influence du courant électrique continu sur la résistance des poissons d'eau douce aux salinités. Buletinul Societății de Științe din Chuj (Bull. de la Soc. des Sci. de Chuj (Chuj, Rumania), 8(4):615-617.

- 183 Gregora, O. 1951. Elektrotechnický obzor (Prague), 40(11):14 pp. (In Bohemian). Tr. on file Pacific Salmon Invest., U.S. Fish & Wildl. Serv.

Another foreign use of electrical barriers for fishes.

- 184 Groody, T., A. Loukashkin and N. Grant. 1950. Electrical stimulation of fish in sea water. Calif. Coop. Sardine Res. Progr. Prog. Rept., pp. 46-47.

A discussion of the use of electricity to catch sardines, smelt and shiners.

- 185 _____ and _____. 1952.

A preliminary report on the behavior of the Pacific sardine (*Sardinops caerulea*) in an electrical field. Proc. Calif. Acad. Sci. 27(8): 311-323.

The movements of the Pacific sardine with electrical charges.

- 186 Gusel'nikov, V. I. and V. I. Ivanova. 1958. Electrical reactions in the cerebellum of fishes, turtles and pigeons in response to external stimuli. Fiziol. Zhur. SSSR (Transl.) 44(1/4):107-113.

Electric stimuli caused changes in electrical potentials in fish brains.

H

- 187 Hagen, F. 1934. Die elektrizität im Dienste der Wildbachfischerei. Österreich Fischereiwirtschaft. (7-8):1-3.

Electric shocking in natural "wild" streams for fishes are discussed; a good report.

- 188 Haier, U. 1954. Die elektrotechnischen Grundlagen der elektro-fischerei im Meer. Archiv. für Fischereiwissenschaft. Braunschweig (Germany) 5(3/4):132-144.

A general review of the physics of the operating electric shockers.

- 189 Halsband, E. 1954. Untersuchungen über die Bedeutung des Polaren Erregungsgesetzes für Reaktion der Fische im elektrischen Feld. Archiv. f. Fischerei. 5(3/4):5.

A study of the positive-negative orientation of fish in an electric field.

- 190 _____. 1955. Die anodische Reaktion der fische im elektrischen feld. Archiv. für Fischerei. 5(3/4):218.

Another positive-negative fish polarity orientation experiment.

- 191 _____. 1955. Untersuchungen über die betäubungsgrenzimpulszahlen verschiedener Süßwasserfische. Archiv. f. Fischerei. 6(1/2):1-10.

A study of the reactions of sea fishes to electrical impulses.

- 192 _____. 1955. Die anodische reaktion der fische in elektrischen feld. Archiv. für Fischerei. 6(3/4):2-4.

Polarity orientation experiments and reactions of fishes.

- 193 _____. 1955. Die Betäubungsgrenzimpulszahlen verschiedener seewasserfische. Archiv. für fischerei. 5(3/4):223.

Similar to 192.

- 194 _____, 1956. Die Beziehung zwischen intensität und Zeitdauer des Reizes bei der elektrischen Durchströmung von fischen. Archiv. für Fischereiw. (Braunschweig, West Germany) 7(1):74. (In German, English summary).
A general study of trout and carp reactions to varying electrical impulses.
- 195 _____, 1959. The effect of pulsating electric current on fish. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 575-580.
A very good study on the intensity levels to catch or lead fish to a net or pump.
- 196 Hammond-Davis, B. E. 1952. "Pirate" fish get a shock; being some recent experiences in electric fishing. Salmon and Trout Mag. (135):124-140.
Electric shocking in streams of Scotland and England are discussed.
- 197 Hausmann, Gertrud. 1927. Über die Bewegungen einiger ciliaten Protozoen im Wechselstrom. Biol. Generalis (3/4):463-474.
A study of various species of protozoans in an alternating current field.
- 198 Harrer, R. 1926. Elektrischen fischfang. Fischerei-Zeitung, Bd 29(23):507.
A general paper on the effects of electrical fishing.
- 199 _____, 1926. Elektrisches fischen. Allg. Fischerei-Zeitung, Jahrg 51(13):210-211.
Similar to 198.
- 200 Harreveld, A. von. 1937. Electroneurosis with alternating current in fish. Archiv. Néerlandaises de Physiol. 22(1):84-92.
The brains of fishes are paralyzed in an alternating current if 50 cycles per second are used.
- 201 _____, 1938. On galvanotropism and oscillotaxis in fish. Jour. Exp. Biol. 15(2):197-208.
A good study of the goldfish and its reactions to electricity. The positive pole is preferred.
- 202 Harris, V. E. 1953. Some practical aspects of electric fishing. Atl. Fisherman 34(1):13, 34.
A general discussion of electrical gear and their effects.
- 203 Hashimoto, T. 1953. An experiment on the performance of an electric fish screen. Jap. Soc. Sci. Fish Bull. 19(1):23-30. (In Japanese with English summary).
The use of electrical fish screens for diversion of fish in Japan.
- 204 Haskell, D. C. 1940. An electrical method of collecting fish. Tr. Am. Fish. Soc. 69 (1939):210-215.
- 205 _____, 1940. Electric shock provides method of anesthetizing fish in laboratory. Prog. Fish Cult. 49:33-34.
Laboratory use of electricity as an anesthetic on brook trout proves successful.
- 206 _____, 1950. Recent developments in the electric method of collecting fish. Prog. Fish Cult. 12(3):131-135.
A good review of problems and usage of electric shocking in collecting fishes.
- 207 _____, 1954. Electrical fields as applied to the operation of electric fish shockers. N. Y. Fish and Game 1(2):130-170.
Brown trout were readily captured by use of direct current.
- 208 _____ and W. F. Adelman, Jr. 1955. Effects of rapid direct current pulsations on fish. N. Y. Fish and Game 2(1):95-105.
Twenty percent less current is necessary to get fish to move toward a positive pole by a current of 18 pulsations per second than steady current.
- 209 _____, D. Geduldig and E. Snoek. 1955. An electric trawl. N. Y. Fish and Game 2(1):120-125.
A method involving two pairs of electrodes operating by portable current generators was successful in collecting warm water fishes.
- 210 _____, J. MacDougall and R. Freeman. 1954. Two back-pack fish shockers. N. Y. Fish and Game 1(1):65-74.
Portable back-pack shockers were used to capture brown trout.
- 211 _____ and D. Geduldig. 1954. Reactions and motion of fish in a direct current electric field. N. Y. Fish and Game 1(1):47-64.
Direct current orientates the fish easier and quicker, but intercepted current requires less voltage and perhaps will permit greater space between electrodes.
- 212 _____ and R. G. Zilliox. 1941. Further developments of the electrical method of collecting fish. Tr. Am. Fish. Soc. 70 (1940):404-409.
Two species of trout are easily captured by electric shocking.
- 213 Hattrop, H. W. 1958. Die möglichkeiten der bewirtschaftung von stehenden Gewässern und Flussläufen mit Hilfe der Elektro-fischerei. (Electrofishing in stagnant waters and rivers). Zeitschrift für Fischerei und deren Hilfswissenschaften (Germany) 7(1/2):1-90.
The capture of elvers is discussed along with safeguards for the operator and the voltages necessary to stun fish in lakes and creeks.

- 214 _____, 1958. Die elektroden und deren anordnung bei der elektrofischerei (The electrodes and their arrangement in electrofishing). Deutsche Fischerei Zeitung 5(5):5 pp. (In German).
If optimum results are desired, best sized plate is 5x500 mm for an electro fishing gear.
- 215 _____, 1958. Die verwendung von leitungsstromzen elektrofischerei (The use of the main current for electrofishing). Deutsche Fischerei Zeitung (Dresden, East Germany) 5(9):4 pp. (In German).
A general discussion of the use of electric shockers to catch fish.
- 216 Hauch, F. R. 1949. Some harmful effects of the electric shocker on large rainbow trout. Tr. Am. Fish. Soc. 77(1947):61-64.
Shockers caused ruptured vertebrae, arteries and veins, curvature of spine and extreme dilation of blood vessels of the body and brain.
- 217 Hermann, L. 1885. Eine wirkung galvanische strome auf organismen. Archiv. fur die ges. Physiol. des Menschen und der Tiere 37:457-460.
Another paper which deals with the positive-negative reactions of organisms in an electrical field.
- 218 _____, 1885. Eine wirkung galvanischer strome auf organismen. Pflügers Archiv. f. d. ges. Physiol. Bd 37:457-460.
A study of the effects of electrical impulses on *Rana temporaria*.
- 219 _____, 1886. Weitere untersuchungen uber das veshalten der froschl arven im galvanischen strome. Pflügers Archiv. f. d. ges. Physiol. Bd 39:414-419.
Similar to 218.
- 220 _____ and Fr. Matthias. 1894. Der galvanotropismus der larven von *Rana temporaria* und der fische. Pflügers Archiv. f. d. ges. Physiol. Bd 57:391-405.
The chromatophores of fish and frogs were greatly affected by electrical currents.
- 221 Higgins, E. 1930. Progress in biological inquiries, 1928. U.S. Comm. Fish. for fiscal yr. 1929 Rept., App. 10, pp. 650.
A review of electrical shocking gear and its use.
- 222 _____, 1931. Progress in biological inquiries, 1929. U.S. Comm. Fish. for fiscal yr. 1930 Rept., App. 15, pp. 1097-1101.
Similar to 221.
- 223 _____, 1931. Progress in biological inquiries, 1930. U.S. Comm. Fish. for fiscal yr. 1931 Rept., App. 3, pp. 595-601.
A general resume of activities and results of the use of electrical shocking gear and methods.
- 224 _____, 1932. Progress in biological inquiries, 1931. U.S. Comm. Fish. for fiscal yr. 1932 Rept., App. 3, pp. 484-489.
Same as 223.
- 225 _____, 1933. Progress in biological inquiries, 1932. U.S. Comm. Fish. for fiscal yr. 1933 Rept., App. 2, pp. 111-113.
Same as 223.
- 226 Higman, J. B. 1956. The behavior of pink grooved shrimp, *Panaeus duorarum* Burkenroad in a direct current electrical field. Fla. St. Bd. Cons. Tech. Ser. 16:25 pp.
Fish were attracted to a pole at 15.15 milliamps per square inch where the pulse rate was 5 per second and a current ratio of 1:2. A good bibliography is included.
- 227 Hiyama, Y. and T. Kusaka. 1950. Effect of electric current on fish, regarding direction, intensity, frequency and type of current. Studies of aquatic animals of Japan 1:1-10.
Another positive-negative reaction experiment with fish.
- 228 Hnatevic, B. 1953. Fishing with electricity. Czechoslovak Acad. Agric. Sci. Bull. (1-2): 101-109. Transl. Pac. Biol. Sta. Cy G. Mares.
The intensity necessary to immobilize fish, flatworms and crustaceans is different in each animal.
- 229 Hoagland, H. 1933. Electrical responses from the lateral-line nerves of fishes. Jour. Gen. Physiol. 17(1):77-82.
The electrical reception levels of the lateral line of trout and catfish is studied.
- 230 Holmes, H. B. 1948. History, development and problems of electric fish screen. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 53:1-62.
- 231 Holton, G. D. and C. R. Sullivan, Jr. 1954. West Virginia's electrical fish-collecting methods. Prog. Fish Cult. 16(1):10-18.
Many freshwater suckers, sunfishes and minnows can be collected by use of alternating or direct currents.
- 232 Holzer, W. 1931. Derelektrische fischrechen. Mittell. a. d. Inst. f. Wasserbau d. Techn. Hochschule, Berlin, 1931, (8):3 pp.
Electric shocking in German streams is discussed.

- 233 _____. 1931. Der elektrische fischrechen. Wasserkraft u. Wasserwirtschaft, Jahrg 17: 203-250.
Same as 232.
- 234 _____. 1931. Fischfang mit elektrizität. Elektrotechnische-Zeitschr. Jahrg 52, (Nov. 19, 1931), 47:1442-1444.
A discussion of how to use shockers for best results.
- 235 _____. 1931. Ueber eine absolute reizspannung bei fischen. Pflügers Archiv. f. d. ges. Physiol. Bd 229:153-172.
A study of the electric potential about a fish.
- 236 _____. 1932. Über eine absolute reizspannung bei fischen. Pflügers Archiv. fur ges. Physiol., West Berlin, (229):153-173.
Same as 235.
- 237 _____. 1932. VIII. Bemerkungen zur anwendung der elektrizität in der fischereiwirtschaft. Allg. Fischerei-Zeitung, Jahrg 57 (14):218-220.
A tabulation only of the findings of collecting with electricity is presented.
- 238 _____. 1932. Der elektrische fischrechen. Ein Betrag zur Wirtschaftlichkeit von Wasserkraft-Niederdruckwerken. Mitteil. a. d. Inst. f. Wasserbau d. Techn. Hochschule Berlin (1932), (12):35 pp.
Similar to 237.
- 239 _____. 1932. Bermerkungen zur anwendung der elektrizität in der fischereiwirtschaft. Fischerei-Zeitung, Bd 35, (35): 413-414.
Aspects of the use of electrical fishing for best results are presented.
- 240 _____. 1933. Modelltheorie über die stromdichte im korper von lebewesen bei galvanischen durchstromung in Flüssigkeit. Pflügers Archiv. f. d. ges. Physiol. Bd 332: 821-834.
Electric potentials around eggs, while in an electric field, were determined.
- 241 _____. 1933. Fischfang mit elektrischen strom in Hamm. Mitteil. d. Fischerei-Ver-ein Westausgabe Bd 3:260.
The use of electrical shockers in various sections of Germany and their catches are discussed.
- 242 _____. 1933. Über die stromdichte im Forellenei bei galvanischen durchstromung in Flüssigkeit. Pflügers Archiv. f. d. ges. Physiol. Bd 232:835-841.
Another paper dealing with the effects of electrical fields on fish behavior.
- 243 Hosl, A. 1955. Die elektrotechnischen grund-lager des elektro-fischfangs. Der Fischwirt 5(8):235. (In German).
Electro fishing and its problems.
- 244 _____. 1959. Dangers and precautions in the electrical fishery. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 589-591.
It was noted that 40 volts and 50 milliamps are a dangerous level to man, best voltage should not exceed 24 volts.
- 245 Hsiao, S. C., I. Miyake and A. L. Tester. 1952. Reaction of tunas and other fishes to stimuli. Pt. 3, Observations on the reaction of tuna to artificial light (pp. 36-58); Pt. 4, Observations on sound production and response in tuna (pp. 59-68); Pt. 5, Notes on the response of a tropical fish (*Kuhlia sandvicensis*) to interrupted direct current (pp. 69-83). U.S. Fish & Wildl. Serv. Spec. Sci. Rept. pp. 36-83.
Lights will attract fish while sound and interrupted direct current varied in their ability to influence fish behavior.
- 246 Hyman, L. H. and A. W. Bellamy. 1922. Studies on the correlation between metabolic gradients, electrical gradients and galvanotaxis I. Biol. Bull. 43(5):313-347.
Higher areas of metabolic rates are negative externally, positive internally. Invertebrates varied greatly in the charge (positive-negative) which was found at each body extremity.

I-J

- 247 Iwata, K. S. 1950. Spawning in *Mytilis edulis*. 2. Discharge by electrical stimulation. Jap. Soc. Sci. Fish. Bull. 15(9):443-446. (In Japanese with English summary).
If *M. edulis* is subjected to 20 volts for 5 seconds, ripe specimens will be induced to spawn.
- 248 Jaisle, K. 1934. Über den ertrag des forellenbaches. Allg. Fischerei-Zeitung, Jahrg 59(2):18-20.
- 249 Jellinek, S. 1909. Atlas der elektropathologie. Urban und Schwarzenberg, Berlin, 1909, pp. xi / 92.
- 250 Joeris, L. 1949. Electric seine used in Kentucky. Prog. Fish Cult. 11(2):119-121.
A seine fitted with alternating current charge was used successfully to collect fishes.

K

- 251 Kellogg, W. N. 1958. Galvanotropism as an avoidance response. The Jour. of Comp. and Physiol. Psychol. 51(6):652-657.
Direct current effects were studied in salt water enclosures 3x8'. Stocked minnows avoided the negative pole.

- 252 King, B. G. 1934. The effect of electric shock on heart action with special reference to varying susceptibility in different parts of the cardiac cycle. Aberdeen Press, N. Y., 1934, 20 pp.
- 253 Kleerekoper, H. and K. Sibakin. 1956. An investigation of the electrical "spike" potentials produced by the sea lamprey (*Petromyzon marinus*) in the water surrounding the head region. Jour. Fish. Res. Bd. Can. 13:375-383.
One of the best papers on spike potentials around a fishes' body.
- 254 _____ and _____. 1956. Spike potentials produced by the sea lamprey (*Petromyzon marinus*) in the water surrounding the head region. Nature 178:490-491.
A potential was recorded 15-20 meters away. The character of potential is 20 mm per second and 200 microvolts.
- 255 _____ and _____. 1957. An investigation of the electrical "spike" potentials produced by the sea lamprey (*Petromyzon marinus*) in the water surrounding the head region II. Jour. Fish. Res. Bd. Can. 14(2): 145-151.
A continuation of 253. A very good paper and an excellent bibliography.
- 256 Koch, F. J. 1925. They take the scales off the perch by electricity now. Fish and Oyster Reporter 7(5):9.
Electrical charges will remove fish scales in a processing plant.
- 257 Koch, H. 1932. Eien rohrenanordnung zur erzeugung pulsierender gleichströme variablen frequenz, intensität und variablen unterbrechungsverhältnisses. Pflügers Archiv. f. d. ges. Physiol. Bd 231:169-174.
Electrocardiographs of responses to electrical shocks are presented.
- 258 Kokubo, S. 1934. On the behavior of catfish in response to galvanic stimuli. The Sci. Repts. of the Tohoku Imp. Univ. (Sendai, Japan) 4th Ser. (Biol.) 9(2-3):87-96.
Catfish are sensitive to electrical stimuli as low as 4 milliamperes.
- 259 _____, N. Abe and K. Uzuka. 1933. Response to fishes to the change of environmental factors. I. Relation of earth current and electrical stimulus to the behavior of fishes. Saito ho-on Kai (The Saito Gratitude Foundation, Sendai, Japan), Annual Rept. of the Work (1932), (9):33-37.
Positive-negative responses of catfish to electrical stimulus are presented.
- 260 Kollensperger, F. K. and F. Scheminsky. 1938. Der "galvanische krampf" bei aufsteigender durchstromung von fröschen. Pflügers Archiv. f. d. ges. Physiol. Bd 241: 38-53.
- * Kraus, H. and W. Reiffenstühl. 1933. See Light.
- 261 Kreutzer, C. O. 1950. Die physiologischen grundlagen der elektrofischerei im Meer. Archiv. f. Fischereiwiss. Jahrg 2(1-2): 10-14.
The physics of electricity in sea water and the power necessary for satisfactory operation are viewed.
- 262 _____ 1951. Thune werden elektrisch geangelt. Fischereiwelt, Jahrg 3, (10):160-161.
- 263 _____ 1954. Elektrofischerei. Elektro-technische Zeitschrift (VDE-Verlag G.m.b. tt.) 6(5):176. (In German).
- 264 _____ 1954. Elektrofischerei. Elektro-techn. Zeitsche. Biol. (5).
- 265 _____ and H. Peglow. 1949. The application of electro-physiological effects on fishing. Fishing Gaz. 66(12):52.
- 266 _____ and _____. 1949. Abstract of: The application of electro-physiological effects on fishing. Comm. Fish. Abstr. 3(5):3. Abstract of 265.
- 267 _____ and _____. 1950. Abstract of: The application of electro-physiological effects on fishing. F.A.O. World Fish. Abstr. Abstract of 265.
- 268 Kuroki, T. 1950. Study on the electric fishing screen. I. On the selection of effective frequencies. Jap. Soc. Sci. Fish. Bull. 16(4): 165-170. (In Japanese with English summary).
If one uses low frequencies, larvae may be protected by limiting the frequency of cycles.
- 269 _____ 1951. Studies on the electric fish-screen. II. On the effects of stimuli by A.C., F.R.C., and H.R.C. Jap. Soc. Sci. Fish. Bull. 17(5):128-131. (In Japanese with English summary).
To equal alternating current, one needs 2-4 X F.R.C., 1/3 to 2/3 H.R.C. R.C. reaction is acute in small and large fish when the electrifying voltage is low.
- 270 _____ 1952-53. Study on the electric fish-screen. IV. The electrifying effects by 10⁻⁴ series order low frequency electric shocks upon fish bodies. Jap. Soc. Sci. Fish. Bull. 18(1):25-59.
A study of gold fish in terms of low frequency shocks.
- 271 _____ 1953. Studies on the electric fish-screen. VIII. About the interruption of the electrifying in trawl net fishing. Jap. Soc. Sci. Fish. Bull. 18(9):385-388. (In Japanese with English summary).

- 272 _____, 1953. Study on the electric fishing-net. IX. About the relations between electric-power and electrocution. Jap. Soc. Sci. Fish. Bull. 18(12):698-702.
There is a lag relation between the fishes' head and the product of the destructive powers of the exponential value and the supplying time of electricity.
- 273 _____, 1959. Electrical fishing in Japan. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 581-582.
Electric gear was patented in 1895 and not used before 1924. Reviews uses and future outlook. It takes 3-5 minutes to electrocute a large active shark.
- 274 _____ and M. Chuman. 1950. Study on the practicality of new fisheries by low frequency electric-shocks. I. About the electric resistance in fish bodies. Jour. Kagoshima Fish. Coll. (Kagoshima, Japan), 1(Ser.):15-21. (In Japanese with English summary).
Discusses fluctuating resistances in fishes using electrode couples and the distance between them.
- 275 _____ and _____. 1952. Study on the electric fishing-net. VI. About the electric-power on the fish-body in the water. Mem. Fac. Fish. Kagoshima Univ. (Kagoshima, Japan), 2(1):41-44. (In Japanese with English summary).
Power input into a body is the cubic of its body length. One-half power is necessary in sea water as opposed to fresh.
- 276 _____ and _____. 1953. Studies on the electric fishing screen. VII. Practical arrangements of electrodes to obtain correct distribution of potential. Jap. Soc. Sci. Fish. Bull. (Toyko), 18(9):381-384.
Negligible effects were noted when electrodes were placed at varying distances.
- 277 _____, Y. Kato and K. Nagashima. 1952-53. Studies on the electric fishing screen. VIII. Interruption of the electrification in combined trawling and electric fishing. Jap. Soc. Sci. Fish. Bull. (Toyko), 18(1):21-24. (In Japanese with English summary).
There is evidence to believe electro-fishing is having a serious effect on shellfish.
- 278 _____ and T. Morita. 1950. Study on the practicality of new fisheries by low frequency electric-shocks. II. About the electrocuting test on the shark in the long-line fishing. Jour. Kagoshima Fish. Coll. (Kagoshima, Japan), 1(Dec.):22-27. (In Japanese with English summary).
Use of low frequency electric shocks in long line fishing is presented.
- 279 _____ and F. Fukudome. 1953. Investigations into the practicality of new fisheries by using low frequency electric shocks. III. About the electrocution test in long-line shark fishing. Rept. III, Jap. Soc. Sci. Fish. Bull. (Toyko) 18(8):359-361. (In Japanese with English summary).
Harpoon electric gear killed all fish in 40 seconds.
- 280 _____ and Y. Narasako. 1957. On the project of a pipe-harpoon and its cable-rope for electrical whale-catching. Mem. Fac. Fish. Kagoshima Univ., 61:82-94.
Use of an electrical harpoon readily catches whales.

L

- 281 Larimore, R. W. 1957. Factors influencing the efficiency of the electric fish shocker in an Illinois stream. In: Symposium on evaluation of fish populations in warm-water streams. March 25, 1957. Iowa St. Coll. pp. 93.
Freshwater fishes are often difficult to shock in streams with wide varying conductivities.
- 281a _____. 1961. Fish population and electrofishing success in a warm-water stream. Jour. Wildl. Mgt. 25(1):1-12.
An electrofishing census was made of a one-mile section of stream. Later when the stream was diverted a complete kill and count was possible. The efficiency of this gear depended on species habits, habitat preferences and morphological peculiarities. No one shocker will work well here because of the diverse fish population.
- 282 _____, L. Durham and G. W. Bennett. 1950. A modification of the electric fish shocker for lake work. Jour. Wildl. Mgt. 14(3):320-323.
A discussion of a gear modification to permit operation in lakes where conductivities vary greatly.
- 283 Larkin, P. A. 1950. Canadian uses of electrical fish shocking devices. Can. Fish Cult. 9:21-25.
Canadian early trials to capture trout and minnows are presented.
- 284 Larsen, K. 1949. First report on the effect of the liberation of salmon fry in the Oudezand 1946-47. Danish Biol. Sta. Rept. 49(1946):27-37.
Shocking was used to search and sample for planted salmon fry.

- 285 _____, 1954. Electrofishing of sea trout for stripping. Danmarks Fisherei-og Havundersogelser Meddeiser. Ny Ser. Bd 1(6): 1-30.
Trout for stripping were caught using shockers. Hatching was found normal.
- 286 _____, 1955. Fish population analyses in some small Danish trout streams by means of D.C. electro-fishing, with special reference to the populations of trout (*Salmo trutta* L.). Danmarks Fisherei-og Havundersogelser Meddeiser. Ny Ser. Bd 1, (10):1-70.
Excellent bibliography concludes this paper. Trout and eels for life-history studies were obtained by shocking.
- 287 Latta, W. C. and G. F. Myers. 1960. Night use of a direct-current electric shocker to collect trout in lakes. Tr. Am. Fish. Soc. 90(1):81-83.
A discussion of problems encountered when sampling trout in lakes.
- 288 Lennon, R. E. and S. P. Parker. 1958. Applications of salt in electrofishing. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 280: 12 pp.
Addition of ordinary cattle feeding blocks were necessary to raise the conductivity to a point where fish could be sampled with shockers.
- 289 Lethlean, N. G. 1953. An investigation into the design and performance of electric fish-screens and an electric fish-counter. Tr. Roy. Soc. Edinburgh (Pt. 2), 62(13):479-526.
- 290 Levin, S. 1957. Hadayig Hekhashmali b' Khalilah (Electric fishing in Houla Lake). Fisherman's Bull. (Haifa, Israel) (13):12. (In Hebrew).
Israeli attempts to shock fish in Houla Lake are presented.
- 291 _____, 1957. Electric fishing in Lake Huleh. Fisherman's Bull. 2(13):12-13. (In Hebrew).
Similar to 290.
- 292 Little, H. R. 1949. Whaling and its anarctic problems today. Can. Geo. Jour. 38:105-113.
A discussion of the use and possible harm of the electric harpoons on whales.
- 293 Linke, R. 1926. Erfahrungen bei der fischerelichen bewirtschaftung der weisseritzalperren. Grines Korresp.-Bl. f. Fischsucher usw. (Dresden), Jahrg 31:204.
- 294 _____, 1927. Fischen mit elektrizitat. Landwirtschaftliche Wochenschr. f. d. Prov. Sachsen, 1927, 1:5-6.
- 295 Loeb, H. A. 1955. An electrical surface device for carp control and fish collection in lakes. N.Y. Fish and Game 2(2):270-271
- 296 _____, 1957. Night collection of fish with electricity. N. Y. Fish and Game 4(1):109-118.
Perch, carp and smallmouth bass were readily captured by shocking at night.
- 297 _____, 1958. Notes on electric fishing techniques. N.Y. Fish and Game 5(1):100.
Carp and pickerel were readily captured by electro-fishing.
- 298 Loeb, J. 1918. Forced movements, tropisms, and animal conduct. Lippincott Co., Phila., and London, 209 pp.
A monographic review of animal reactions in electrical fields.
- 299 _____ and W. E. Gerry. 1896. Zur theorie des galvanotropisms. II. Versuche an Wirbelteiren. Pflügers Archiv. f. d. ges. Physiol. lxx:41-47.
Positive-negative reactions of *Ampelgoma* are presented.
- 300 _____ and S. S. Maxwell. 1896. Zur theorie des galvanotropisms. Pflügers Archiv. f. d. ges. Physiol. lxxii:121-144.
Crustaceans orientate head positive, tail negative in an electric field.
- 301 Lucas, K. 1906. On the optimal electric stimuli of muscle and nerve. Jour. Physiol. 35(1-2):103-114.
The optimum vibrations at which the sartorius muscle and sciatic nerve will still function is 80 but a range of 41-233 vibrations will be tolerated.
- 302 _____, 1907. On the rate of variation of the exciting current as a factor in electric excitation. Jour. Physiol. 36(4-5):253-274.
Minimum reception by a muscle for a current to produce an effect is 4.4 vibrations.
- 303 Ludloff, K. 1895. Untersuchungen über den galvanotropismus. Pflügers Archiv. f. d. ges. Physiol. Bd 59:525-554.
Protozoans orient and prefer positive pole when in an electric field.
- 304 Lyon, E. P. 1909. Rheotropism. II. Rheotropism of fish blind in one eye. Am. Jour. Physiol. 24:244-251.
A general orientation experiment with partially blind fishes.

M

- 305 MacDonald, Rose M. E. 1921. An analytical subject bibliography of the publications of the Bureau of Fisheries 1871-1920. App. V, Rept. of U. S. Comm. of Fish. for 1920. Bur. Fish Doc. 899:1-306.
- 306 Marlier, G. and J. Michel. 1951. La pêche électrique. Ann. de la Soc. Roy. Zool. de Belgique. Tome 81(1950):147-150.

- 307 Marsden, R. 1952. Electrocution of whales. Gen. Elec. Co. Jour. (London) 19(2):122-123. A discussion of the use of harpoons which can electrocute whales is decreed better than normal harpoons.
- 308 _____, 1952. Electrical method of killing whales. World Fishing (London), Pt. I, 1(3):97-100.
Another paper discussing the ease with which whales can be killed by an electrically powered harpoon.
- 309 Mathews, A. P. 1903. Electrical polarity in the hydroids. Am. Jour. Physiol. 8:294-299. In hydroids the point of regeneration is negative. This polarity is due to unequal regeneration of the protoplasm.
- 310 McCauley, R. W. 1960. The role of electrical conductivity of water in shocking lampreys (*Petromyzon marinus*). Jour. Fish. Res. Bd. Can. 17(4):583-589.
Voltage to immobilize sea lampreys at 15°C. against lag of conductivity of water is a rectangular hyperbula normal to the axis. Conductivity of live lamprey at 15°C. was 2700 microohms per centimeter cube.
- 311 McKinley, G. M. 1930. Some biological effects of high frequency electrostatic fields. Proc. Penn. Acad. Sci. 4:43-46.
A review of the general field of electrostatic fields.
- 312 _____, 1933. The ultrahigh frequency magnetic-electric field in biology. Univ. Pgh. Bull. 30(2):183-188.
Abstract of thesis of the use of ultrahigh frequency magnetic-electric fields in biology.
- 313 McKinley, J. G., Jr., and G. M. McKinley. 1930. High frequency equipment for biological experimentation. Science 71(1846):508-510.
- 314 McLain, A. L. and W. L. Nielsen. 1953. Directing the movement of fish with electricity. U. S. Fish & Wildl. Serv. Spec. Sci. Rept. 93:1-24.
Direct currents were used successfully to direct the movements of trout.
- 315 McMillan, F. O. 1928. Electric fish screen. U. S. Bur. Fish. Bull. 44:97-128.
A relation was found in order to paralyze salmon: $g = \frac{3.70 W}{L}$ g = volts per second
 w = water resistivity corrected
 L = fish length.
- 316 Meyer, P. F. 1951. Erfahrungen mit der elektrischen thunfischangel. Fischereiwelt Jahrg 3, 11:176-179.
- 317 _____, 1952. Der weg naar elektrotrawl ist urij (summary). Het Vissersijblad (Os-tend) 7(22):5; 7(23):8.
Another paper dealing with the topic of electroshocking gear and its use on fishes.
- 318 _____, 1952. Der weg zum elektrotrawl ist frei. Die Fisch Industrie (Bremerhaven) 4(5):73-74.
Similar to 317.
- 319 Meyer-Waarden, P. F. 1953. Beeinflusst die elektronarkose lebensfähigkeit und wachstrem der fische. Der Fischwirt, Hamburg, 3(7): 225-228. (In German).
- 320 _____, 1953. Elektrizität und fischfang. Orion Naturwissenschaftlich-Technische Zeitschrift für Jederman, Munich, 8(3/4): 91-99. (In German).
- 321 _____, 1955. Neue wege der elektro-fischerei. Elektronik, Würzburg, Germany, 4(7):159-165.
Electric shockers are used successfully in Germany to capture fish.
- 322 _____, 1957. Electrical fishing. F. A. O. Study, Chapters 1-8, (7):1-78.
A good review of the uses of electrical fishing gear and their affects to fish and whales.
- 323 _____, 1958. Wo steht gegenwärtig die elektro-fischerei (What is the present state of electrical fishing). Jahrbuch des Technischen Hochschule Hannover 1955-56, 3 pp. und Protokolle zur Fischereitechnik (Institut für Netzforschung Hamburg, West Germany) 5(22/23):7 pp. (In German).
- 324 _____, et al. 1959. Discussion of electrical fishing. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 592-595.
- 325 Miyake, I. 1957. The response of tuna and other fish to electrical stimuli. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 223:23 pp.
After calibrating the frequencies necessary to produce electro-taxis in the whole-hole a tank 35x11x4 feet was constructed to hold tuna. A multi-capacitor (55,000 mfd) charged by 2 series of banks of 6 volt automobile storage batteries and a variable speed contactor was used to control it when electrodes were 16 feet apart.
- 326 _____ and W. R. Steiger. 1957. The response of tuna and other fish to electrical stimuli. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 223:1-23.
Need 6.6 ma/cm² 10 cps. and 6-8 milli-sec. which is the optimum current density, pulse frequency and pulse duration for electro-taxis in *K. sandvicensis*.

- 327 Mohnke, --. 1932. Elektrischer fischfang in Hamm. Mitteil d. Fisherei-Verein Westaus-Bd 2:210.
- 328 Moor, W. N. 1954. A newtype of electric fish catcher. Jour. Animal Ecol. 23:373-375.
A newly designed electric shocker was most effective in stunning trout, minnows, lampreys and crayfish.
- 329 Moore, A. R. 1926. Galvanic stimulation of luminescence in *Pelagia noctiluca*. Jour. Gen. Physiol. 9(3):375-379.
The ctenophore glowed at positive pole, slime glows at negative. Luminescence is not the result of muscle contractions. Potassium relaxes and causes liminescence.
- 330 Moorehouse, V. H. K. 1933. Reactions of fish to noise. Can. Biol. and Fish. 7(35/38): 467-475.
- 331 Morgan, M. E. 1951. Fishing with electricity, Univ. Hawaii, Hawaii Mar. Lab. News Cir. 12:3 pp. Mimeo.
Used to catch skipjack, tuna and aholehole. Present problems in salt water are discussed.
- 332 _____. 1953. The response of a tropical fish to direct current and its application to the problems of electrofishing in sea water. Pacific Sci. 7(4):482-492.
The aholehole orientates itself toward the positive pole.
- 333 Morris, R. W. 1950. An application of electricity to collection of fish. Prog. Fish Cult. 12(1):39-42.
- 334 Muller, H. K. 1926. Die latenzzeit konteaktiller infusorien bei reizung mit einzelinduktionsschlag. Zeitschr. Biol. 85(1):31-34.
Protozoan reactions and orientations to electrical fields are presented along famed positive-negative orientation lines.
- 335 Murray, A. R. 1959. A direct current electro-fishing apparatus using separate excitation. Can. Fish Cult. 23(27):6 pp.
A new shocking gear with separate leads was successful in shocking trout and salmon.
- 337 Neb, K. E. 1952. Betäubung von fischen durch elektrische strome. Fischereiwelt, Jahrg 4, 3:44-45.
- 338 Neergaard, K. V. 1922. Experimentelle untersuchungen zur elektronarkose. Archiv. f. Klinische Chirurgie Bd 122:100-150.
A review of muscular responses to electric currents.
- 339 Newman, E. 1876. Mr. Saville Kent's lecture, at the Society of Arts, on "The aquarium: construction and management." Zool., 2nd Ser. (London), 11:4853-4858.
- 340 Newman, H. W. 1959. Effect of field polarity in guiding salmon fingerlings by electricity. U. S. Fish & Wildl. Serv. Spec. Sci. Rept. 319:1-15.
Guidingsalmon is due to the avoidance of the fish to an electrical field, not electrotaxis.
- 341 Nicolai, L. 1930. Über elektrotaxis und elektronarkose von fischen. Pflügers Archiv. f. d. ges. Physiol. Bd 224:268-277.
Aclassical positive-negative reaction experiment and its results are presented.
- 342 Nikonorov, I. W. 1955. Beobachtungen über das verhalten von kilka (Breitlings-sprotte) inder zone der Wirksamkeit der Sangpumpe. Deutsche Fischerei Zeitung, pp. 156. (In German).
- 343 _____ and A. K. H. Pateev. 1959. Lov kil'ki rybonasosom pri podvodnom osveshemi s primenenem impul'snago toka (Sprat fishing with suction pumps, underwater light and pulsating current). Rybnoe Khozjalstvo 35(7):53-58. (In Russian).
If the light is too strong gathering occurs outside it. Problems of polarized light and fishoutside or inside the suction field and possible loss are discussed.
- 344 Noddach, Ida and W. Noddach. 1939. Die haufigkeiten der schwermetalle in meerstieren. Archiv. Zool. 32(4):1-35.
- 345 Nomura, S. and K. Ishikawa. 1933. Response of fishes to the change of environmental factors. II. Preliminary experiment in the measurement of Chronaxie in fishes. Saito ho-on kai (The Saito Gratitude Foundation Sendai, Japan), Annual Rept. of the Work, 1932, (9):37-42.
- 346 Nusenbaum, L. M. 1959. O provedenii ryb v elekticheskom pile v soyazi s probemoy ikh Okhrany prigidrostoi-tel'stve (The behavior of fishes in an electric field and their protection during hydraulic construction). U.S. Fish & Wildl. Serv., Misc. Lt. Transl. Boothbay Harbor.
- 336 Nagel, W. A. 1895. Ueber galvanotaxis. Pflügers Archiv. f. d. ges. Physiol. Bd 59: 603-642.
Fish, frogs, protozoans and crayfishes all orientate their bodies parallel to lines of electrical force in water. The head faces the positive pole.

O

- 347 "Observer." 1928. Electrical screen tested. Western Out-of-Doors 5(2):11.
- 348 Ohta, T. 1924. (Investigations on electric current and living fish). Suisan Kenkiushi 19 (12):432. (In Japanese).
Another Japanese experiment to show positive-negative body orientation in fishes in an electrical field.
- 349 Okada, M. 1929. On the action of electric current on fishes. I. Excitation and narcosis. Jour. Imp. Fish. Inst. (Toyko) 24(2):64-72.
Good data are presented on the action due to a polar drop along a fishes body. This drop depends on current density.
- 350 _____. 1929. Note on leading the movement of fish-groups by electric current. Jour. Imp. Fish. Inst. (Toyko) 24(5):124-128.
- 351 _____. 1929. On the action of electric current on fishes. II. Electrophototaxis of fishes in a group. Jour. Imp. Fish. Inst. (Toyko) 25(1):1-11.
- 352 Omand, D. N. 1950. Electrical methods of fish collection. Can. Fish Cult. 9:13-20.
Electrical shockers can be used successfully to collect fishes.
- 353 Oren, O. H. and Z. Fried. 1959. Electro-fishing in Lake Huleh. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 586-588.
Of a number of fish species which were thought possible to collect by electrofishing only Clarias lazera succumbed.
- 354 Ota, F., H. Ajisaka and L. Oshiro. 1953. On the effects of electric shocks in low frequency upon the fish muscle. Mem. Fac. Fish. Kagoshima Univ. (Kagoshima, Japan) 3(1): 103.
In an electrical field the ammonium content of the muscle is less than if it were killed otherwise.

P

- 355 Parker, G. H. and A. P. Van Heusen. 1917. The responses of the catfish, Amiurus asotus to metallic and non-metallic rods. Am. Jour. Physiol. 44(3):405-420.
If the charge is one milliamper the positive pole repels the fish, if it is 0.7 or less no effect is noticed.
- 356 Pearl, R. 1901. Studies on electrotaxis. 1. On the reactions of certain infusoria to the electric current. Am. Jour. Physiol. 4:96-123.
The general, extreme effects to infusoria in an electrical field is death, however, not all areas of the body are affected alike.
- 357 Peglow, H. 1949. Use of electro-physiological effects in ocean fishing. U.S. Fish & Wildl. Serv. Fish Leaflet 348:5-8.
- 358 Peterson, C. E. 1952. Electrical fishing experiments in salt water reported successful. Comm. Fish. Rev. 14(10):62-64.
- 359 "Petrale." 1953. Salmon to be shocked into place. Pacific Fisherman 51(8):35.
- 360 Petty, A. C. 1955. An alternate-polarity electrode. N. Y. Fish and Game 2(1):114-119.
- 361 Pieron, H. and J. Segal. 1939. Les manifestations electriques de l'excitation lumineuse chez la Mya. Compt. Rend. Soc. Biol. 130 (1):47-51.
- 362 Piffl, H. 1913. Dalmatinische fischerei. Der Fischerbote 5:272-275.
Fishing for herring with electricity proved successful.
- 363 Pora, E. A. 1936. Influence du passage der courant continu dans le milieu extérieur, sur la composition du sang, chez Scyllium canicula, la region branchiale étant au voisinage de la cathode. Comp. Rend. Hebdom Soc. de Biol. (Paris), Tome 121:411-413.
- 364 _____. 1936. Sur les modifications du milieu interieur de Scyllium canicula soumis au courant continu, quand la region branchiale se trouve à la proximite de l'anode. Compt. Rend. Hebdom Soc. de Biol. (Paris), Tome 121:503-504.
- 365 _____. 1936. Sur les modifications que produit le courant électrique continu, dans le milieu intérieur du Scyllium canicula male orienté dans la direction de passage der courant pendant des tempes variables. Compt. Rend. Hebdom Soc. de Biol. (Paris), Tome 121:507-508.
- 366 Pratt, V. S. 1952. A measure of the efficiency of alternating and direct current fish shockers. Tr. Am. Fish. Soc. 81(1951):63-68.
Sampling with alternating and direct current shockers in a stream are compared. In the stronger and a swifter stream the direct current was the most reliable.
- 367 _____. 1955. Fish mortality caused by electric shockers. Tr. Am. Fish. Soc. 84: 93-96.
Alternating current produced 11 percent mortality in trout whereas only 2 percent occurred with a direct current shocker. There is no relationship between mortality and fish size or trout species.
- 368 Prevost, G. 1946. Electric fishing. Que. Dept. Game and Fish. Gen. Rept. Min. Game and Fish. for yr. ending March 31, 1945; 3rd Rept. Biol. Bur. Sec. 513:59-65.

R

- 369 Ranstedt, C. O. 1872. (Om den galvaniska induktionsströmmens inverkan på fiskarnes fång). Öfversigt af Finska Vetenskaps-Societätens Förhandlingar (Helsingfors) 14:6-7. (In Swedish).
- 370 Raymond, H. L. 1956. Effect of pulse frequency and duration in guiding salmon fingerlings by electricity. U. S. Fish & Wildl. Serv. Res. Rept. 43:1-19.
Diversions of salmon up streams was accomplished by electrical charges.
- 371 Rayner, H. J. 1949. Direct current as aid to the fishery worker. Prog. Fish Cult. 11(2):119-121.
- 372 ———. 1949. Direct current as aid to the fishery worker. Prog. Fish Cult. 11(3):169-170.
- 373 ———. 1950. Electrodes used in electro-fishing. Prog. Fish Cult. 12(1):42-43.
- 374 "Reflector." 1949. Views on the News. Electrical Rev. 145:787.
A general article on the use of electrical gear to catch fish.
- 375 Regnart, H. C. 1931. The lower limits of perception of electrical currents by fish. Jour. Mar. Biol. Assoc., U.K., 17:415-420.
The lowest threshold electrical current level goldfish perceive is 5 microamperes per square meter. Cod perceive above 2 microamperes per square meter.
- 376 Regnault, J. 1930. Electro-et radio-culture. Revue de Path. Comp. et d'Hyg. Gen. (Paris) 30(402-403):927-939.
- 377 Reichert, W. 1949. An electrocution of whales. U. S. Fish & Wildl. Serv. Fish. Leaflet 348: 14-16.
The use of electro-harpoons kills whales in shorter times with less damage and loss than with a normal harpoon.
- 378 Reinmann, F. L. 1946. Electric fish screen keeps intake clear. Electrical World 125 (15):149-150.
- 379 Rhodes, D. N. 1951. He makes fish and go. Sat. Eve. Post 223(41):11.
A popular article on the directing of salmonid fishes with electricity.
- 380 Ricket, C. 1927. Des conditions de la mort par le tétanos électrique chez les poissons. Compt. Rend. Hebdom Acad. des Sci. (Paris), Tome 184:1100-1103.
Of many species subjected to an electrical force of 280 volts all died in 40 seconds except Box salpa.

- 381 Riedel, D. 1952. Über eine beeinflussung der fischgeschlechtsprodukte durch den elektrischen strom, unter besonderer beruchsigung der elektrofischerei. Institut für Fischerei der Deutsche Akad. der Landwirtschaftswissenschaften, Berlin, (819):1-54.
An excellent paper on the use of electricity in a fishery and its effects.
- 382 Riedel, F. 1954. Über eine beeinflussung der fischgeschlechtsprodukte durch den elektrischen strom unter besonderer beruchsigung der elektrofischerei. Zeitschr. für Fischerei, Berlin, n.s. 3(1/2/3):183-233. (In German).
An excellent paper on the effects to organisms when subjected to different voltages.
- 383 Riggs, C. D. 1955. Collecting fish by combined use of a seine and an electric shocker. Proc. Okla. Acad. Sci. 34(1953):1-5.
- 384 Rohrl, G. 1949. Praktische erfahrungen beim fischfang mit elektrizitat. Allg. Fischerei-Zeitung, Jahrg 74(4):49-50.
Another fishery use of electricity.
- 385 Rushton, W. 1952. Biological notes: Fish killed by shock. Salmon and Trout Mag. 135:168-169.
- 386 Russell, E. S. and H. O. Bull. 1932. A selected bibliography of fish behaviour. Jour. du Conseil 7:255-283.

S

- 387 Saunders, J. W. and M. W. Smith. 1954. The effective use of a direct current fish shocker in a Prince Edward Island stream. Can. Fish Cult. 16:42-49.
- 388 Savage, P. L. 1936. Engineer holds electric screen is answer to fish conservation. Sportsman's Rev. 1(4):3.
- 389 Schafer, --. 1927. Versuche mittels elektrizität zur auffischung nicht ablassbarer Gewässer. Mitteil d. Fischerei-Verein f. d. Prov. Brandenburg usw., Bd 31 (N. F. Bd 19):348.
The problems of using shockers in waters with low conductivities are discussed.
- 390 Scheminsky, F. 1922. Über die verschiedene empfindlichkeit der forelleneier während ihrer entwicklung dem elektrischen strom gegenüber. Biochem. Zeitschr. Bd 132, 1-3:154-164.
Trout eggs and embryos are attracted toward the positive pole of an electrical field.

- 391 _____. 1923. Über den einfluss dauernder elektrischer durchströmung auf Lebewesen (Elektrokultur). I. Mitteilung versuche an fischen. Archiv. f. Mikr. Anat. u. Enter.-Mech. Bd 98, 3-4:315-378.
Embryological positive-negative reactions are studied with discussions on the changes physiologically. A review with an excellent literature.
- 392 _____. 1924. Über das auftreten der galvanotaxis bei forellenembryonen. Zeitschr. f. Biol. Bd 80 (N. F. Bd 62), 1-2:23-34.
Galvanotaxis effects to the eggs of sand lance are studied.
- 393 _____. 1924. Versuche über elektrotaxis und elektronarkose. Pflügers Archiv. f. d. ges. Physiol. Bd 202:200-216.
Classical positive-negative reaction experiences on fish and Daphnia.
- 394 _____. 1928. Der fischfang mit elektrischen strom. Nachrichtenblatt f. Fischzucht u. Fischerei (Tetschen a. Elbe) Bd 1(4):49-53.
- 395 _____. 1928. Kammergericht fischfang mit elektrizität. Allg. Fischerei-Zeitung Jahrg 53(13):203.
- 396 _____. 1931. Über galvanotaxis bei erwachsenen echinodermen. Pflügers Archiv. f. d. ges. Physiol. Bd 226:58-78.
Echinoderms respond to positive pole just as so many other animals do.
- 397 _____. 1931. Weitere untersuchungen über die galvanotaxis von echinodermen. Pflügers Archiv. f. d. ges. Physiol. Bd 226:354-365.
Further positive-negative response experiments with echinoderms.
- 398 _____. 1931. Zur analyse der zwei phasischen galvanotaxis der echinodermen. Pflügers Archiv. f. d. ges. Physiol. Bd 226:366-376.
- 399 _____. 1931. Die stromdichte im körper der Wollhandkrabbe bei galvanischen Reizung in Süßwasser und Seewasser. Pflügers Archiv. f. d. ges. Physiol. Bd 229:242-250.
Marine crabs react to an electrical field by orienting their head toward the positive pole.
- 400 _____. 1933. Über die natur der "Wechselstromnarkose" bei fischen. Pflügers Archiv. f. d. ges. Physiol. Bd 233:371-379.
A review of previous papers.
- 401 _____. 1933. Über die natur der "Wechselstromnarkose" bei fischen. (A Holak, Valtoaramnarhosis - arol). A Magyar Biológiai Kutatóintézet Munkai (Tihany, Hungary). M. Arbeiten des Angarischen Biologischen Forschungsinstit Bd 6:209-211.
A review of previous papers.
- 402 _____. 1936. Zur physiologie der galvanonarkose bei wassertieren. Pflügers Archiv. f. d. ges. Physiol. Bd 237:273-283.
Crabs and starfish exhibit a negative pole reaction when in an electrical field.
- 403 _____. 1936. Neuere untersuchungen über elektrische narkose. Wiener Klinische Wochenschr. Jahrg 49(39):1190-1191.
An excellent review of the literature on electricity and its effects to animals.
- 404 _____. 1947. Depolarisation als ursache der α nachwirkungen bei galvanarkose, beim galvanischen Krampf sowie beim physiologischen elektrotonus am peripheren nerven. Pflügers Archiv. f. d. ges. Physiol. Bd 249:59-75.
- 405 _____. and F. Gauster. 1924. Beiträge zur physikalisch-chemischen biologie der forellenentwicklung. I. Mitteilung. Die Schädigung der Membran des Forelleneies durch den Elektrischen Strom. Archiv. f. Mikr. Anat. u. Entw.-Mech. Bd 101, 1-3:1-39.
Trout embryos are studied when subjected to electrical impulses.
- 406 _____. O. Hochstadt and P. Adler. 1936. Über das wesen der galvanonarkose beim frosch. Pflügers Archiv. f. d. ges. Physiol. Bd 237:284-294.
A good study on the effects of electricity on frog physiology.
- 407 _____. and F. K. Kollensperger. 1938. Bildung erregbarkeits steigender stoffe im Rückenmark des frosches während elektrischen durchströmung. Pflügers Archiv. f. d. ges. Physiol. Bd 241:54-70.
Same study as 406.
- 408 Scheminsky, Fe. and Fr. Scheminsky. 1926. Über die WechselstromEinstellung bei einigen ciliaten (Oscillotaxis). Pflügers Archiv. f. d. ges. Physiol. Bd 213:112-118.
Ciliates are drastically affected when in an electrical field.
- 409 _____. and _____. 1931. Körpergröße und empfindlichkeit gegen den galvanischen strom. Pflügers Archiv. f. d. ges. Physiol. Bd 228:548-564.
A good three phase study of echinoderm reactions to electricity.
- 410 _____. and _____. 1933. Nachweis polarer durchlässigkeitssteigerung am elektrisch durchströmten forellenei. Pflügers Archiv. f. d. ges. Physiol. Bd 232:806-820.
Developing eggs are affected by an electrical current by a pulling of the yolk on one side to a pole with eventual destruction of the egg.

- 411 _____ and _____. 1938. Wirkung des wechselstromes auf ein-mehrzellige wassertiere. (Oscillotaxis, fixation und elektrische Betäubung). Zeitschr. f. vergleich. Physiol. Bd 25, 2(1937):170-192.
Animals from protozoa to fishes are shown reacting or orientating to electrical impulses.
- 412 _____ and F. Bukatsch. 1941. Elektro-taxis, elektro-tropisms, elektro-narkose und verwandte erscheinungen. Tabulae Biologicae 19(2):76-262.
Best compilation of data and literature review with dates of experiments noted in the literature.
- 413 _____, _____ and _____. 1941. Elektro-biologie. Die wirkung des elektrischen stromes auf den gesamtorganismus bei Pflanze, tier und mensch sowie ihre pharmakologische beeinflussung. Dr. W. Junk, Den Haag 1941, 198 pp.
Similar to 412 review.
- 414 Schiemenz, F. R. 1932. Holzers arbeiten zum elektrischen fischfang. Fischerei-Zeitung Bd 35(24):284-285.
- 415 _____. 1932. Fischfang mit elektrizität. Fischerei-Zeitung Bd 35(73):157.
- 416 _____. 1943. Fischfang durch sprengung. Fischerei Zeitung, Kriegszemeinschaftsausgabe 46(14/15):83-85.
Bombing explosions detonated electrically have little effect on fishes.
- 417 _____. 1952. Behavior of fishes, especially concurrence of reflectorial and psychical reactions, in electric fishing. Zeitschrift f. fischerei No. 5/6 Transl. by G. Maus, Pacific Biol. Sta. 5 pp.
Lampreys or chubs are attracted toward a pole if the electrical current is strong enough, otherwise flight is the primary response.
- 418 _____. 1953. Das verhalten der fische, insbesondere die konkurrenz von reflektori-schen und psychischen reaktionen, bei der elektrofischerei. Zeitschr. f. Fischerei N. F. Bd 1, 5-6:369-372.
- 419 _____ and K. Humburg. 1939. Über den räumlichen amwendungsbereich des elektrischen fischfanges. Zeitschr. f. Fisherei Bd 37, 3:429-458.
- 420 _____ and A. Schönfelder. 1927. Fisch-fang mit elektrizität. Zeitschr. f. Fisherei Bd 24, 2:161-187.
Another paper dealing with the collection of fishes using electrical shockers.
- 421 _____ and _____. 1927. Elektrisches fischen in nicht ablassbaren gewässern. Fisherei-Zeitung Bd 30(1):13.
- 422 Schindler, O. 1946. Betrachtungen nach der elektischen abfischung eines forellenbaches. Allg. Fischerei-Zeitung Jahrg 71(11):11-12.
- 423 Schoonens, J. G. 1951. Elektrisch vangen van vis. Visserijwereld 10(16):12-13.
- 424 Schubert, K. 1949. Electrocution of whales. U. S. Fish & Wildl. Serv. Fish. Leaflet 348: 10-14.
A paper dealing with the effects of electro-harpooning right whales.
- 425 Schuck, H. A. 1942. The effect of population density of legal-sized trout upon the yield per standard fishing effort in a controlled section of stream. Tr. Am. Fish. Soc. (1941), 71:236-248.
Trout were easily captured in a stream where population pressures were being observed.
- 426 _____. 1945. Survival, population den-sity, growth and movement of the wild brown trout in Crystal Creek. Tr. Am. Fish. Soc. 73:209-230.
- 427 Schultz, K. 1958. Neuartige thunfischangel in der elektrofischerei (New type of tuna hook in electrofishing). Schiff und Hafen (Hamburg, West Germany) 10(9):752. (In German).
The use of the electric hook for tuna fish-ing is discussed in detail.
- 428 Schumann, F. 1929. Fischfang mit elektri-schem strom in Westfalen. Fischerei-Zei-tung Bd 32(22):285; (50):630.
- 429 _____. 1930. Ein beitrag zur abfischung geschlossener gewässer mit elektrischen strom. Zeitschr. f. Fischerei Bd 28, 2: 159-165.
Papers 429-432 deal with the general use and effects of shockers.
- 430 _____. 1930. Misslungenes elektrisches fischen. Fischerei-Zeitung Bd 33(20):261.
- 431 _____. 1931. Ein weiterer beitrag zur befischung geschlossener gewässer mit elek-trischen strom. Mittell. d. Fischerei-Ver- ein Westausgabe Bd 1:5.
- 432 _____. 1931. Anwendung von elektrizität beim fischfang. Mittell. d. Fischerei-Verein Westausgabe Bd 1:197.
- 433 Senuma, H. 1929. The effect of electric cur-rent on fish. Suisan Gakkwai Hô 5(2):201-219.
Another positive-negative reaction study.
- 434 Shetter, D. S. 1938. Review-Hagen, Franz: Use of electricity in fishing wild streams. U. S. Bur. Fish. Mem. I-131. Prog. Fish Cult. (36):32-33.

- 435 _____. 1947. The electric "shocker" and its use in Michigan streams. Mich. Cons. 16(9):8-10.
 - 436 _____. 1948. The electric "shocker" and its use in Michigan streams. Prog. Fish Cult. 10(1):43-47.
 - 437 Smetanin, K. 1933. O materialakh po elektrolovu (Concerning data on electrofishing). Inst. Freshwater Fish. Bull. (Leningrad), 16:3-4. (In Russian).
 - 438 Smith, G. F. M. and P. F. Elson. 1950. A direct-current electrical fishing apparatus. Can. Fish Cult. 9:34-46.
A comparison of the efficiency of collecting by means of a seine and electric shocker.
 - 439 Smith, K. A. 1955. Pump and electricity tried for catching bait. Nat. Fisherman 36(4):11.
 - 440 _____. 1955. New "fish pump" experiments on electrical device. Western Fisherman 50(2):104.
 - 441 Smolian, K. 1942. Neue erfahrungen mit dem elektrischen Abfischapparat des Landes-fischerverbandes Wurttemberg. Allg. Fischerei-Zeitung Jahrg 67(2):13-16.
 - 442 _____. 1944. Die elektrofischerei. Sammlung Fischereilicher Zeitfragen Herausgegeben von Reichsverband der Deutschen Fischerei, Neudamm und Berlin, 35:1-27.
 - 443 _____. 1944. Die elektrofischerei; ihr Zweck, die methode ihrer anwendung, die Grenzen ihres erfolges und ihres Gefahren nach dem gegen wartigen stande unseres wissens und den Ergebnissen der untersuchungen des vom Reichsverband der Deutschen Fischerei gebildeten "Ausschussas für Elektrofischerei." Fischerei-Zeitung, Kriegsgemeinschaftsausgabe Bd 47(11-12): 41-44; (13-14):50-52; (17-18):65-68; (23-24): 91-93.
 - 444 Solandt, D. Y. 1936. Conduction and excitation in nerve. The time-factors of excitation. Evans' Recent Advances in Physiol., 5th Ed. Chap. 8. J. and A. Churchill Ltd., London, 500 pp.
 - 445 Stutkewitsch, P. 1905. Galvanotropisms und galvanotaxis der Ciliata II. Zeitschr. f. Allg. Physiol. 5:511-534.
Ciliates are affected and orientate in a positive-negative field similar to so many other organisms, head positive, tail negative.
 - 446 Steinhausen, W. 1921. Über stromdichtebestimmung und die Beziehung der stromdichte zum Erregungsvorgang. Pflügers Archiv. f. d. ges. Physiol. Bd 193:171-200.
A very good review of the effects of electricity on the physiology of animals.
 - 447 Stewart, L. 1959. Electrical fish diversion screen in England. Prog. Fish Cult. 21(3): 137.
Trout were easily collected using an alternating current shocker.
 - 448 Sullivan, C. 1956. The importance of size grouping in population estimates employing electric shockers. Prog. Fish Cult. 18(4): 188-191.
- T
- 449 Tägtström, B. (Kisker). 1931. Fischerei mit elektrizitat in Hawiks' Fischzuchtanstalt. Ny svensk Fiskeritidskrift (5):44-47.
 - 450 Tamura, M. 1922. Denki o òg ò seru gyodō heisaku sochi (Electric device for stopping the passage of fish). The Suisankai (Jour. Fish Soc. Japan, Toyko) (476):302-303. (In Japanese).
 - 451 Tamura, T. 1959. Section 12: Attraction of fish. Fundamental studies on the visual sense in fish. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 543-547.
Sparids were conditioned to a size of nylon twine and later were shocked to avoid it. The same was done with carp and light.
 - 452 Tanner, Z. L. 1885. The use of the electric light in fishing. U.S. Bur. Fish. Bull. 5:464.
 - 453 Tauti (Tauchi), M. 1931. Nitsuite (On the electric fish screen). Jap. Jour. Limnol. 1(1):22-24. (In Japanese).
 - 454 _____. 1932. A new form of electric fish screen. Jour. Imp. Fish. Inst. (Toyko) 27(1):33-44.
 - 455 _____. 1934. On the electric fish screen. Proc. 5th Pacific Sci. Cong. Div. of Biol. Sci., 5(1933):3633-3635.
An excellent review of the literature, especially Japanese.
 - 456 Taylor, G. M., L. S. Cole and W. F. Sigler. 1957. Galvanotoxic responses of fish to pulsating direct current. Jour. Wildl. Mgt. 21(2):201-213.
 - 457 Teike, --. 1937. Ueber elektrische fischbe-täubung. Berliner und Munchener Tierarztl. Wochenschr. Jahrg (9):137-138.
 - 458 Terry, O. P. 1906. Galvanotropism of volvox. Am. Jour. Physiol. 5:235-243.
Volvox is usually not affected by electrical fields. Assimilation is stimulated by red light but not by blue.
 - 459 Tesch, F. W. 1960. Fische reiforschungen der USA an den Groszen Seen. Zeitschr. fur Fischerei Band 9 N. F., 1-2:107-132.
Review of research on the Great Lakes and efforts to control sea lampreys.

- 460 Tester, A. L. 1952. Reaction of tuna and other fish to stimuli - 1951. Pt. V. Notes on the response of the tropical fish (*Kuhlia sandvicensis*) to interrupted direct current. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 91:69-83.
- * Tester, A. L. 1959. See Sound.
- 461 _____ and S. M. Trefz. 1954. The food of the aholehole, *Kuhlia sandvicensis* (Steindachner), in Hawaiian waters. Pacific Sci. 8(1):3-10.
A life history study of the aholehole made possible in that the specimens were collected with electrical gear.
- 462 Thompson, R. B. 1960. Capturing tagged red salmon with pulsed direct current. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 355:1-10.
For best results 90 seconds of shocking at 80-85 percent of the duty cycle is necessary to catch red salmon.
- 463 Thornton, W. M. 1931. Electrical perception by deep sea fish. Proc. Univ. Durham Phil. Soc. 8(Pt. 4):301-312.
Only zones of positive and negative fields occur on deep sea fishes when in an electric current.
- 464 Timmermans, J. A. 1954. La peche electrique en eau douce. Jette Impr. Jour. de Clercq. 31 pp.
- 465 _____. 1954. La peche electrique en eau douce (Electric fishing in fresh water). Station de Recherches de Groenendaal, Travaux (Belgium) Ser. D (15):31 pp., 6 pls. (In French).
- 466 Trefethen, P. S. 1955. Exploratory experiments in guiding salmon fingerlings by a narrow direct current electric field. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 158:1-42.
- 467 Tschernigen, N. F. 1952. A new fishing method. Fishing Industry, Moscow, 2:22. (In Russian).
- 468 Tzonis, K. 1935. Gleichstromnarkose bei Insekten. Mittell. aus der Biol. Versuchsanstalt der Akad. der Wissenschaften (235):1-2.
The classical experiment with aquatic insects in an electrical field and their orientation to positive and negative poles.
- 469 _____. 1937. Elektrometanarkose bei fischen. Anzeiger d. Kaiserlichen Akad. d. Wissensch. (Wien), Sitzung der Mathemat. - Naturwiss. Klasse, Bd 74, 23:201-202.
- 470 _____. 1938. Vergleichende untersuchungen über elektronarkose und elektrometanarkose bei fischen. Praktike, Akad. Athēnōn (Athens) 13:555-561. (In Greek with German summary).
Good bibliography on positive-negative reactions. Review of Scheminsky papers.

- 471 _____ and W. Baar. 1936. Elektrotaxis und verwandte erscheinungen bei niederen krebsen. Radiobiologia Generalis 4(4):1-7.

U

- 472 Uzuka, K. 1934. Some notes on the behavior of the catfish, *Parasilurus asotus*, as seen through the responses to weak electric current. The Sci. Repts. of Tohoku Imp. Univ. (Sendai, Japan). 4th Ser. (Biol.), 8(4):369-381.

V

- 473 Vietze, --. 1927. Neue fischfangversuche mit hilfe der elektrizitat. Fischerei-Zeitung Bd 30, (2):36.
- 474 _____. 1927. Kurzschluss im fischteich. Fischerei-Zeitung Bd 30, (18):386.
- 475 _____. 1927. Fischen mit elektrizitat. Fischerei-Zeitung Bd 30, (22):465-467.
- 476 _____. 1927. Die elektrizitat im dienste der fischzucht. Elektrizitatswirtschaft, Jahrg 26 (Mittell. der VDEW) (433):207-210.
- 477 Volf, F. 1953. Verwundung der forellen beim fang mittels elektrischen stromes. Sbornik Ceskoslovenske Akad. Zemedelskych ved (Prague) Rada (Series) B, 26(1-2):109-114. (In Bohemian with Russian and German summary).
- 478 _____. 1953. Injuries done to trouts by electric fishing. Bull. Czechoslovak Acad. Agric. Sci. 1-2:104-109.
Electric shock ruptures vertebral column and swim bladder. Minimum intensity is 0.025 amps per 1 cm². Fish will return to a normal condition in 3-5 minutes.

W

- 479 Wagner, H. D. 1948. Ein neues elektro-fisch-fanggerat. Allg. Fischerei-Zeitung. Jahrg 73, (10):85-88.
- 480 Wagner, R. and E. Wetterer. 1949. Ein elektrisches gerät zur erzeugung rhythmischen linear ansteigender und abfallender reizspannungen einstellbarer steilheit sowie rechteckiger und anderer reizspannungsformen. Pflügers Archiv. f. d. ges. Physiol. Bd 251: 585-593.
- 481 Walch, A. 1949. Die einwirkung des elektrischen stromes auf den fisch bei der elektro-fischerei. Allg. Fischerei-Zeitung, Jahrg 74, (12):213-216.
- 482 _____. 1950. Die gefahren und die unfallverhütung bei der elektro-fischerei. Allg. Fischerei-Zeitung, Jahrg 75, (1):18-20.

- 483 _____. 1950. Die geräte der elektro-fischerei. Allg. Fischerei-Zeitung. Jahrg 75, (15):371-372; 16:391-394; (17):414-416; (18):438-439.
- 484 Wallengren, H. 1903. Zur kenntnis der galvanotaxis. I. Die anodische galvanotaxis. II. Dei kathodische galvanotaxis. Zeitschr. f. Allg. Physiol. Bd 2:341-384.
- 485 _____. 1903. Zur kenntnis der galvanotaxis. II. Eine analyse der galvanotaxis bei Spirostomum. Zeitschr. f. Allg. Physiol. Bd 2:516-555.
- 486 Ward, H. B. 1930. Some responses of sock-eye salmon to environmental influence during fresh-water migration. Ann. and Mag. Nat. Hist. 6(3):18-36.
- 487 Webster, D. A. 1950. Results of electric shocking demonstration in Fall Creek, Ithaca, New York, May 16, 1950. Dept. Cons., Cornell Univ. 6 pp.
- 488 _____, J. L. Forney, R. H. Gibbs, Jr., J. H. Severns and W. F. Van Woert. 1955. A comparison of alternating and direct currents in fishery work. N. Y. Fish and Game 2(1):106-113.
- 489 Wegner, H. D. 1948. Ein neues elektro-fisch-fanggerät. Allg. Fischerei-Zeitung, Jahrg 73(10):85-88.
- 490 Welsh, T. J. 1943. Electric fish screen saves steel. Electrical West 90(1):37-38.
- 491 Whitney, L. V. and R. L. Pierce. 1957. Factors controlling the impact of electrical energy into a fish (*Cyprinus carpio* L.) in an electrical field. Limnol. and Oceanog. 2(2): 55-62.
- 492 Wilkenig, --. 1926. Electrisher fischfang in Ausgleichweilher an der Möhmetalsperre. Allg. Fischerei-Zeitung, Jahrg 51, (15):242-244.
- 493 Wöhlisch, E. 1926. Untersuchungen über elastische thermodynamische, magnetische, und elektrische eigenschaften tierischer gewebe. Verhandl. d. Physikallisch-Medizinischen Gesellsch. zur Würzburg. N. F. Bd 51:53-64.
- 494 Wolf, P. 1947. Laxisverige och England. (Electrofishing pp. 22-23; 44-45). C.W.K. Gleerup; Lund, Sweden, 121 pp.
- 495 Wood, E. J. F. 1949. Electric barrier impracticable. Fish. Newsletter (Australia) 8(6):8.

Y

- 496 Yates, J. E. 1930. Electric screens divert fish. Electrical World 96(5):216-217.

Electronics

- 497 Anon. 1949. Tubes guide fish. Electronics 22(8):154.
- 498 _____. 1950. Control of fish schools by electronics. Western Fish. 39(6):48-49.
Use of a trawl which is hoped will guide fish into it by means of devices attached to its leading edge.
- 499 _____. 1956. Electronic fish counter developed. Comm. Fish. Rev. 18(7):31-32.
An aid in tabulating migrant fishes such as salmon is used here with no effects to the fish.
- 500 _____. 1957. Electronic fish counter tested. Comm. Fish. Rev. 19(2):22-23.
Same as 499.

Explosives

- 501 Anon. 1948. Effects of underwater explosions on oysters, crabs and fish. Ches. Biol. Lab. Publ. 70:1-43.
Crabs, fish and oysters set in traps at varying distances (0-400') from underwater explosions up to 800 pounds were found dead within the first 200 feet. The closer to the explosion the greater the percent mortality.
- 502 Aplin, J. A. 1947. The effect of explosives on marine life. Calif. Fish and Game 33(1):23-30.
Fish and albalones were subjected to underwater explosives. When close to shore greater numbers were killed than if in deeper water. There is no relationship between depth of water and size of explosive charge and weight of fish killed. Fish with air bladders were more readily killed than those without.
- 503 Baldwin, W. J. 1954. Underwater explosions not harmful to salmon. Calif. Fish and Game 40(1):77.
Black powder charges 6 feet below surface 1-5 miles offshore did not kill or injure salmon and other fishes in the area.
- 504 Bebb, A. H. 1951. Under-water explosion measurements from small charges at short ranges. Philos. Tr. Roy. Soc. London, Ser. A. 244(879):154-175.
A discussion of the theories and possible ways underwater charges might affect organisms.
- 505 Beritoff, J. 1945. Ob izmeneniakh v organizme ot vosdenstviia vosdumnoi udarnoi volny po vabliendeniiam na liudiakh i po otam na zhivotnykh. (Tbilisi) Trudy Inst. Fiziologii J. Beriatashvili (Trans. Jour. Beriatashvili Physiol. Inst.) 6:1-36.
Effects of explosions on frogs are presented.
- 506 Burner, C. J. and H. L. Moore. 1953. Recent attempts to guide small fish with underwater sound. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 1112.
A wampus proved ineffective at disturbing fish. Successive small explosions didn't have a direct effect either.
- 507 Coker, C. M. and E. H. Hollis. 1950. Fish mortality caused by a series of heavy explosions in Chesapeake Bay. Jour. Wildl. Mgt. 14(4):435-445.
Twenty-six charges of HBX² ranging from 250-1200 pounds and detonated in 17-134 feet of water killed fish within a 200 yard radius of the blast. The number and weight of fish was not proportioned to charge size. Internal damage was greatest in relation to air bladder, vascular system and body organs.
- 508 Cole, R. H. 1948. Underwater explosions. Princeton Univ. Press, Princeton, N.J. 436 pp.
A thorough presentation of the physics and mechanics behind explosions.
- 509 Eklund, C. R. 1946. Effect of high explosive bombing on fish. Jour. Wildl. Mgt. 10(1):72.
Bombs dropped from planes and exploded did not kill whitefish. These bombs were used to break holes in the ice of several lakes where 3 feet of ice had covered them.
- 510 Fitch, J. E. and P. H. Young. 1948. Use and effect of explosives in California coastal waters. Calif. Fish and Game 34(2):53-70.
Charges up to 80 pounds were detonated in or on the sea floor. Kills of up to 21,000 pounds of fish were made. The number of fish on the bottom which didn't float was negligible. A true picture of the kill remains yet to be obtained.
- 511 Fry, D. H. and K. W. Cox. 1953. Observations on the effect of black powder explosions on fish life. Calif. Fish and Game 39(2):233-236.
Shots of 45 pound strength were not effective on sea anemones and Sebastes.
- 512 Gowanloch, J. N. 1950. The effects of underwater seismographic exploration. Univ. Miami Mar. Lab. Proc. Gulf and Carib. Fish. Inst. 2nd Annual Session, pp. 105-106.
Shrimp, crabs and fish were affected to a small degree.
- 513 _____ and J. E. McDougall. 1944. Louisiana experiments pave way for expanded oil research. La. Cons. 3(1):3, 6.
It is feared the use of dynamite by oil exploratory groups will kill a lot of sea life.

- 514 _____ and _____. 1945. Effects from the detonation of explosives on certain marine life. *Oil* 4(12):13-16.
Fish were not affected at 20, but were killed if within 150 yards.
- 515 _____ and _____. 1946. The biological effects on fish, shrimp and oysters of the underwater explosion of heavy charges of dynamite. *Tr. 11th N. Am. Wildl. Conf.* pp. 217-219.
Kill varied by size of shot and distance animals were away from it.
- 516 Hubbs, C. L. and A. B. Rehnitz. 1952. Report on experiments designed to determine effects of underwater explosions on fish life. *Calif. Fish and Game* 38(3):333-366.
Black powder is less effective than dynamite in producing negative pressure to which fish are very susceptible. Dynamite peak pressures of 40-70 psi killed fish whereas 124-160 psi were necessary before kills with black powder occurred. Oil exploration can continue without undue destruction to the fauna.
- 517 Indrambraya, B. 1949. Note on the effect of explosions on fish in Siamese coastal waters. *Dept. Fish. Siam (Processed Rept. 3 pp.)*.
The use of plastic C-2 killed 99,000 gms of fish, but not in first 20 meters of the charge.
- 518 Kavanagh, L. D. 1939 (?). Explosions effects on oysters. *La. Cons. Dept. Rept.*
- 519 Knight, A. P. 1907. The effects of dynamite explosions on fish life, a preliminary report. Further contribution to Canadian biology being studied from the Mar. Biol. Sta. of Can. 1902-05 Annual Rept. *Dept. Mar. and Fish. Fish. Br. Sess. Pap. (22A):21-30.*
- 520 Koyama, T. 1954. Effect of dynamite explosion on fish. *Tokai Reg. Fish. Res. Lab. Bull.* 8:23-29. (In Japanese with English summary).
An experiment to see if dynamite will kill fish at close range and at what low level.
- 521 Leenhardt, O. 1955. Premiers résultats seismiques déduits d'expériences de la marine nationale pres de Toulon. *Centre de Recherches et l'Études Oceanographiques Paris, Travaux* 2(12):5 pp.
- 522 (Margreiter)? 1932. Fischfang mit elektrischen strom. *Der Tiroler u. Vorarlberger Fischer Bd* 7:85.
* Nehru, J. 1958. See Radiation, Atomic.
- 523 Sieling, F. W. 1954. Experiments on the effects of seismographic exploration on oysters. *Proc. Nat. Shellfish. Assoc. (1953)*, pp. 93-104.
Forty feet away oysters were not affected by a blast. Those subjected to gases for up to 8 months were not affected. After 8 months those oysters 20-250 feet away showed no affect nor were different than so called normal oysters from other areas.
- 524 Tiller, R. E. and C. M. Coker. 1955. Effects of Naval ordnance tests on the Patuxent River fishery. *U. S. Fish & Wildl. Serv. Spec. Sci. Rept.* 143:20 pp.
Charges up to 1200 pounds had varying degrees of kill. No weight of fish to charge size position or depth correlation was found. Menhaden were the most readily killed fish. Heaviest mortalities were noticed in spring followed by winter, fall and summer.
- 525 Tyler, R. W. 1960. Use of dynamite to recover tagged salmon. *U. S. Fish & Wildl. Serv. Spec. Sci. Rept.* 353:1-9.
Dynamite can be used to recover tagged salmon and is effective if the direction is controlled.

Light

A

- 526 Alfonsi, B. 1933. Confronto fra due tipi di lampada usate nella pesca luminosa nei regaiardi della penetrazione delle loro luci nell'acqua di mare. *Boll. Pesca, Piscicoltura e Idrobiol.* 9:1062-1067.
The use of lights for fishing and their effective depth penetration are discussed.
- 527 Allison, L. N. 1951. Delay of spawning of eastern brook trout by means of artificially prolonged light intervals. *Prog. Fish Cult.* 13:111-116.
- 528 Andrews, C. W. 1946. Effect of heat on the light behavior of fish. (Proc.) *Tr. Roy. Soc. Can. Ser. 3*, 40:27-31.
Temperature of susceptibility varied directly with the light intensity. This aspect decreased with age.
- 529 _____. 1952. Sensitivity of fish to light and the lateral line system. *Physiol. Zool.* 25(3):240-242.
- 530 Anon. 1949. Fiske med lys og elektrisitet. *Fiskets Gang (Bergen)*, 35(44):508.
Lights were used by the Norwegians to raise the sild catch.
- 531 _____. 1949. Fixed net fishing with lamp lures. *Fish. Newsletter* 8(5):10.
- 532 _____. 1949. Trends and development. *Comm. Fish. Rev.* 11(2):48-49.
An early paper pointing out the advantages of increased catches made possible by the use of electric lamps.
- 533 _____. 1950. Fixed net fishing with lamp lures. *España Pesquera* (2):7. (In Spanish).
Same as 532.
- 534 _____. 1950. Night fishing for horse mackerel at Uchiura. *Comm. Fish. Rev.* 12(1):47.
* Anon. 1950. See Electricity.
- 535 _____. 1952. Marine fouling and its prevention. U. S. Naval Inst., Annapolis, Md., 388 pp.
It was believed lights and electrical stimulus would keep organisms off ship's hulls to no avail.
- 536 _____. 1952. The lure of light. *Pacific Fisherman* 50(6):26-27.
Sardines are easily lured to the surface for capture by lights.
- 537 _____. 1952. A pesca com luz eléctrica (Fishing with electric light). *Boletim de Pesca (Portugal)* 9(37):110. (In Portuguese).
Similar to 533.

- 538 _____. 1952. La pesca con luz eléctrica (Fishing with electric light). *España Pesquera* 33:31. (In Spanish).
Similar to 533.
- 539 _____. 1958. Attraction of fish by lights only effective with certain species. *Western Fish.* 57:28-34.
Herring, cod and hake fishes are more easily attracted to the surface by a light than most marine fishes.
- 540 _____. 1958. Japanese find blue and green lights catch most shellfish. *The Fishing News (London)* 2365:13,15.
Blue and green lights seemed to increase the lobster and crab catches greatly.
- 541 _____. 1959. Modern fishing gear of the world. *Fishing News Ltd., London*, 1500 pp.
A number of papers which deal with types of lights, intensities and use of lights to catch fish and shellfish are included.
- 542 _____. 1960. Colored lights for attracting fish and new method of setting sampling nets tested. *Comm. Fish. Rev.* 22(9):15.
Blue, red and white lights above and below the surface were tested. Blue had no effect whereas red did with lower catches ensuing.
- 543 _____. Pit lamping pays off. *Pacific Fisherman* 58(1):31-32.
Herring were easily collected with lights.

B

- 544 Bainbridge, R. and T. H. Waterman. 1957. Polarized light and the orientation of two marine crustacea. *Jour. Exp. Biol.* 34(3):342-364.
Palaeomon and *Mysidium* orientate toward a light or its axis.
- 545 _____. and _____. 1958. Turbidity and the polarized light orientation of the crustacean *Mysidium*. *Jour. Exp. Biol.* 35(3):487-493.
Mysidium swims perpendicular to plane of polarization when water is turbid.
- 546 Baldwin, W. M. 1919. The artificial production of monsters conforming to a definite type by means of x-rays. *Anat. Rec.* 17:175-183.
The effects of x-ray treatment are delayed in their appearance.
- 547 Balls, R. 1951. Environmental changes in herring behavior: a theory of light avoidance as suggested by echosounding observations in the North Sea. *Jour. du Cons.* 17:274-290.

- 548 Bateson, W. 1889. The sense-organs and perception of fishes. Modes in which fish are affected by artificial light. Jour. Mar. Biol. Assoc., U.K., (n.s.) 1:46.
- 549 Bauer, V. 1910. Über das farbenunterscheidungsvermögen der fische. Pflügers Archiv. f. d. ges. Physiol. des Menschen und der Tiere, Berlin-Göttingen-Heidelberg, 133:7-26.
Various species of marine fishes from Box to Cobitis are attracted to a light source.
- 550 _____. 1911. Zu meinen versuchen über das farbenunterscheidungsvermögen der fische. Pflügers Archiv. f. d. ges. Physiol. 137:622-626.
A discussion of the affects of red and blue light on fish. Red usually produces a negative reaction or behavior.
- 551 Baylor, E. R. 1959. The responses of snails to polarized light. Jour. Exp. Biol. 36(2): 369-376.
Nassa obsoleta orientates at right angles to vertically positioned polarized light.
- 552 _____. and F. E. Smith. 1953. The orientation of Cladocera to polarized light. Am. Nat. 87:97-101.
Cladocera are readily attracted to a light source and swam at right angles to the light source.
- 553 Beebe, W. 1935. Resume of the 1935 expedition of the Department of Tropical Research. N.Y. Zool. Soc. Bull. 38(6):191-196.
Various organisms would remain in the area as long as an ultra violet light was on.
- 554 Behre, Ellinor H. 1933. Color recognition and color changes in certain species of fishes. Copeia (2):49-58.
Daylight (and 6 types of colors) produced a darkening while absence of light produced the reverse. Fading occurred in the following order of type of light: blue, red, minus green, minus red and green. Red end is responsible for darkening and short wave lengths counteract this.
- 555 Bert, P. P. 1868. Les animaux voient ils les mêmes rayons lumineux que vous. Mem. Soc. Sc. Phys. et Nat. Bordeaux, pp. vi / 375-483.
- 556 Beuther, E. (1927). Ueber die einwirkung verschiedenfarbigen lichtes auf Planarien. Sitzungsber u. Abhandl. Naturforsch. Ges. Rostock Ser. 3, 1:17-57.
- 557 Blaxter, J. H. S. and B. B. Parrish. 1958. The effect of artificial lights on fish and other marine organisms at sea. Scottish Home Dept. Mar. Res. (2):24 pp.
- 558 Blinov, A. F. 1958. Nekotorye dannye o re-aktsii sel di na elektrosvet (Certain data on reactions of herring to electric illumination). Rybnoe Khoziaistvo 34(2):33-34. (In Russian).
A lamp is ineffective for this species; a search light is better.
- 559 Borissov, P. G. 1955. The behaviour of fishes under the influence of artificial light. Proc. Conf. on behavior of fish and on locating its commercial concentrations. Ed. by E. N. Pavlovskii, Moscow, pp. 121-143. (In Russian).
- 560 _____. 1956. Use of artificial light in the world fisheries. Moscow, 10 pp. (In Russian).
- * Brawn, Vivien M. 1960. See Mechanical.
- 561 Breder, C. M., Jr. 1934. An experimental study of the reproductive habits and life history of the cichlid fish, Aequidens latifrons (Steindachner). Zoologica 18(1):1-42.
- 562 _____. 1944. Ocular anatomy and light sensitivity studies on the blind fish from Cueva de los Sabinos, Mexico. Zoologica 131-143; 674-675, 677.
Astyanx is indifferent to light.
- 563 _____. 1951. Studies on the structure of the fish school. Am. Mus. Nat. Hist. Bull. 98(1):1-28, 9 figs., 4 pls., 3 tables.
A classical paper and excellent report on the schooling of this species in a light zone. Patterns break up if light is extinguished.
- 564 _____. 1959. Studies on social groupings in fishes. Am. Mus. Nat. Hist. Bull. 117 (Art. 6):399-481, pls. 70-80.
A good paper on the orientation of many species of marine fishes which are dependent on light in order to form a school.
- 565 _____. and E. B. Gresser. 1941. Correlations between structural eye defects and behavior in the Mexican blind characin. Zoologica 26(16):123-131.
Astyanax is a sensitive form which is killed if the light intensity was too great.
- 566 _____. and P. Rasquin. 1947. Comparative studies in the light sensitivity of blind characins from a series of Mexican caves. Am. Mus. Nat. Hist. Bull. 89:319-352.
A very good paper dealing with the light and dark reactions of blind characins.
- 567 _____. and _____. 1950. A preliminary report on the role of the pineal organ in the control of pigment cells and light reactions in recent Teleost fishes. Sci. 111(2871):10-12.
Five species were positively attracted to light, 4 were neutral and 10 were negative in their pigments reactions to light.

- 568 Brett, J. R. and D. MacKinnon. 1953. Preliminary experiments using lights and grabbles to deflect migrating young spring salmon. Jour. Fish Res. Bd. Can. 10(8):548-559.
 - 569 Brown, F. A. 1936. Light intensity and melanophore response in the minnow Ericymba buccata Cope. Biol. Bull. 70:8-15.
A good paper. Above .00053' candles fish are at maximum degree of paleness, in spite of background.
 - 570 Brown, F. A., Jr. 1937. Responses of the largemouth black bass to colors. Ill. Nat. Hist. Surv. Bull. 21(2):33-55.
Largemouth bass trained to four colors responded best to red.
 - 571 Bull, H. O. 1928. Studies on conditioned responses in fishes Pt. I. Jour. Mar. Biol. Assoc., U.K., N.S. 15(2):485-533.
Electrical, color and sound conditioning was established for Blennius, Crenilabrus and Labrus. Crenilabrus could distinguish between red and green.
 - 572 _____ . 1930. Studies on conditioned responses in fishes Pt. II. Jour. Mar. Biol. Assoc., U.K., (N.S.) 17:615-637.
See 571.
 - 573 _____ . 1935. Studies on conditioned responses in fishes. Pt. III. Wavelength discrimination in Blennius pholis L. Jour. Mar. Biol. Assoc., U.K., N.S. 20:347-364.
Blennius was light and dark adapted. Lighter areas or light was readily distinguished.
 - 574 Bullough, W. S. 1941. The effect of the reduction of light in spring on the breeding season of the minnow (Phoxinus laevis). Proc. Zool. Soc. London, Ser. A, 110:147-157.
 - 574a Burdon-Jones, C. and G. H. Charles. 1958. Light reactions of littoral gastropods. Nature 81:129-131.
 - 575 Burger, J. W. 1937. Experimental sexual photoperiodicity in male turtle, Pseudemys elegans (Wied). Am. Nat. 71(736):481-487.
- C
- 576 Cahn, Phyllis H. 1952. Spectral effects on the growth rate and endocrine histology of the Teleost, Astyanax mexicanus. Zoologica 37(1):33-42.
The endocrine system of Astyanax is not affected by different wave lengths of light.
 - 577 Canella, M. F. 1937. Azione degli stimoli luminosi sulla posizione d'equilibrio dei pesci. Boll. della Societa Italiana di Biologia Sperimentale 12:2 pp.
 - 578 Catala-Stucki, R. 1959. Fluorescence effects from corals irradiated with ultra-violet rays. Nature 183(4666):949.
The coral Flabellum shuns green light while Trachyphyllia avoids orange light.
 - 579 Chellappa, D. E. 1959. A note on the night fishing observations from a Kelong. Jour. Mar. Biol. Assoc., India, 1(1):53-54.
 - 580 Clark, F. N. 1956. Average lunar month catch of sardine fishermen in southern California 1932-33 through 1954-55. Calif. Fish and Game 42(4):309-323.
Catch of sardines and mackerel varies with lunar intensities.
 - 581 _____ and Anita E. Daugherty. 1950. Average lunar month catch by California sardine fishermen 1932-33 through 1948-49. Calif. Fish and Game Fish Bull. 76:28 pp.
Similar to 580.
 - 582 _____ and _____. 1952. Average lunar month catch by California sardine fishermen 1949-50 through 1950-51. Calif. Fish and Game 38(1):85-97.
Similar to 580.
 - 583 Cobb, J. N. 1903. The commercial fisheries of the Hawaiian Islands. U.S. Fish Comm. Bull. 23:717-765.
Hawaiian fishermen dazzle fish by the use of lights for easier catches. A good literature and statistics summary is included.
 - 584 Combs, B. D., R. E. Burrows and R. G. Bigg. 1959. The effect of controlled light on the maturation of adult blueback salmon. Prog. Fish Cult. 21(1):63-69.
 - 585 Commercial Fisheries Review. 1960. Tunisia: Fishery trends, second quarter 1960. Comm. Fish. Rev. 22(11):86.
Lights are used in Tunisia to catch sardines.
 - 586 Corson, B. W. 1955. Four years' progress in the use of artificially controlled light to induce early spawning in brook trout. Prog. Fish Cult. 17(3):99-103.
Trout, 2-1/2 years old, produce better eggs which hatch out better when under artificial light than if older.
 - 587 Craig, R. E. and I. G. Baxter. 1952. Observations in the sea on the reaction to ultra-violet light of certain sound scatterers. Jour. Mar. Biol. Assoc., U.K., 31(2):223-227.
 - 588 Crawford, D. R. 1930. Some considerations in the study of the effects of heat and light on fishes. Copeia (173):89-93.
Yellow and green were good but blue caused high mortalities among young salmon.

D

- 589 Damas, H. 1949. Nouvelles observations sur l'influence de la lumière sur le développement embryonnaire de *Lampetra*. Commun 3mes Journées Cyto-Embryol. Belgo-Neerland, pp. 96-99.
- 590 Dannevig, A. 1932. The influence of light on the cod. Jour. du Cons. 7(1):53-59.
- 591 _____ and E. Sivertsen. 1933. On the influence of various physical factors on cod larvae; experiments at the Flødevig sea fish hatchery. Jour. du Cons. 8(1):90-99.
Cod larvae are attracted to a light if of moderate intensity, die if too strong.
- 592 Davidson, V. M. 1949. Salmon and eel movement in constant circular current. Jour. Fish Res. Bd. Can. 7(7):432-448.
- 593 Dildine, G. C. 1936. Effects of light and temperature on the gonads of *Lebistes*. Anat. Rec. 67(Suppl. 1):61.
Light does not have any influence on color or gonad condition in the guppy.
- 594 Dragesund, O. 1958. Reactions of fish to artificial light, with special reference to large herring and spring herring in Norway. Jour. du Cons. 23(2):213-227.
- 595 Drimmelman, D. E. V. 1951. The use of light in the catching of eels. Visserijnieuws 3(12).
Traps with lights caught more eels than unlit traps.
- 596 Duge, F. 1913. Die anwendung elektrischen lichter beim fischen. Der Fischerbote 5: 192-194.
A general discussion on the possible effects of light on fish.
- 597 Dunkan, Rea E. 1956. Use of infrared radiation in the study of fish behavior. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 170:16 pp., 9 figs.

E

- 598 Eckert, B. 1953. Orientující vliv polarizovaného světla na perloočky (The orienting influence of polarized light on *Daphnia*). Českoslov. Biol. 2:76-83 (Abstr. in Ber. wiss. Biol. 89, 189 G Birukowt).
Daphnia orients 180° to the light source.
- 599 Eisler, R. 1957. The influence of light on the early growth of Chinook salmon. Growth 21(3):197-203.
Chinook salmon larvae reared under lights grew faster and weighed more than those reared normally.
- 600 _____. 1958. Some effects of artificial light on salmon eggs and larvae. Tr. Am. Fish. Soc. 87:141-162.

F

- 601 Fage, L. 1924. La pêche à la lumière son intérêt pratique et scientifique. Rev. Gen. Sciences Pur et Appl. 35:327-333.
A review of the use of lights to capture fish.
- 602 _____ and R. Legendre. 1923. Essais de pêche à la lumière dans la baie de Concarneau. Inst. Oceanog. Bull. (431):1-20.
A thorough list of the species of invertebrates captured by night lighting.
- 603 _____ and _____. 1923. Rythmes lunaires de quelques Néreidiens. Compt. Rend. Acad. Sci. (Paris) 177:982-985.
- 604 Fick, H. 1951. Der thunfisch mit der elektrischen Angel. Hansa, Jahrg 88, 46-47:1723.
- 605 Fields, P. E., D. E. Johnson and S. Z. El-Sayed. 1959. The 1958-59 McNary Dam light guiding studies. Univ. Wash. Sch. Fish. Tech. Rept. 50, vi + 24 pp.
Light helped guide downstream migrant salmon and trout but they couldn't be persuaded to use a 50' deep exit.
- 606 Folger, H. T. 1927. The relation between the responses by *Amoeba* to mechanical shock and to sudden illumination. Biol. Bull. 53 (6):405-412.
- 607 Frenz, V. 1913. Die phototaktischen erscheinungen im Tierreiche und ihre Rolle im Freileben der Tiere. Zool. Jahrb. Abt. 3:33: 259-286.
- 608 Friedrich, H. 1931. Mitteilungen über vergleichende untersuchungen über den Lichtsinn einigen mannir Copepoden. Zeit. Vergleich. Physiol. Bd xv:121-138.
Calanus and *Corycaeus* responded positively to a light source.
- 609 Froloff, J. P. 1925. Bedingte reflexe bei fischen 1. Pflüg. Archiv. f. d. ges. Physiol. 208:261-271.
Fish movements in response to light were studied.
- 610 Fry, D. H. 1950. Moving lights lure fish past diversion channels. World Fish. Abstr. 5(1):13.

G

- 611 Gast, R. 1918. Über die verwendung des lichter beim fischen. Der Fischerbote 10:69-71.
A general review of light fishing.
- 612 Geissler, R. 1952. Fischerei im Golf von Neapel. Fischereiwelt 4:193-194.
- 613 Graber, V. 1884. Grundlinien zur erforschung des Helligkeits und farbenses der Tiere. Leipzig vii + 322 pp.
During daylight various snails prefer a blue light but at night a red is preferred.

- 614 Grave, C. A. 1928-29. Continuation of study on the influence of light on the behavior and metamorphosis of the larvae of Ascidians. Yearbook Carnegie Inst. 27:273-275; 28:284-286.
 - 615 Grein, K. 1912. Eien elektrische lampe zum anlocken positiv phototaktischer seetiere. Inst. Oceanog. Monaco, Bull. (242):1-5.
Lights were used to ease the capture of copepods.
 - 616 Gribble, L. R. 1934. Reaction of brook lam-preys to various colored lights. W. Va. Univ. Bull. Sci. 34(15):30-32.
 - 617 Grundfest, H. 1932. The sensibility of the sun-fish, *Lepomis*, to monochromatic radiations of low intensity. Jour. Gen. Physiol. 151:307-328.
- H
- 618 Haempel, O. and H. Lechler. 1931. Über die wirkung von ultravioletter bestrahlung auf fischerei und fischbrut. Zeitschr. Vergl. Physiol. 14:265-272.
With increasing distances the effect of light on trout and pike diminishes.
 - 619 Harrington, N. R. and E. Leaming. 1900. The reactions of Amoeba to light of different colors. Am. Jour. Physiol. 3:9-18.
Amoeba exhibits stress if placed in a red light source and stops all movement in a violet light source.
 - 620 Harrington, R. W., Jr. 1948. The life cycle and fertility of the bridled shiner, *Notropis bifrenatus* (Cope). Am. Midl. Nat. 39(1): 65-82, 3 tables, 3 figs.
Varying amounts of light will change the spawning period and condition of the bridled shiner.
 - 621 _____. 1950. Preseasonal breeding of the bridled shiner, *Notropis bifrenatus*, induced under light-temperature control. Copeia (4):304-311.
When exposed to 17 hours of light the breeding cycle was moved up. This amount of light was needed for sexual maturity to occur.
 - 622 _____. 1956. An experiment on the effects of contrasting daily photoperiods on gametogenesis and reproduction in the Centrarchid fish, *Enneacanthus obesus* (Girard). Jour. Exp. Zool. 131(3):203-219, 2 pls.
A short light day produced no sex discrimination. A 15 hour day caused differentiation in 45 days.
 - 623 _____. 1957. Sexual photoperiodicity of the Cyprinid fish, *Notropis bifrenatus* (Cope) in relation to the phases of its annual reproductive cycle. Jour. Exp. Zool. 135(3):529-553, 1 pl.
See 620 and 621.
 - 624 Hazard, T. P. and R. E. Eddy. 1951. Modification of the sexual cycle in brook trout (*Salvelinus fontinalis*) by control of light. Tr. Am. Fish. Soc. 80(1950):158-162.
 - 625 Hecht, S. 1921. The relation between the wave-length of light and its effects on the photosensory process. Jour. Gen. Physiol. 3(3):375-390.
Mya arenaria was stimulated with a light wave-length of 500 millimicrons.
 - 626 Herter, K. 1929. Dressuwersuche an fischen. Zeitschr. Wiss. Biol. Abt. C. Zeitschr. Vergleich. Physiol. 10(4):683-711.
 - 627 Hinelin, G. M. White. 1927. Color vision in the mudminnow. Jour. Exp. Zool. 47(1): 85-94.
Umbra limi can distinguish red and yellow colors.
 - 628 Hinrichs, M. A. and I. J. Genther. 1931. Ultra-violet radiation and the production of twins and double monsters. Physiol. Zool. 4:461.
 - 629 Hoar, W. S. 1955. Phototactic and pigmentary responses of sockeye salmon smolts following injury to the pineal organ. Jour. Fish. Res. Bd. Can. 12(1):178-185.
 - 630 Hafen, G. 1935. Zur psychologie der Dressurversuche. Zeitschr. Verg. Physiol. 22:192-220.
 - 631 Holmes, S. J. 1905. The reactions of *Ranatra* to light. Jour. Comp. Neurol. and Psychol. xv:305-349.
Ranatra will bend its head toward light regardless of how it is positioned.
 - 632 _____. 1908. Phototaxis in fiddler crabs and its relation to theories of orientation. Jour. Comp. Neurol. and Psychol. xviii: 493-497.
Uca reacts positively toward a light source.
 - 633 Holst, E. J. 1935. Über den lichtdrückenreflex bei fischen. Pubbl. Staz. Zool. Napoli 15: 143-158.
 - 634 Hoover, E. E. 1937. Experimental modification of the normal sexual cycle in trout by control of light. Sci. 86(2236):425-428. Also a review in Prog. Fish Cult. 36:34.
 - 635 _____. and H. E. Hubbard. 1937. Modification of the sexual cycle in trout by control of light. Copeia (4):206-210.

- 636 Hough, W. 1926. Fire as an agent in human culture. U.S. Nat. Mus. Bull. 139:270 pp.
A popular article on the early uses and myths surrounding the use of fire as a light.
- * Hsiao, S. C., I. Miyake and A. L. Tester. 1952. See Electricity.
- 637 Hubbs, C. and K. Strawn. 1957. The effects of light and temperature on the fecundity of the greenthroat darter, Etheostoma lepidum. Ecol. 38(4):596-602.

I

- 638 Imamura, Y. 1953. Study on the disposition of fish towards the light. Report No. 1. Study on the behavior of Trachurus japonicus to light. Jour. Tokyo Univ. Fish 39(2):223-229.
A report of 4 experiments which illustrate the attraction to light of Trachurus and Charbda.
- 639 _____. 1958. Study on the disposition of fish towards the light. II. The strength of illumination preferred by fish. Jour. Tokyo Univ. Fish 44(1-2):75-89.
Carp were more active if the light source was under the water than above it.
- 640 _____. 1959. Study on the disposition of fish towards light. 4. The strength of illumination comfortable to mackerel and Trachurus japonicus. Jour. Tokyo Univ. Fish 45(2):185-193.
See 638.
- 641 _____ and A. Koike. 1959. Study on the disposition of fish towards light. 3. The strength of illumination comfortable to Cololabis saira. Jour. Toyko Univ. Fish 45(2):179-183.
- 642 _____ and S. Takeuchi. 1960. Study of the disposition of fish towards light (No. 5) The strength of illumination comfortable to Engraulis japonicus. Jour. Tokyo Univ. Fish 46(1-2):133-148.
Light at a 45° angle to the water had these effects: .01-.04 lux caused a movement out and concentration at the zone of less light intensity; .03-8.5 and 0.2-39 lux always drove the fish into the zones of less illumination.
- 643 _____ and _____. 1960. Study on the disposition of fish toward light (No. 6) Compare with the disposition of Engraulis japonicus, Decapterus muroadsi, Trachurus japonicus and Scomber japonicus. Jour. Tokyo Univ. Fish 46(1-2):149-155.
Species phototaxis varied with prolonged light experiments. Anchovies were negative, scad positive, horse mackerel negative and mackerel negative.

J

- 644 Johnson, W. H. 1940. Effect of light on movements of herring. Jour. Fish. Res. Bd. Can. 4(5):349-354, 1 fig.
- 645 Jones, F. R. H. 1956. The behavior of minnows in relation to light intensity. Jour. Exp. Biol. 33(2):271-281.

K

- 646 Kawada, S. and C. Yoshimuta. 1952. Fresh water Hypomeus olidus and Zacco platypus are attracted by artificial light. Jap. Soc. Sci. Fish. Bull. 18(5):227. (In Japanese with English summary).
- 647 Kawamoto, N. Y. 1955. Experiments with the fish gathering lamp. Sec. II of Proc. of Indo-Pacific Fish. Conseil 6(2/3):278-279.
The results were influenced by many factors.
- 648 _____. 1959. The significance of the quality of light for the attraction of fish. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 553-555.
Wave lengths over 750 millimicrons not susceptible by fish.
- 649 _____ and H. Kobayaski. 1952. Influence of various light conditions on the gathering rates of fish. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1(2):139-150.
Most fish preferred blue and green lights. Eels were negatively phototactic.
- 650 _____ and J. Konishi. 1952. The correlation between wave length and radiant energy affecting phototaxis. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1(2):197-208.
A good study. Best results were obtained when 510-530 millimicrons were used.
- 651 _____ and _____. 1955. Diurnal rhythm in phototaxis of fish. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 2(1):7-17.
Girella and Rudamis showed a strong attraction to light. The schools were found to break down at night.
- 652 _____ and S. Nagata. 1952. On the relation between light gradient and fish behavior. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1(2):151-173.
An excellent paper on the light-behavior aspects of fish. Sphaeroides was most active day or night when the intensity was 55 lux. Mulletts preferred 87 lux during the day only.

- 653 _____ and T. Niki. 1952. An experimental study on the effect of leading fish by fish attracting lamps. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1(2):175-196.
Light intensity was the most important factor in leading fish. A short period was not good.
- 654 _____, H. Ozaki, H. Kobayashi, J. Konishi and U. Uno. 1952. Fundamental investigations of the fish gathering methods II. Jour. Fish. Res. Inst. 4:263-291. (In Japanese).
- 655 _____ and M. Takeda. 1950. On the fundamental studies of the fish gathering method by the light 1. Rept. Fish. Res. Inst. 3:153-188. (In Japanese).
- 656 _____ and M. Takeda. 1950. Studies on the phototaxis of fish. 1. The influence of wave lengths of light on the behavior of young marine fishes. Jap. Jour. Ichthyol. 1(2): 101-115.
Green and blue lights attracted most fish larvae. Only eels preferred violet and red lights.
- 657 _____ and _____. 1951. The influence of wave lengths of light on the behavior of young fish. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1(1):41-53. (In English).
- 658 _____ and K. Uno. 1954. Studies on the influence of the moonlight upon efficiency of the fish lamp. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1:355-364.
Pempheria, *Girella* and *Sphaeroides* will gather to a lamp regardless of intensity of moon if the light is of proper intensity.
- 659 Keenleyside, M. H. A. 1955. Some aspects of the schooling behaviour of fish. Jour. Comp. Ethology, Leiden, 8(2-3):183-247, 18 figs., 16 tables.
- 660 Kleerekoper, H., Grace Taylor and R. Wilton. 1961. Diurnal periodicity in the activity of *Petromyzon marinus* and the effects of chemical stimulation. Tr. Am. Fish. Soc. 40(1): 73-78.
Two periods of light cause ammocoete and adult to go through endogenous cyclic activity rhythm. If light is constant, this does not happen.
- 661 Kraus, H. and W. Reiffenstühl. 1933. Vergleich von galvanonarkose und "wechselstromnarkose" bei fischen und fröschchen. Pflügers Archiv. f. d. ges. Physiol. Bd 233:380-385.
- 662 Krefft, G. and K. Schubert. 1950. Beobachtungen über den einfluss künstlichen Beleuchtung der Meeresoberfläche auf fische. Fischereiwelt 2(6):66-68. (In German).
- 663 Kristjonsson, H. 1959. Underwater electric lamps for light fishing. F.A.O. Current Affairs Bull. 25:1-2.
- 664 Kurien, C. V., U. K. Pillai and G. S. Nair. 1952. Use of light of different intensity and color in luring fish. Current Sci. 21(5):130.
- 665 _____, _____ and _____. 1953. Emploi de lumieres d'intensites et de couleurs différentes pour attirer le poisson. La Pêche Maritime, la Pêche Fluviale et la Pisciculture (Paris) (901):168. (In French).
Same as 664.
- 666 Kuroki, T. and M. Chuman. 1957. An example of three-dimensional records of fish-school attracted by underwater lamps. Mem. Fac. Fish. Kagoshima Univ. 6:77-81. (In Japanese with English summary).
- 667 _____ and H. Nakayama. 1957. Studies on the fluorescent color-lamps for attracting of fish. (1) Characteristics of these color-lamps and their comparison with incandescent lamps. Mem. Fac. Fish. Kagoshima Univ. 6:95-98.
Blue lights were best for attracting fish.
- 668 Kusaka, T. 1959. Fish gathering effects and submarine illumination and fluorescent mercury-vapor lamps. Jap. Soc. Sci. Fish. Bull. 25:17-22.
Fish gathered better to a mercury lamp than to an incandescent lamp.
- 669 _____ 1959. Fish gathering effects and submarine illumination of the incandescent and fluorescent mercury-vapor lamps. Comm. Fish. Rev. 13(1):23 review of original article. (Jap. Soc. Sci. Fish. Bull. 25(1):17-21).

L

- 670 Laurens, H. and H. D. Hooker, Jr. 1920. Studies on the relative physiological value of spectral lights. II. The sensibility of *Volvox* to wave-lengths of equal energy content. Jour. Exp. Zool. 30(3):345-369.
Sensitivity of *Volvox* depends on the penetration of the light and the rate of *Volvox* motion.
- 671 LeBreton, J. F. 1952. La pêche à la lumière électrique. Pêche Mar. 31:469-470.
- 672 _____ 1952. La pêche ou chalut pélagique avec lumière. Pêche Mar. 31:470-471.
Continuation of 671.
- 673 Lewis, J. B. 1959. Note on a technique for catching flying fish at night. West Indies Fish Bull. (6):9-10.
- 674 Lindsey, C. C. 1958. Modification of meristic characters by light duration in Kokanee *Oncorhynchus nerka*. Copela (2):134-136.
The amount of light developing salmon eggs receive during their development does influence the final number of vertebrae.

- 675 Loeb, J. 1907. Concerning the theory of tropisms. Jour. Exp. Zool. iv:151-156.
 - * Loeb, J. 1918. See Electricity.
 - 676 _____ and J. H. Northrop. 1917. Heliotropic animals as photometers on the basis of the validity of the Bunsen-Roscoe Law for Heliotropic reactions. Proc. Nat. Acad. Sci. 3:539-544.
 - 677 _____ and H. Wasteneys. 1915. The relative efficiency of various parts of the spectrum for the Heliotropic reactions of animals and plants. Jour. Exp. Zool. xix:23-25.
Endendrium prefers yellow light.
 - 678 Loukashkin, A. S. and N. Grant. 1959. Behavior and reactions of the Pacific sardine, Sardinops caerulea (Girard), under the influence of white and colored lights and darkness. Proc. Calif. Acad. Sci. 29(15):509-548, 23 figs.
 - 679 Lowe, Rosemary H. 1952. The influence of light and other factors on the seaward migration of the silver eel (Anguilla anguilla). Jour. Animal Ecol. 21(2):275-309.
Lights were used to lead eels. A very good study of this factor as affecting eels.
 - 680 Lynch, W. F. 1947. The behavior and metamorphosis of the larvae of Bugula neritina (Linnaeus); experimental modification of the larvae to light and gravity. Biol. Bull. 92 (2):115-150.
- M
- 681 Maeda, H. 1951. Analytical studies on marine lamp-communities. Publ. Seto Mar. Biol. Lab. 1(4):195-213.
The best paper on light where one gives good coaction data. Drawings and interrelationships of a lamp-community are presented.
 - 682 _____ . 1955. Statistical analysis of the influences of various lights upon the distribution of fishes in aquarium -1. Jap. Soc. Sci. Fish. Bull. 21(3):159-163. (In Japanese with English summary).
 - 683 Mast, S. O. 1911. Light and the behavior of organisms. John Wiley & Sons, N. Y. xi / 410 pp.
Excellent bibliography.
 - 684 _____ . 1921. Reactions to light in the larvae of the ascidians, Amaroucium constellatum and A. pellucidum, with special reference to photic orientation. Jour. Exp. Zool. 34:149-188.
Decreased light activates these species of Amaroucium. Increased light causes them to rest.
- 685 _____ . 1936. Motor responses to light in the invertebrate animals. In: Biol. Effects of Radiation, McGraw Hill, N. Y., 1st Ed., pp. 573-624.
 - 686 Matthews, S. 1938. The effects of light and temperature at the male sexual cycle of Fundulus. Biol. Bull. 77:92-95.
 - 687 McHugh, J. L. 1954. The influence of light on the number of vertebrae in the grunion, Leuresthes tenuis. Copeia (1):23-25.
Mean number of vertebrae of grunion can be modified by light during embryonic stages.
 - 688 McKinley, E. M. and J. G. McKinley, Jr. 1931. The vacuum tube oscillator in biology. Quart. Rev. Biol. 6(3):322-328.
 - 689 Medlin, A. B. 1951. Preliminary observations on effects of temperature and light upon reproduction in Gambusia affinis. Copeia (2): 148-152.
 - 690 Merker, E. 1938. Der einfluss kurz welligen lichtes auf die tierwelt. Bioklimatische Beiblätter 5(4):167-173.
An excellent review of light as an influencing force.
 - 691 Merriman, D. and H. P. Schedl. 1941. The effects of light and temperature on gametogenesis in the four-spined stickleback Apeltes quadracus (Mitchill). Jour. Exp. Zool. 88: 413-446.
 - 692 Miyazaki, T. 1950. On the shoal of fishes crowding toward a lamp. Jap. Soc. Sci. Bull. 16(235-238):4 pp. (In Japanese with English summary).
 - * Moehres, F. P. 1940. See Mechanical.
 - 693 Monaco, A. de (Prince Alb de). 1895. Sur les premières campagnes scientifiques de la Princess Alice. Compt. Rend. Acad. Sci. Paris 120:20-24.
An early use of lamps to capture specimens of fishes.
 - 694 Mookerjee, N. 1934. Reactions of goldfish to colours. Indian Jour. Psychol. 9:69-78.
 - 695 Miura, T. 1951. Studies on the fish alluring lights. 1. Some notes on the present studies. Bull. Fac. Fish. Hokkaido Univ. 1(3-4):142. (In Japanese with English summary).
- N
- 696 Nikonorov, I. V. 1957. The basic principles of fishing for Caspian kilka by underwater light. F.A.O. Int. Fishing Gear Cong. Pap. 111 B.

- 697 _____. 1959. The basic principles of fishing for the Caspian kilka by underwater light. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 559-566.
With the use of lights the catch of Caspian kilka has risen since 1951 to 1,500,000 hundred weights.
- * Nikonorov, I. V. and A. K. H. Pateev. 1959. See Electricity.
- 698 Noble, G. K. and B. Curtis. 1939. The social behavior of the jewel fish Hemichromis bimaculatus Gill. Am. Mus. Nat. Hist. Bull. 76:1-46, 1 pl.
A study of the effect of varying colors on schooling jewel fish.

O

- 699 Oka, M. 1950. An experimental study on attraction of fishes to light. Jap. Soc. Sci. Fish. Bull. 16(6):3-14. (In Japanese with English summary).
- 700 Osborn, C. M. 1948. Factors influencing the growth of integumentary pigment in fish. I. The role of light. Proc. Soc. Exp. Biol. Med. 67:440-445.
Light induced melanophore production in the summer flounder.
- 701 Owatari, A. and Furuno Kiyokata. 1954. The behavior of sardine schools shown by the fish-detector. II. Influences of the water temperature when the fish schools are being attracted to a fishing light. Jap. Soc. Sci. Fish. Bull. 19(11):1072-1076. (In Japanese with English summary).
- 702 Ozaki, H. 1951. On the relation between the phototaxis and the aggregation of young marine fishes. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1(1):55-66.
An excellent paper on the effects of light on fish schools of Girella and Mugil.
- 703 _____. 1952. Sur la phototoxique des poissons isoles. Rept. Fac. Fish. Prefectural Univ. Mie, Japan, 1(2):129-138.
Similar to 702.
- 704 Ozton, N. and A. Gorbman. 1960. The hypophysis and hypothalamo-hypophyseal neurosecretory system of larvae lampreys and their responses to light. Jour. Morphol. 106(3):243-252, 4 pls.
Continuous light causes depletion of neurosecretory granules from cell bodies and axon of the preoptic nucleus. These are normal when light is diurnal.
- 706 Parschin, A. N. 1929. Bedingte reflexe bei schildkröten. Archiv. ges. Physiol. 222(3):328-333.
- 707 Pel, H. van. 1950. Lampen als lokmiddel bij de Zeevisserij. (Light used for the attraction of fish). Berita Perikavan, Visserij-nieuws (Djakarta, Indonesia) 2(8):122. (In Dutch).
- 708 (Pel, H. V. 1950). Light used for the attraction of fish. (Lampen als lokmiddel bij de zeevisserij in Indonesie). Het Nieuw Visserijblad (Belgium) 10(3):2. (In Flemish).
Same as 707.
- 709 Peters, E. 1926. Vergleichende untersuchungen uber der lichtsinn einbelmischer Cladocerenarter. Zool. Jahrg. Abt. Allg. Zool. u. Physiol. 43(1):1-40.
- 710 Piskunov, I. A. 1949. An experiment in catching Pacific herring by means of an electric light. Rybn. Khoz. 25(7):27.
- 711 Plavilstchikov, N. N. 1928. Observations sur l'excitabilite des infusoires. Arch. Russes Protistol 7(1/2):1-24. (Russian summary).
- 712 Pomerat, C. M. and E. R. Reiner. 1942. The influence of surface angle or of light on the attachment of barnacles and other sedentary organisms. Biol. Bull. 82:14-25.
If one excludes light, set decreases.
- 713 Poynter, C. W. and A. Moritz. 1923. The effects of ultraviolet light on pond snails. Jour. Exp. Zool. 37:1-13.
- 714 Privolnev, T. I. 1956. Reaction of fish to light. Voprosy Ichthyology. (The problems of Ichthyology) published by the Acad. Sci., USSR, Div. Biol. Sci. Ichthyol. Comm. issue 6:3-20. (In Russian).
A good bibliography and good work on the use of light and fishes' reaction to it.

R

- 715 Rasalan, S. B. and B. Datingaling. 1956. Observations on fishing with light in the Philippines. Indo-Pacific Fish Council Proc. 6(2/3):275.
Six bulbs of 150,000 watts were used successfully for night fishing.
- 716 Reece, M. 1951. Color plate Characters. Iowa Cons. 10(4):121,126-127.
- 717 Reeves, Cora D. 1917. The discrimination of wave-lengths of light by fish. Behavior Monog. 4(3):1-106.
Light with the longer wave lengths were discriminated better than those of short by freshwater fishes.

P

- 705 Parker, G. H. and A. J. Lancher. 1922. The responses of Fundulus to white, black and darkness. Am. Jour. Physiol. 61(3):548-550.

- 718 Richard, J., et al. 1934. Liste générale des stations des campagnes scientifiques du Prince Albert de Monaco avec notes et observations. Résultats Campagnes Sci. Albert 1^{er} Prince Souverain de Monaco 89: 1-472.
A list of species caught by lighting.
- 719 Richardson, I. D. 1952. Reactions of herrings, sprats and pilchards to light. World Fishing 1(7):239-244.
- 720 Rose, M. 1925. Contribution a l'étude de la biologie du plankton. Le problème des migrations verticales journalières. Arch. Zool. Exp. et Gen. 64:388-542.
A fair paper on the influence of light on plankton primarily crustaceans as a factor influencing their vertical movements.
- 721 Rugh, R. 1929. Egg laying habits of *Goniionus murbaichi* in relation to light.
- 722 Ruivo, M., et al. 1959. Discussion on fish attraction. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 571-574.
- 723 Russo, A. 1915. Ulteriori ricerche su la pesca con sorgenti luminose nel golfo di Catania. Atti. Accad. Gioeni Catania Anno 92, Ser. 5, Mem. 23, 8:12 pp.
A good observation of species made possible by use of light.
- 724 _____. 1917. Esperimenti di pesca con luce subacqua. Atti. Accad. Gioeni Catania Anno 94, Ser. 5, Me. 22, 10:7 pp.
The use of lights with a purse net as a fishing aid.
- 725 _____. 1928. L'azione delle sorgenti luminose su gli animali marini nei riguardi della pesca. Atti. del Convegno di Biologia Marina Applicata Alla Pesca. Messina.
A review of the use of lights in fisheries.
- 726 _____. 1932. Esperimenti di pesca luminose con lampada elettrica sommersa. Pesca della accinghe con sorgenti luminose nel golfo di Catania e maggiore sviluppo dell'industria sardiniera nei mari italiani. Boll. Pesca, Piscicoltura Idrobiol. 8:809-837.
- 727 _____. 1935. Zone di concentramento, migrazioni e pesca dell' accinghe (*Engraulis encrasicolus* L.) con sorgenti luminose nel golfo di Catania. Atti. Accad. Gioeni Catania Anno 111, Ser. 6, Mem. 11, 1:16 pp.
- 728 _____. 1950. Osservazioni marittime problemi della pesca costiera in Italia. Rendiconti Accad. Nazionale dei Lincei della XL, Ser. IV, Vol. 1.
- S
- 729 Safranova, T. E. 1954. (Results of a study of the reaction of Black Sea fishes to electric light). Trudy Vsesoiusnovo N.-I. Inst. (Morskovo) Rybnovo Khoziaistvo i Okeanografii 28:175-187.
- 730 Sasaki, T. 1950. Fishing apparatus equipped with a fish attraction lamp system. Jap. Soc. Sci. Fish. Bull. 16(7):7-20. (In English).
- 731 _____. 1950. Fishing apparatus equipped with a fish attraction lamp system. Jap. Soc. Sci. Fish. Bull. 16(7):281-294.
Horse mackerel are affected by lights as a leading agent only to about a 20 percent extent.
- 732 _____. 1950. On the color of the fish attraction lamp. Jap. Soc. Sci. Fish. Bull. 16(7):295-298.
Horse mackerel and sardines were readily attracted to a green light.
- 733 _____. 1953. Studies on underwater light source. Jour. Oceanog. Soc. Japan 5(2).
- 734 _____. 1957. Fishing apparatus equipped with a fish attraction lamp system. F.A.O. Inst. Fishing Gear Congr. Pap. 10(a).
- 735 _____. 1959. The use of light attraction for traps and set nets. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 556-558.
Fish and lobsters were attracted best when a direct beam was used.
- 736 Savage, R. E. and W. C. Hodgson. 1934. Lunar influence on the East Anglian herring fishery. Jour. Cons. 9:223-237.
- 737 Schallek, W. 1943. The reaction of certain crustacea to direct and diffuse light. Biol. Bull. 84:98-105.
- 738 Scharfe, J. 1952. "Über das Verhalten von fischen gegenüber künstlichem Licht." Fischereiwelt 4:161-162.
- 739 _____. 1953. Über die Verwendung künstlichem Lichtes in der fischerei. Prot. Fischerei Technik 8(15):1-29.
Best recent review on use of lights and their effects on fishes.
- * Scheminsky, F. 1931. See Electricity.
- 740 Schnurmann, F. 1920. Untersuchungen an Elritzen über farbenwechsel und Lichtsinn der fische. Zhur. Biol. 71:69-98.
Fish chromatophores react to blue, green and red light more than to white or other colored lights.
- 741 Schoonens, J. G. 1951. Licht en visvangst. (Light and fishing). De Visserijwereld (Netherlands) 10(26):13. (In Dutch).

- 742 Schuler, F. and G. Krefft. 1951. Versuche zur beeinflussung von Meeresfischen durch Schalldruckwellen und Kunstliches Licht. *Fischereiwelt* 3:8-10.
- 743 Sette, O. E. 1950. Biology of the Atlantic mackerel (*Scomber scombrus*) of North America. Pt. II. Migrations and habits. U.S. Fish & Wildl. Serv. Fish. Bull. 51(49): 249-358, 21 figs.
- 744 Shaw, R. J., R. A. Escobar and F. M. Baldwin. 1938. The influence of temperature and illumination on the locomotor activity of *Carassius auratus*. *Ecol.* 19(2):143-146.
Goldfish locomotive ability is reduced 1/2 to 1/3 usual rate by low illumination (0.5 ft. candles).
- 745 Shentiakov, V. A. and V. A. Strakhov. 1953. Rezultaty elektrolova ryby na Rybinskom vodokhranilishche. (Results of fishing with electrical gear in the Rybinsk water reservoir). *Rybnoe Khoziaistvo* 35(7):59-65. (In Russian).
Lights of 220-330 volts were employed to prevent trawl escape.
- 746 Shlaifer, A. 1939. An analysis of the effect of numbers upon the O₂ consumption of *Carassius auratus*. *Physiol. Zool.* 1, 2:381-392.
If kept in the dark, the oxygen consumption decreases, using the same number of fish, as when exposed to light conditions.
- 747 _____. 1942. The schooling behavior of mackerel: a preliminary experimental analysis. *Zoologica* 72(Pt. 2) (9-16):75-80.
Colored light has no effect on *Pneumatophorus grey*.
- 748 Smith, E. V. 1916. Effect of light on the development of young salmon. *Puget Sound Marine Sta. Publ.* 1(11):89-107.
Salmon development is slowed when the fish are placed in the dark.
- 749 Smith, F. G. W. 1943. Effect of illuminating a depth on the attachment and growth of fouling organisms on stationary surfaces. *Pap. 17, Mar. Fouling and Its Prevention*, 7th Rept., 11:1-2, 5 figs.
- 750 Spencer, W. P. 1939. Diurnal activity rhythms in fresh-water fishes. *Ohio Jour. Sci.* 39(3):119-132.
The light intensity affects their activity during any season of the year.
- 751 Spooner, G. M. 1933. Observations on the reaction of marine plankton to light. *Mar. Biol. Assoc., U.K.*, 19(1):385-438.
A good review of the effects of light on varied groups of animals.
- 752 Steven, D. M. 1959. Studies on the shoaling behavior of fish. I. Responses of two species to changes in illumination and to olfactory stimuli. *Jour. Exp. Biol.* 36:261-280.
Fish schools dispersed and broke down at night when no illumination was present.
- 753 Stier, T. J. B. 1926. Reversal of phototropism in *Diemictylus viridescens*. *Jour. Gen. Physiol.* 9(4):521-523.
- 754 Strawn, K. 1955-56. A method of breeding and raising three Texas darters. *Aquarium Jour.* 26:408-412; 27:11-17, 31-32.
- 755 Stringer, G. E. and W. S. Hoar. 1955. Aggressive behavior of under-yearling Kamloops trout. *Can. Jour. Zool.* 33(3):148-160.
Aggressiveness in young trout was attributed to a light source.
- 756 Sullivan, Charlotte M. and K. C. Fisher. 1947. Temperature selection and the effects of light and temperature on movements in fish. *Fed. Proc.* 6, Pt. 2, (1):212-213.
Salvelinus fontinalis avoids intense light areas.
- 757 _____ and _____. 1954. The effects of light on temperature selection in speckled trout, *Salvelinus fontinalis* (Mitchill). *Biol. Bull.* 107(2):278-288.
Low light intensity was more critical than on temperature selectivity.
- 758 Sutcliffe, W. H., Jr. 1956. Effect of light intensity on the activity of the Bermuda spiny lobster *Panulirus argus*. *Ecol.* 37:200-201.
The light intensity directly affected the catch of Bermuda spiny lobsters.
- 759 Sweeney, Beatrice M., F. T. Haxo and J. W. Hastings. 1959. Action spectra for two effects of light on luminescence in *Gonyaulax polyedra*. *Jour. Gen. Physiol.* 43(2):285-299.
Illumination may inhibit luminescence. The intensity of the illumination depended on the preillumination.

T

- 760 Takayama, S. 1951. Saury lift-net fishing with light. *Proc. UNSCCUR* 7:100-102.
- 761 _____. 1956. Fishing with light in Japan. *Indo-Pacific Fish Comm. Proc.* 6(2/3):276-277.
Lamps of 50-500 watts were successfully used to increase the catch of fish at sea.
• Tamura, M. 1959. See Electricity.
- 762 Tauti, M. and H. Hayasi. 1928. On the shoal of fishes crowding toward a lamp. *Jour. Imp. Fish. Inst. Tokyo* 21(4):42. (In Japanese).
- Terry, O. P. 1906. See Electricity.
- Tester, A. L. 1959. See Sound.
- 763 _____ and M. Takata. 1953. Contribution to the biology of the sholehole, a potential baitfish. *Ind. Res. Advis. Council, Terr. of Hawaii, Grant No. 29, Final Rept.* 1.
The sholehole are easily gathered when fished at night with lights.

- 764 Tryon, C. A., Jr. 1942. The effect of covering hatchery troughs on the growth of cut-throat trout (Salmo clarkii). Tr. Am. Fish. Soc. 72:145-149.
The growth of trout in open troughs was 13.8 percent greater than in covered troughs.

U

- 765 Uhlenhuth, E. 1911. Zur untersuchung des farbennnnes. Biol. Zentralblatt 31:767-771.
A good review of the attraction of fishes to colored lights.

V

- 766 Vanden, Eeckhoudt, J.-P. 1947. Recherches sur l'influence de la lumiere sur le cycle sexuel de l'épinoche (Gasterosteus aculeatus). Ann. Soc. Roy. Zool. Belgique 77:83-89.
767 Verheijen, F. J. 1953. Laboratory experiment with herring, Clupea harengus. Experimentia 9(5):193-194.
768 _____. 1956. On a method for collecting and keeping clupeoids for experimental purposes. Publ. Staz. Zool. Napoli 28:225-240.
769 _____. 1958. The mechanisms of the trapping effect of artificial light sources upon animals. Arch. Neerl. Zool. 13:1-107.
Excellent review of concepts of the effects of lights and colors on invertebrates and fishes. Excellent bibliography.
770 _____. 1959. Section 12: Attraction of fish. Attraction of fish by the use of light. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 548-549.
771 Verhoeven, B. and G. J. Van Oordt. 1955. The influence of light and temperature on the sexual cycle of the Bitterling, Rhodeus amarus. Koninkl. Nederl. Akad. van Wetenschappen (Amsterdam) Proc., Ser. C, 58(5): 629-634, 2 figs., 1 table.
772 Verkhovskaya, I. N. 1940. The influence of polarized light on the phototaxis of certain organisms. Bull. Moscow Nat. Hist. (Biol. Sec.) 49:101-113. (In Russian with French summary and figure legends).
773 Vibert, R. 1953. Effect of solar radiation and of gravel cover on development, growth and loss by predation in salmon and trout. Tr. Am. Fish. Soc. 83:194-201.

- 774 Visschu, J. P. and R. H. Luce. 1928. Reactions of Cyprid larvae of barnacles to light with special reference to spectral colours. Biol. Bull. LIV:336-350.
Barnacles in a 505-590 millimicron light of the blue range are affected. If in a 700 m range less than 5 affect are noted. If the range is 420 or less, ultra violet light, strong influences are noted.

W

- 775 Walker, B. W. 1949. Periodicity of spawning by the grunion Leuresthes tenuis, anatherine fish. Ph. D., Univ. Calif., Los Angeles.
Lights are often used to catch grunion as they are about to come ashore to spawn.
776 Walls, G. L. 1942. The vertebrate eye and its adaptive radiation. Cranbrook Inst. Sci. (19):xiv + 785 pp.
777 Warner, L. H. 1931. The problem of color vision in fishes. Quart. Rev. Biol. 6:329-348.
A good review of the literature.
778 Waterman, T. H. 1950. A light polarization analyzer in the compound eye of Limulus. Sci. 111(2880):252-254.
The horse-shoe crab eye has a polarizer capable of breaking down a beam of light entering its compound eye.
779 _____. 1951. Polarized light navigation by arthropods. Tr. N.Y. Acad. Sci. 14(1): 11-14.
780 _____. 1954. Polarized light and angle of stimulus incidence in the compound eye of Limulus. Proc. Nat. Acad. Sci. 40(4):258-262.
781 _____. 1957. Polarized light and plankton navigation. In Perspectives in Mar. Biol., Univ. Calif. Press, pp. 429-450.
Another review of the use of polarized light and its effects to plankton distribution and movement.
782 Weiss, C. M. 1947. The effect of illumination and stage of tide on the attachment of barnacle Cyprids. Biol. Bull. 93:240-249.
Largest set is obtained when a light of one foot candle is placed at the water surface.
783 White, Gertrude M. 1919. Association and color discrimination in mud minnows and sticklebacks. Jour. Exp. Zool. 27(4):443-498.
784 _____. 1924. Reactions of the larvae of the shrimp Palaemonetes vulgaris and the squid Loligo pealii to monochromatic light. Biol. Bull. 47:265-273.
Maximum strain occurs when a blue-green light is used.

- 785 Woodhead, P. M. J. 1956. The behaviour of minnows (*Phoxinus phoxinus* L.) in a light gradient. Jour. Exp. Biol. 33(2):257-270.
- 786 _____ and A. D. Woodhead. 1955. Reactions of herring larvae to light: a mechanism of vertical migration. Nature 176(4477):349-350.
Herring larvae orientate to a light source and move up to it.
- 787 Woods, L. P. 1952. Fishes attracted to surface light at night in the Gulf of Mexico. Copeia (1):40-41.
Many marine fishes were obtained (often for the first time) by the use of lights at night.
- 788 Woynarovich, E. 1960. Aufzucht der zander-larven bis zum Raubfischalter. Zeitschr. für Fischerei Bond 9 N.F., 1-2:73-84.
Death affect on larvae but not the egg at 407 lux. Pikeperch at 20-26 days of age become predators.
- 789 Wyatt, H. V. 1960. Response of larvae of *Calyptura chinensis* (L) to light. Nature 186(4721):328.

Y

- 790 Young, J. Z. 1935. The photoreceptors of lampreys. I. Light sensitive fishes in the lateral line nerves. Jour. Exp. Biol. 12(3):229-238.
The tail of lampreys is photoreceptive. A light source played on a tail section stimulates these cells.
- 791 Young, P. A. 1950. Netting bait and cannery fish with the aid of light. Calif. Fish and Game 36(4):380-381.

Magnetism

- * Anon. 1952. See Electricity.
- * Baldwin, W. M. 1919. See Light.
- 792 Braemer, W. and H. Braemer. 1958. Orientation of fish to gravity. Limnol. and Oceanog. 4:362-372.
Equilibrium is a feedback process of peripheral and central factors, with the sensory receptor built into the system as the external control element. One utricular statolith removal didn't 1/2 the peripheral equilibrium component.
- 793 Brown, F. A., Jr., M. F. Bennett and W. J. Brett. 1959. Effects of imposed magnetic fields in modifying snail orientation. Biol. Bull. 117:406.
- 794 _____, W. J. Brett, M. F. Bennett and F. H. Barnwell. 1960. Magnetic response of an organism and its solar relationships. Biol. Bull. 118(3):367-381.
A rhythm of turning to the left occurs between 7 a.m. and 9 p.m. Magnetic fields greatly influenced the degree.
- 795 _____ and H. M. Webb. 1959. Fluctuations in the orientation of the mud snail *Lyanassa obsoleta* in constant conditions. Biol. Bull. 117:406-407.
- 796 _____, H. M. Webb, M. F. Bennett and F. H. Barnwell. 1959. A diurnal rhythm in response of the snail *Lyanassa* to imposed magnetic fields. Biol. Bull. 117:405-406.
- 797 _____ and W. J. Brett. 1960. Magnetic orientation in an organism and its lunar relationship. Biol. Bull. 118:382-392.
- * Burner, C. J. and H. L. Moore. 1953. See Explosives.
- * Harvey, E. B. 1933. See Mechanical.
- * Lynch, W. F. 1947. See Light.

Mechanical

A

- * Anon. 1952. See Light.
- * Applegate, V. C., B. R. Smith and W. L. Nielsen. 1952. See Electricity.

B

- 798 Bramsnaes, F., Jul Mogens and C. V. Otterstrom. 1945. Barriers against fish by means of electricity or veils of air. Rept. Danish Biol. Sta. 47(1942):39-46.
Air screens are good as a barrier to pike and carp but trout are unaffected.
- 799 Brawn, Vivien M. 1960. Underwater television observation of the swimming speed and behavior of captive herring. Jour. Fish. Res. Bd. Can. 17(5):689-698.
Shaking of the cage produced a flight response. At night schools of fish are not packed as once believed.
- 800 Breder, C. M., Jr., and F. Halpern. 1946. Innate and acquired behavior affecting aggregation of fishes. Physiol. Zool. 19:154-190.
- * Brett, J. R. and D. MacKinnon. 1953. See Light.
- 801 Bull, H. O. 1935. Studies on conditioned responses in fishes. Pt. VI. The formation of a conditioned motor response in Blennius pholis L. to a change in direction of current flow. Rept. Dove. Mar. Lab. Ser. 3(3):37-48.
B. pholis orientate 90° to a water flow.
- * Burner, C. J. and H. L. Moore. 1953. See Explosives.

G

- 802 Goff, R. A. 1940. The effects of increased atmospheric pressure on the developing embryo of the zebra fish Brachydanio rerio (Hamilton). Tr. Kans. Acad. Sci. 43:401-410.
Two atmospheres of pressure slightly retards embryo development, but no abnormalities are produced.
- 803 Gray, J. 1937. Pseudo-rheotropism in fishes. Jour. Exp. Biol. 14(1):95-103.
Blind fish are insensitive to certain curvilinear displacements, but respond to passive curvilinear movements.

H

- 804 Harvey, E. B. 1932. The development of half and quarter eggs of Arbacia punctulata and of strongly centrifugal whole eggs. Biol. Bull. 62(1):155-167.

- 805 _____. 1933. Development of the parts of sea urchin eggs separated by centrifugal force. Biol. Bull. 64(1):125-148.
One-half eggs can be fertilized as easily as whole can. Unfertilized eggs were used.
- 806 _____. 1933. Effects of centrifugal force on fertilized eggs of Arbacia punctulata as observed with the centrifuge-microscope. Biol. Bull. 65(3):389-396.
Arbacia eggs broke up more after fertilizing than before. If centrifuged slowly the anterior portion yields 2 parts to the eggs which may develop separately.
- 807 _____. 1934. Effects of centrifugal force on the cytoplasm layer and nuclei of fertilized sea urchin eggs. Biol. Bull. 66(7):228.
Centrifugation may cause breakage or some protoplasm to be thrown off but development will take place normally.
- 808 _____. 1940. A comparison of the development of nucleate and non-nucleate eggs of Arbacia punctulata. Biol. Bull. 79:166-187.
A centrifuge was used to get 2 types of eggs with development occurring only for a few stages.
- 809 _____. 1940. A new method of producing twins, triplets and quadruplets in Arbacia punctulata and their development. Biol. Bull. 78(2):202-216.
- 810 Harvey, E. N. 1933. Flattening of marine eggs under the influence of gravity. Jour. Cell and Comp. Physiol. 4:35-47.
- 811 Hata, K. 1927. On the influence of four kinds of vibration upon the eggs of Oncorhynchus masua (Brevoort). Jour. Imp. Fish. Inst. Tokyo 23:74-78.
A blow type of vibration was more harmful than an oscillating type to salmon eggs.
- 812 _____. 1929. On the influence of the duration of time of vibration upon development of fish eggs. Jour. Imp. Fish. Inst. Tokyo 24:121-123.
Death of salmon eggs increased with increasing time of vibrating. Greatest mortality occurred if the eggs were one day old.
- 813 Hatai, S. 1932. The responses of the catfish, Parasilurus asotus, to earthquakes. Proc. Imp. Acad. 8(8):375-378.
- 814 _____. S. Kokubo and N. Abe. 1932. The earth currents in relation to the responses of catfish. Proc. Imp. Acad. Japan (Tokyo) 8(10):478-481.
Catfish show a resistivity potential to earthquakes.

- 815 _____, K. Seiji and A. Noboru. 1932. The earth currents in relation to the responses of catfish. Proc. Imp. Acad. Japan 8(10): 478-481.
- 816 Hoagland, H. 1933. Electrical responses from the lateral-line nerves of catfish I. Jour. Gen. Physiol. 16(4):695-714.
- 817 _____. 1933. Quantitative analysis of responses from lateral-line nerves of fishes II. Jour. Gen. Physiol. 16(4):715-732.
Under pressure catfish emit electrical impulses.

I

- 818 Imamura, Y. and M. Ogura. 1959. Study on the fish gathering effects of air curtain. Jour. Tokyo Univ. Fish 45(2):173-177.
- 819 _____ and _____. 1959. Study on the response of *Trachurus japonicus* to air-bubbles. Jour. Tokyo Univ. Fish 45(2):195-203.

L

- 820 Lillie, R. S. and W. Cattell. 1925. The condition of activation of unfertilized starfish eggs by the electric current. Biol. Bull. XLIX(2):100-110.
Currents of water jetted at starfish eggs while developing produce deformed specimens.
- * Lynch, W. F. 1947. See Light.
- 821 Lyon, E. P. 1907. Results of centrifugalizing eggs. Archiv. f. Entw. Mech. 23:151-173.
Centrifugation determines the direction of cleavage in starfish and enchinoderm eggs.

M

- 822 Moehres, F. P. 1940. Untersuchungen über die frage der wahrnehmung von druckunterschiedendes Medirenes (Versuche an Bodenfischen). Zeitschr. Vergleich Physiol. 28 (1):1-42.
A good bibliography accompanies this paper which deals with the effects of light and pressure on fishes.
- 823 Morgan, T. H. and E. P. Lyon. 1907. The relation of the substances of the egg separated by a strong centrifugal force to the location of the embryo. Archiv. f. Entw. Mech. 24:147-159, 2 pls.
Centrifugation affects the cleavage of enchinoderm eggs.

P

- 824 Pardi, L. and F. Papi. 1953. Recherche sull'orientamento di *Talitrus saltator* (Montagu) (Crustacea-Amphipoda) I. L. orientamento durenico. Zeit. Vergl. Physiol. 35:459-489.
Regardless of the external effect *Talitrus* always orients toward the sea.
- 825 _____ and _____. 1953. Recherche sull'orientamento di *Talitrus saltator* (Montagu) (Crustacea-Amphipoda). II. Sui fattori che regolano la variagone dell' antamento di notte. L'orientamento diurno di altre popolazioni. Zeit. Vergl. Physiol. 35:490-518.
Similar to 824.
- 825 Phelps, A. 1941. Observation on fouling of test panels at Port Aransas, Texas. Interim Rept. to Bur. Ships, Feb. 15, 1941, pp. 1-11.
Fast water currents affect the setting rate of barnacles.

R

- 827 Regnard, P. 1884. Recherches experimentales sur l'influence des tres nautes pressions sur les organismes oivante. Compt. Rend. Acad. Sci. 98:745-747.

S

- 828 Smith, F. G. W. 1943. Publication note on the use of a rotating disc as an accelerated test of resistance to erosion. Paper 15. Studies of Biol. of Fouling. Woods Hole Oceanog. Inst. Rept., Vol. 2, 7th Rept.
Revolving 14 inch discs kept off all organisms except *Mogula*.
- 829 _____. 1944. The use of rotating discs in an accelerated method of testing erosion of anti fouling paints. Interim Rept. II, Bur. Ships, U.S. Navy, Vol. 1.
Similar to 828.
- 830 Spooner, G. B. 1911. Embryological studies with the centrifuge. Jour. Exp. Zool. 10: 23-49.
Cyclops subjected to a centrifugal force readily broke up.

W

- 831 Ward, J. W., L. H. Montgomery and S. L. Clark. 1948. A mechanism of concussion: a theory. Science 107:349-353.
- * Warner, L. H. 1932. See Sound.

Radiation: Atomic

A

- 832 Africk, D. L., P. E. Novak and J. O. Blomeke. 1957. Radioactive waste treatment and disposal - a bibliography of unclassified literature. Oak Ridge Nat. Lab.
A good bibliography.
- 833 Agranot, V. Z. 1958. Spread and dynamics of accumulation of Polonium-210 in the tissues of fish. *Gigiena i Sanit.* 23(10):73-76.
- 834 Amano, K., H. Tozawa and A. Takase. 1955-56. Radioactivity in certain pelagic fish. IV. Separation and confirmation of Radioiron in skipjack. *Nippon Suisangaku Kaishi* 51:1261-1268.
- 835 _____, K. Yomada, M. Bito, A. Takase and S. Tanaka. 1955. Radioactivity in the pelagic fish. I. Distribution of radioactivity in various tissues of fish. *Jap. Soc. Sci. Fish Bull.* 20:907-915;838-848. (In Japanese).
Soft body parts were most contaminated.
- 836 Anghileri, L. J. 1959. Estado de contaminación del *Prochilodus platensis* (Sabalo) con productos de fisión. Rept. 15, U.N.Sci. Comm. (A/AC.82/G/Z311) Argentina, Comisión Nacional de Energía Atómica, Buenos Aires.
- 837 Anon. 1948. An international bibliography on atomic energy scientific aspects. United Nations Atomic Energy Comm. Vol. 2(24, 282 items) and Suppl. 1(8, 231 items), Suppl. 2 (7, 997 items).
- 838 _____. 1954. Nuclear fission and radioactive fish. *Atomica* 5:298.
Counters were used to clear tuna for the commercial market.
- 839 _____. 1955. Conference of the Academy of Sciences of the USSR on the peaceful uses of atomic energy, July 1-5, 1955. English Transl. of Akad. Nauk SSSR vi., Biol. Sci. Sec. pp. 1-192, Tech. Sec. pp. 1-193, Physics and Math. pp. 1-259.
A general discussion.
- 840 _____. 1955. International conference on the peaceful uses of atomic energy, Geneva 1955. U.N. Doc. A/Conf.8/P.
A discussion paper.
- 841 _____. 1955. Radioisotope uptake in marine organisms with special reference to the passage of such isotopes as are liberated from atomic weapons through food chains leading to organisms utilized as food by man. Ann. Rept. 1954-55, (A. E. C. U-3079), 47 pp.
A good review of the uptake of radioactivity and its fate in food chains. If one monitors the caudal fin (external) of tuna it gives a good picture of the entire Sr⁸⁹ content.
- 842 _____. 1955. Radiobiological resurvey of Rongelap and Ailinginae Atolls, Marshall Islands, Oct.-Nov. 1955. U.S. Atomic Energy Comm. Rept. UWFL-43, Dec. 30.
- 843 _____. 1956. The biological effects of atomic radiation. Summary reports from a study by the National Academy of Science. Nat. Acad. Sci. Nat. Res. Council 14:1-108.
- 844 _____. 1956. The determination of Alpha and Beta activities in mussels and other invertebrates. U.K. Atomic Energy Authority, Industrial Group H.Q., Risley Lams, England. 2 pp. (IGO-AM/W-34).
- 845 _____. 1956. Oceanography, fisheries and atomic radiation. *Science* 124(3210):13-16.
- 846 _____. 1956. (Studies on the radioactive marine organisms (especially *Katsuwonus vagans*) caused by nuclear detonation). Jour. Fac. Sci. Prefec. Univ. Mie, Japan, 2(2): 43-96.
An excellent review of the problems of radioactivity and contamination.
- 847 _____. 1957. Radiation effect on fish - new study. *Atomic* 8(2):38.
A 5 year study of radioactivity and its effects to fishes.
- 848 _____. 1959. Radioactive waste disposal from nuclear powered ships. Nat. Acad. Sci., Nat. Res. Council, Publ. 658:1-52.
A review of where to put waste and how to safeguard it from leakage and contamination of food organisms of the sea.
- 849 _____. 1959. Radioactive contamination in fisheries products. Rept. of Sub-Comm. III. 16 pp. (FAO/59/12/8852); Recommendations 5 pp. (FAO/59/12/8887); Addition to Rept. of Sub-Comm. III. Fisheries 1 pp. (FAO/59/12/8888).

B

- 850 Bartsch, A. F., R. H. Drackman and E. F. McFarren. 1959. Report of a survey of the fish poisoning problem in the Marshall Islands. U.S. Dept. Health, Educ. and Welfare, Wash.
A review of what species of fish were contaminated with activity.
- 851 Berner, L., R. Bieri, E. D. Goldberg, DeC. Martin and R. L. Wisner. 1956. Field studies of uptake of fission products by marine organisms. In: Effects of Nuclear Explosion on Mar. Biol. pp. 126-146.

- 852 Bidwell, K. W. E. and E. E. Foremar. 1957. Distribution of strontium-90 in pond weed and fish. *Nature* 180:1195-1196.
Fish absorbed strontium into the flesh while *Myriophyllum spicatum* concentrates it at the nodes.
- 853 Bieri, R. 1956. Zooplankton investigations. In: *Effects of Nuclear Explosion on Mar. Biol.* pp. 21-38.
- 854 Bogoiavlenskaia, M. P. 1959. Izuchenie kaltsievovo obmena s tshiu ispolzovaniia Ca^{45} v karbestve metki dla ryb. (A study of calcium metabolism with a view to utilizing Ca^{45} as a mark for fish). *Vsesoiuznyi N. - I. Inst. Morskovo Rybnovo Khoziaistvoi Okeanografii (NNIRO)* 55 pp. (Transl. No. 276, *Fish. Res. Bd. Can.*).
 Ca^{45} in young carp was absorbed through gill filament covers (69-88%) and mucous of mouth (12-31%). In mirror carp most Ca passes through the skin than in mirror carp above. In 24 hours most will be deposited in bones. Only 35-350 microcurie were used per liter. After one year absorption the level will be 15-20% of background level. Sturgeon do the same but at higher level. Uptake in both is a physiological phenomenon.
- 855 Bonham, K. 1958. Radioactivity of invertebrates and other organisms at Eniwetok Atoll during 1954-55. Jan. 6, 1958. (UWFL-53). 55 pp. (A.E.C. files).
- 856 Boroughs, H., W. A. Chipman and T. R. Rice. 1957. Laboratory experiments on the uptake, accumulation and loss of radionuclides by marine organisms. In: *The Effects of Atomic Radiation on Oceanog. and Fish. Nat. Acad. Sci. - Nat. Res. Council Publ.* 551:80-87.
An excellent paper. Crabs, clams and fish all pick up Sr^{89} . All body parts and the percent pickup are discussed.
- 857 _____ and D. Reid. 1957. The role of the blood in the transportation of strontium 90 - yttrium 90 in fish. *Anat. Rec.* 128(3):524.
- 858 _____, S. J. Townsley and W. Ego. 1958. The accumulation of Y^{90} from an equilibrium mixture of Sr^{90} - Y^{90} by *Artemia salina*. *Limnol. and Oceanog.* 3(4):413-417.
- 859 _____ and R. W. Hiatt. 1956. Method of predicting amount of strontium-89 in marine fishes by external monitoring. *Science* 129(3230):1027-1028.
- 860 _____ and _____. 1956. The metabolism of radionuclides by marine organisms. I. The uptake accumulation and loss of strontium 89 by fishes. *Biol. Bull.* 111(3):336-351.
Areas supplied with ample blood retained less radioactivity than those poorly supplied. *Tilapia* excretion of radioactive material is slower, 3 times more was found in the trunk muscles than in those of other fishes.
- 861 _____ and _____. 1956. The metabolism of radionuclides by marine organisms. II. The uptake, accumulation and loss of yttrium 91 by marine fish and the importance of short-lived radionuclides in the sea. *Biol. Bull.* 111(3):352-357.
Two percent of the absorbed radioactive material remained after 2 days in fish. There was a fear of food consumption.
- 862 _____ and _____. 1956. The uptake, accumulation and loss of strontium 89 by fishes. *Biol. Bull.* 111(3):336-351.
Large pelagic fishes excreted most Sr in a few hours. *Tilapia* holds Sr longer. Tuna holds a lot in the muscles; 3 times that of other fish.
- 863 _____ and _____. 1957. The metabolism of radionuclides by marine organisms. III. The uptake of calcium 45 in solution by marine fish. *Limnol. and Oceanog.* 2(1):28-32.
- 864 Borstel, R. C. and R. W. Rogers. 1958. Alpha-particle bombardment of the *Habrobracon* egg. II. Response of the cytoplasm. *Radiat. Res.* 8:248-253.

C

- 865 Carritt, D. E. 1959. Radioactive waste disposal into Atlantic and Gulf Coastal waters. *Nat. Acad. Sci. - Nat. Res. Council Publ.* 655:36 pp.
A discussion of the fears of haphazard disposal.
- 866 _____ and J. H. Harley. 1957. Precipitation of fission product elements on the ocean bottom by physical, chemical and biological processes. The effects of atomic radiation on oceanography and fisheries. *Nat. Acad. Sci. - Nat. Res. Council Publ.* 551:60-68.
A good review.
- 867 _____, et al. 1958. The feasibility of the disposal of low level radioactive wastes into inshore waters of the Atlantic and Gulf Coasts of the U.S. Mimeo Rept. to Nat. Acad. Sci. Nat. Res. Council. Comment on Oceanog. 36 pp. / 10 app.

- 868 Chakravarti, D. and T. Joyner. 1959. Potassium as an index of naturally occurring radioactivity in tuna muscle. (UWFL-60) 11 pp. No difference in radioactivity content was found in light or dark meat of tuna.
- 869 Chavin, W. 1956. The poid distribution and function in the goldfish *Carassius auratus* L. determined by the uptake of tracer doses of radioiodine. *Anat. Rec.* 124(216):272. An abstract. The kidney of the goldfish took up more radioactive iodine than any other organ.
- 870 Chipman, W. A. 1956. Passage of fission products through the skin of tuna. U.S. Fish & Wildl. Serv. Spec. Sci. Rept. 167:1-6. In 4 days the skin and muscle content possessed equal amounts of radioactive particles.
- 871 _____. 1958. Biological accumulation of radioactive materials. *Proc. 1st Ann. Texas Conf. on Utilization of Atomic Energy*, Misc. Publ. Texas Eng. Exp. Sta. pp. 36-41. Most radioactive materials were deposited in the soft tissues.
- 872 _____. 1959. The use of radioisotopes in studies of the food and feeding activities of marine animals. *Publ. Staz. Zool. Napoli* 31 Suppl. (154-175).
- 873 _____. 1959. Accumulation of radioactive pollutants by marine organisms and its relation to fisheries. *Tr. 2nd Session on Biol. Problems in Water Pollution*. U.S. Publ. Health Serv., Cincinnati, Ohio. 71 pp. A call to attention to the organisms that may become radioactive and the value of their loss as food.
- 874 _____. 1959. Accumulation of radioactive materials by fishery organisms. *Proc. 11th Ann. Meeting Gulf and Carib. Fish. Inst.* pp. 97-110. Fish are quick to take up and concentrate radioactive substances.
- 875 _____. 1959. Disposal of radioactive materials and its relation to fisheries. *Proc. Nat. Shellfish. Assoc.* 49:1-12. Discussion of disposal and its effects.
- 876 _____. 1960. Biological aspects of disposal of radioactive wastes in marine environments. In: *Disposal of Radioactive Wastes*, Internat. Atomic Energy Agency, Vienna. pp. 1-15. Abstr. in English, French, Russian and Spanish.
- 877 _____ and J. G. Hopkins. 1954. Water filtration by the bay scallop *Pecten irradians* as observed with the use of radioactive plankton. *Biol. Bull.* 107:80-81.
- 878 _____, T. R. Rice and T. J. Price. 1958. Uptake and accumulation of radioactive zinc by marine plankton, fish and shellfish. *U.S. Fish & Wildl. Serv. Fish. Bull.* 58(135):279-292.
- 879 Clements-Merlini, Margaret. 1960. The secretory cycle of Iodoproteins in *Ammocoetes*. 1. A radioautographic time study of the sub-pharyngeal gland. *Jour. Morph.* 106(3):337-342, 7 pls. Sea lampreys injected with I^{131} picked it up and deposited it in the lining of epithelial cells of the sub-pharyngeal glands of ammocoetes.
- 880 _____. 1960. The secretory cycle of Iodoproteins in *Ammocoetes*. II. A radioautographic study of the transforming larval thyroid gland. *Jour. Morph.* 106(3):357-359, 4 pls. Sea lampreys placed in an I^{131} solution deposited it in their subpharyngeal glands, in transforming individuals. This varied according to the stage of transformation.
- 881 Coopey, R. W. 1948. The accumulation of radioactivity as shown by a limnological study of the Columbia River in the vicinity of Hanford Works. *Prel. Rept. Nov. 12, 1948*, 14 pp. (HW-11662).
- 882 _____. 1953. The abundance of the principal crustacea of the Columbia River and the radioactivity they contain. (HW-25191), 13 pp. (A.E.C. files). Astarid crustaceans picked up P^{32} from food which was tagged with this isotope.
- 883 _____. 1954. The abundance of the principal crustacea of the Columbia River and the radioactivity they contain. *Biol. Res. Ann. Rept. for 1953*, pp. 14-15. (HW-30437).
- 884 Craig, H. 57. Disposal of radioactive wastes in the ocean: the fission product spectrum in the sea as a function of time and mixing characteristics. The effects of atomic radiation on oceanography and fisheries. *Nat. Acad. Sci. Nat. Res. Council Publ.* 551:34-42. A good discussion of the diffusion rate of radioactive materials in the sea.
- 885 _____. 1957. Isotopic tracer techniques for measurement of physical and chemical processes in the sea and the atmosphere. The effects of atomic radiation on oceanography and fisheries. *Nat. Acad. Sci. Nat. Res. Council Publ.* 551:103-120.
- 886 Davis, J. J. and C. L. Cooper. 1951. Effect of Hanford Pile effluent upon invertebrates in the Columbia River. (HW-2005 Del.). 85 pp. Midges concentrate the most radiation substances, 4.4×10^{-3} microcurie grams per wet weight.

- 887 _____, R. W. Coopey, D. G. Watson, C. C. Palmeter and C. L. Cooper. 1951. The radioactivity and ecology of aquatic organisms of the Columbia River. Biol. Res. Ann. Rept. for 1951, pp. 19-29. (HW-25021). Highest concentration and occurrence of radioactivity was in the reservoir while the lowest was below Bonneville Dam. Plankton picked up the most radioactivity, fish the least.
 - 888 _____ and R. F. Foster. 1958. Bioaccumulation of radiostopes through aquatic food chains. Ecol. 39(3):530-535.
 - 889 _____, R. W. Perkins, W. C. Hansen and J. F. Cline. 1954. Radioactive materials in aquatic and terrestrial organisms exposed to reactor effluent water. Indus. Radioactive Waste Disposal. Hearings before the Spec. Sci. Comm. on Rad. Joint Comm. on Atomic Energy, Congr. of U.S. 2:1103-1115.
 - 890 _____, _____ and _____. 1958. Radioactive materials in aquatic and terrestrial organisms exposed to reactor effluent water. Proc. 2nd Internat. Conf. Peaceful Uses Atomic Energy 18:423-428.
 - 891 Donaldson, L. R. and R. F. Foster. 1957. Effects of radiation on aquatic organisms. Effects of atomic radiation on oceanography and fisheries. Nat. Acad. Sci. Nat. Res. Council Publ. 551:96-102.
A good review of the subject.
 - 892 _____, A. H. Seymour and J. R. Donaldson. 1957. Radiological analysis of biological samples collected at Eniwetok, May 16, 1948. A.E.C. Rept. (UWFL-18) 11 pp.
 - 893 _____, _____, E. E. Held, N. O. Hines, F. G. Lowman, P. R. Olson and A. D. Welander. 1956. Survey of radioactivity in the sea near Bikini and Eniwetok Atolls June 11-21, 1956. Univ. Wash. Applied Fish. Lab. Rept. UWFL-46, 39 pp.
 - 894 _____, _____, A. D. Welander and K. Bonham. 1947. Concentration of active materials by hydroids in the Bikini Lagoon during the summer of 1947. A.E.C. Rept. (UWFL-11) 9 pp.
Plumularidae - uptake radioactive substances in great quantities.
 - 895 Duggar, B. M. 1936. Biological effects of radiation. McGraw Hill Co., N.Y., 1st Ed. X + 676 pp.
A good review of the subject.
 - 896 Dunham, C. L. 1960. Marine sciences research. Div. of Biol. and Med. (U.S. Atomic Energy Comm.), TID-404D, 46 pp. Jan.
Discusses projects and contracts in radioactivity and biology.
 - 897 Dunster, H. J. 1956. The discharge of radioactive wastes into the Irish Sea. Pt. 2. The preliminary estimate of the safe daily discharge of radioactive effluent. Proc. 1st Conf. on Peaceful Uses of Atomic Energy, Geneva, 1955, 9:712-715.
- E
- 898 Ellinger, F. and R. Gross. 1941. Depth dosage measurements by means of goldfish. Radiology 37(6):717-721.
 - 899 Epshtein, Ya. A. and N. F. Lavroskaya. 1959. Effect of ionizing radiation on the protein metabolism of fish. Biokhimiia (Transl.) 24(4):549-555.
 - 900 Evans, R. D. 1946. The use of radioactive traces in biology. Growth 10 (Suppl. 6 Symposium):5-6.
- F
- 901 Finn, D. B. 1957. Radio-activity and world fisheries. Bull. Internat. Oceanog. Found. 3(3):180-186.
A review.
 - 902 Floyd, D. J. 1952. Food and feeding of oysters as observed with the use of radioactive plankton. Proc. Nat. Shellfish. Assoc. pp. 171-180.
Oysters sort out tagged plankton by size, shape and abundance of food.
 - 903 Folsom, T. R. and J. H. Harley. 1957. Comparison of some natural radiations received by selected organisms. Nat. Acad. Sci. Nat. Res. Council Publ. 551:28-34.
Fish experience 50% reduction in natural radiation when one goes 100 meters away from the source.
 - 904 _____ and A. C. Vine. 1957. On the tagging of water masses for the study of physical processes in the oceans. Effects of atomic radiation on oceanography and fisheries. Nat. Acad. Sci. Nat. Res. Council Publ. 551:121-132.
Good labeling experiments to see prolonged effects which can be detected for weeks.
 - 905 Foster, R. F. 1946. Some effects of pile area effluent water on young chinook salmon and steelhead trout. A.E.C. Rept. (HW-7-4759) 100 pp.
 - 906 _____ and J. J. Davis. 1955. The accumulation of radioactive substances in aquatic forms. Proc. Internat. Conf. for Peaceful Uses of Atomic Energy 13(P/280):364-367.
A review.

- 907 _____ and _____. 1956. Accumulation of radioactive materials in aquatic forms. Proc. Internat. Conf. on Peaceful Uses of Atomic Energy. 1st Conf., Geneva, 13:364-367.
Fish uptake material easier when water tests highest in radioactivity.
- 908 _____ and P. A. Olson, Jr. 1953. Effect of reactor effluent water on young silver salmon. A.E.C. Rept. (HW-28636) 189 pp.
Encompassed all gear papers in this volume.
- 909 Fraga de Azevedo, J. and F. Carvao Gomes. 1956. L'action biologique de la radiation gamma sur des mollesques d'eau douce. (The biological action of gamma radiation on fresh water mollusks). Soc. Pathol. Exot. Bull. 49(5):917-921.
- 910 Fretter, V. 1953. Experiment with strontium 90 on certain mollusca and polychaetes. Jour. Mar. Biol. Assoc., U.K., 32:367-384.

G

- 911 Gajewskaya, N. 1923. Der einfluss der Röntgenstrahlen auf *Artemia salina*. Verh. Int. Vereinig. Limnologie Stuttgart, 1:359-362, 5 figs.
A general experiment on total lengths attained after radiation.
- 912 Gong, J. K., W. H. Shipman, H. V. Weiss and S. H. Cohn. 1957. Uptake of fission products and neutron induced radio-nuclides by the clam. Proc. Soc. Exp. Biol. Med. 95:451-454.
- 913 Gorbman, A. and C. W. Creaser. 1942. Accumulation of radioactive iodine by the endostyle of larval lampreys and the problem of homology of the thyroid. Jour. Exp. Zool. 87:391-401.
The use of radioactive iodine to show that it is localized in the endostyle of lampreys.

H

- 914 Hansborough, L. A. and D. Denny. 1951. Distribution of phosphorus ³² in the embryo and larvae of the frog. Prog. Soc. Exp. Biol. Med. 78:437-441.
Exposure to 65,300 and 550 millicuries of ³²P was deposited in the digestive tract. The amount increased with the age of the embryo.
- 915 Harada, Y., Alt T. Ai and S. Kondo. 1959. Radiation effects on germcells of rainbow trout. 3rd Jap. Conf. on Radioisotopes, 1 pp. (JalF, JR1A-59/P-89, A-28).

- 916 Hayes, F. R. and L. H. Jodrey. 1952. Utilization of phosphorus. Physiol. Zool. 25: 134-144.
The peak absorption was in 1-2 hours. After 52 days trout still retained 66% of the phosphorus.
- 917 Healy, J. W. 1946. Accumulation of radioactive elements in fish immersed in pile effluent water. Feb. 27, 1946. A.E.C. Rept. (HW-3-3442) 9 pp.
- 918 _____. 1958. Research and development activities in the field of radiological science. Quart. Prog. Rept. for Oct.-Dec. 1957. A.E.C. Rept. (HW-54938) 43 pp.
Papers on varied topics.
- 919 Hielbrunn, L. V. and D. Mazia. 1936. The action of radiations on living protoplasm. In: Biol. Effects of Radiation, McGraw Hill, N.Y., 1st Ed., pp. 625-676.
Excellent review of the literature.
- 920 Helfrich, P. 1960. A study of the possible relationship between radioactivity and toxicity in fishes from the central Pacific. Univ. Hawaii Mar. Lab. (TID-5748), 17 pp.
- 921 Herde, K. E. 1946. Studies in the accumulation of radioactive elements in *Oncorhynchus tshawytscha* (chinook salmon) exposed to a medium of pile effluent water. A.E.C. Rept. (M-4130; HW3-5064), 21 pp.
Absorption greatest in the first 6 hours of exposure. Peak in 48 hours, then a slight decline for 24 hours with leveling thereafter.
- 922 _____. 1948. A one year study of radioactivity in Columbia River fish. A.E.C. Rept. (HW-11344), 11 pp.
The bones of fishes contained the greatest concentrations of radioactivity.
- 923 Hevesy, G. 1945. Rate of renewal of the fish skeleton. Acta. Physiol. Scandinav. 9:234-247.
In sticklebacks the uptake of ³²P is not different if a supply of O₂ is present. One gram fish in 16 days took up 1/40,000 parts of P₂ = 2.10⁻⁵ mg/l.
- 924 Hiatt, R. W., et al. 1954-55. Radioisotope uptake in marine organisms with special reference to the passage of such isotopes as are liberated from atomic weapons through food chains leading to organisms utilized as food by man. Univ. Hawaii Mar. Lab. Ann. Rept. to U.S.A.E.C., Prog. No. AT(04-3)56.
See references 859-863.
- 925 Hibiya, T. and T. Yagi. 1957. Effects of fission materials upon the development of aquatic animals. Research on the effects and influences of the nuclear bomb tests. Jap. Soc. Prom. Sci. pp. 1219-1224.

- 926 Higgins, E. 1950. Radioactive wastes and their significance in stream ecology. Tr. Am. Fish. Soc. 79:217-232.
An early paper calling attention to the hazards of radioactive dumping into the Tennessee and Clinch River systems and its possible effects on the life therein.
- 927 _____. 1957. Atomic radiation hazards for fish. Jour. Wildl. Mgt. 15(1):1-12.
- 928 Hinricks, M. A. 1928. Modification of development on the basis of differential susceptibility to radiation. 1. *Fundulus heteroclitus* and ultraviolet radiation. Jour. Morph. and Physiol. 41:239-265.
Early stages of developing *Fundulus* were not affected.
- 929 Hiyama, Y. 1956. Fission products in water area and aquatic organisms. A.E.C. Rept. (A/AC.82/G/R.4(Pt.8)). Japan.
- 930 _____. 1957. Maximum permissible concentration of Sr-90 in food and its environment. Records of Oceanog. Work in Japan 3(1):70-77.
Radiation levels for sea water and organisms therein are set.
- 931 _____ and R. Ichikawa. 1956. Movement of fishing grounds where contaminated tuna were caught. Jap. Soc. Prom. Sci. pp. 1956-1979.
- 932 _____ and _____. 1957. Uptake of strontium by marine fish from the environment. Records Oceanog. Works Japan, 3 (1):78-84.
Bones and body parts were best areas for deposition.
- 933 _____, M. Shimizu, J. Matsubara, T. Asari, T. Arika and R. Ichikawa. 1960. Sr-90 in marine organisms in Japan. Pts. 9-12 of Radioactive Contamination of Marine Products in Japan, 38 pp. Tokyo Univ. Hongo Fish. Inst. Rept. to A.E.C. (A/AC/82/G/L-394; NP-8862).
- 934 Hooper, F. F., H. A. Podoliak and S. F. Snieszko. 1960. Use of radioisotopes in hydrobiology and fish culture. Tr. Am. Fish. Soc. 90(1):49-57.
- 935 Hori, R. 1959. The uptake of radioactive calcium by eggs of the fish, *Oryzias latipes*. 3rd Japan Conf. on Radioisotopes, 1 pp. A. E. C. Rept. (JAIF, JRIA59/P/202, P-1).
- I
- 936 Ichikawa, R. 1960. Strontium-calcium discrimination in the rainbow trout. Records of Oceanog. Works in Japan 5(2):120-131.
With labeled water rainbow trout discriminates against strontium in preference to calcium.
- 937 _____ and Y. Hiyama. 1959. Deposition and radiostrontium to the various tissues of jack mackerel, mackerel and tuna. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Uneo, Tokyo, Japan Soc. Prom. Sci. pp. 1143-1155.
In tuna and mackerel the soft tissues were most affected by radiation.
- 938 _____ and _____. 1957. The uptake of strontium by marine fish from various concentrations of calcium and strontium in the environment. Records Oceanog. Works Japan 4:55-66.
See 936.
- K
- 939 Karzinkin, G. S., E. V. Soldatova and I. A. Shakhanova. 1959. Nekotorye rezultaty massovovo mekhanizma radioaktivnykh fosforom "nestandardnoi" molodi osetra. (Some results of mass marking of "non standard" sturgeon fingerlings by means of radioactive phosphorus. Migratsii Zhivotnikh 1:27-40. Akad. Nauk SSSR. Transl. No. 279 Fish. Res. Bd. Can. 1960.
- 940 Kawabata, T. 1954. Radiological contamination of fishes. Kagaku 24:617-622. (In Japanese).
Another uptake paper.
- 941 _____. 1955. Radiologic contamination of fish. I. Distribution and migration of contaminated fish on basis of the compiled data of radiological surveys. Japan Jour. Med. Sci. and Biol. 8:337-346.
Similar to 940.
- 942 _____. 1955. Radiologic contamination of fish. II. Actual state of radiologic contamination in fish and its possible routes on the basis of the findings of the "Bikini Expedition." Japan Jour. Med. Sci. and Biol. 8:347-358.
Similar to 940.
- 943 _____. 1955. Radiological contamination of fish. III. Radiochemical studies of contaminated fish. Japan Jour. Med. Sci. and Biol. 8:359.
Similar to 940.
- 944 _____. 1956. Radiochemical studies of contaminated fish. Vol. II of Res. in Effects and Influences of the Nuclear Bomb Test Explosions, pp. 861-874. Ueno, Tokyo, Jap. Soc. Prom. Sci.
- 945 _____. 1960. Radionuclides in tissues and organs of the Pacific tunas. p.38 of radioactive contamination of marine products in Japan. 38 pp. A.E.C. Rept. (A/AC/82/G/L-394; NP-8862).
Similar to 940.

- 946 Keishi, A., H. Tozawa and A. Takase. 1956. Studies on the radioactivity of certain pelagic fish. IV. Separation and confirmation of radioiron in skipjack. Jap. Soc. Sci. Fish. Bull. 21(12):1261-1268. (In Japanese with English summary).
- 947 Ketchum, B. H. 1957. The effects of the ecological system on the transport of elements in the sea, the effects of atomic radiation on oceanography and fisheries. Nat. Acad. Sci. Nat. Res. Council Publ. 551:52-59.
- 948 _____ and V. T. Bowen. 1954. Biological factors determining the distribution of radioisotopes in the sea. Indus. Radioactive Waste Disposal. Hearings before the Spec. Sci. Comm. on Rad. Joint Comm. on Atomic Energy Congr. of U.S., 2:1417-1427.
- 949 _____ and _____. 1958. Biological factors determining the distribution of radioisotopes in the sea. Proc. 2nd Internat. Conf. Peaceful Uses Atomic Energy (Geneva) No. (UN402-01C 724); 11 pp. Contr. 968, Woods Hole Oceanog. Inst. 18:429-433.
Radioactive food chains are discussed and their effects on man.
- 950 Kiba, T., S. Ohaski, M. Shibata and T. Mizube. 1954. Radioactive substances found on the contaminated fish. Jap. Analyst 3:361-363. (AEC-Tr-2104). pp. 55-60 of Analysis of the Bikini Ash (Spec. Coll. pap.). 75 pp.
Levels of radioactivity were measured from fish sampled at Bikini.
- 951 Kikuchi, T., H. Goto, T. Koni, S. Fujioka, T. Sano, T. Matsuki, M. Watanabe, M. Fujio, H. Okagi and G. Wakisaka. 1954. The contamination of the fishes caught by the No. 5 Fukuryu Maru and the food manufactured from these fishes. Bull. Inst. Chem. Res. Kyoto Univ. Suppl. pp. 35-38.
- 952 Kirpichnikov, V. S., A. N. Svetovidov and A. S. Troskin. 1938. Mechanizma karpov radioaktivnymi izotopami fosfora i kaltsiya. (Marking carp by means of radioactive isotopes of phosphorus and calcium). Dokl. AN SSSR, 3(1):10 pp.
- 953 Klement, A. W., Jr. and I. E. Wallen. 1960. A selected list of references on marine and aquatic radiobiology. U.S. Atomic Energy Comm. Div. Biol. and Med., May 20, 1960. pp. 1-42. (TID-3903).
A bibliography.
- 954 Knobf, V. I. 1951. Studies of radioactivity in fish from White Oak Lake and the Clinch River. Oak Ridge Nat. Lab. ORNL-1031, 39 pp.
Some fish were "hot" 13.3 miles downstream from the contaminating source.
- 955 Korringa, P. 1960. Problems arising from disposal of low-activity radioactive waste in the coastal waters of the Netherlands. In: Disposal of Radioactive Wastes. Internat. Atomic Energy Agency, Vienna. pp. 51-56.
A general discussion of plans for Holland.
- 956 Krumholz, L. A. 1954. A summary of findings of the ecological survey of White Oak Creek, Roane County, Tennessee, 1950-53. U.S. Atomic Energy Comm. Tech. Inf. Serv. No. ORO-132.
The fauna and numbers of organisms changed, with time, with radioactive contamination.
- 957 _____. 1956. Observation on the fish population of a lake contaminated by radioactive wastes. Bull. Am. Mus. Nat. Hist. 110 (A 4):227-368.
An excellent paper which discusses the disappearance of redhorse suckers and white crappies. Growth slowed with generally shorter life spans the result of contamination.
- 958 _____ and R. F. Foster. 1957. Accumulation and retention of radioactivity from fission products and other radiomaterials by fresh-water organisms. The effects of atomic radiation on oceanography and fisheries. Nat. Acad. Sci. Nat. Res. Council. Publ. 551:88-95.
An excellent review of this subject plus an outlook for the future.
- 959 _____, E. D. Goldberg and H. A. Boroughs. 1957. Laboratory experiments on the uptake, accumulation and loss of radionuclides by aquatic organisms. The effects of atomic radiation on oceanography and fisheries. Nat. Acad. Sci. Nat. Res. Council Publ. 551:69-79.
Similar to 958.
- 960 Kunasheva, K. G. 1944. (The amount of radium in plants and animals). Trav. Lab. Biogeochem USSR 7:98.
Good reference to literature on fish, barnacle uptake levels. The barnacle took up the most.
- 961 Kuroki, T. and T. Tague, 1955. II. On the radioactivity of fishes, planktons and sea water in the sea off Kagoshima. Mem. Fac. Fish. Kagoshima Univ. 4:143-150. (In Japanese with English summary).
A good paper. The liver, spleen and kidney had high radioactive levels. Tail wasting was used as an index of intensity in billfish and tunas.

L

- 962 Lackey, J. B. 1958. The suspended microbiota of the Clinch River and adjacent waters in relation to radioactivity in the summer of 1956. Fla. Univ. Eng. and Indus. Exp. Sta. Tech. Pap. 145:1-23, A1-10, 1957.
- 963 LaRoche, C. and C. P. Leblond. 1954. Destruction of thyroid gland of Atlantic salmon (*Salmo salar* L.) by means of radioiodine. Proc. Soc. Exp. Biol. and Med. 87:273-276.
Salmon with I^{131} may not survive in high water temperatures.
- 964 Lear, D. W., Jr. and C. H. Openheimer, Jr. 1956. Biological removal of radioisotopes of Sr^{90} and Y^{90} from sea water by marine microorganisms. In: Effects of Nuclear Explosion of Mar. Biol. pp. 60-94.
In evaluating the uptake of radioactive substances the filtration method using molecular filters to separate bacteria from media proved the most reliable method.
- 965 Lin, T. P. and E. D. Goldberg. 1951. Accumulation of radioiodine in the thyroid gland of Elasmobranchs. Endocrinology 48:485-488.
In sharks 400 microcuries of I^{131} affects the ribonucleic acid which yields DNA.
- 966 Lovelace, F. E. and H. A. Podoliak. 1952. Absorption of radioactive calcium by brook trout. Prog. Fish Cult. 14(4):154-158.
Uptake was greater during first 12 hours of immersion than later. Increasing the activity of the aquarium water to 10,000 counts per minute didn't increase the amount of the element uptake per gram of fish. After absorption - distribution before deposition is by the blood stream.

M

- 967 Marshall, S. M. and A. P. Orr. 1957. Feeding and digestion in marine copepods. Abstr. 137 Internat. Conf. on Radio Isotopes in Sci. Res. U.N. Ed. Sci. and Cult. Org. Paris. Sept.
- 968 Martin, DeC., Jr. 1957. The uptake of radioactive wastes by benthic organisms. Pap. presented at 9th Pacific Sci. Congr. Bangkok Thailand.
- 969 _____ and E. D. Goldberg. 1956. Uptake and assimilation of radiostrontium by Pacific mackerel. In: Effects of Nuclear Explosion Mar. Biol. (WT-1013) pp. 116-125.
- 970 McCoy, A. V. Tunison, M. Crowell and H. Paul. 1936. The calcium and phosphorus content of the body of brook trout in relation to age, growth and food. Jour. Biol. Chem. 114:259-263.
- 971 Mikami, Y., H. Watanabe and K. Takano. 1954. The influence of radioactive rain-water on the growth and differentiation of a tropical fish "Zebra Danio." Vol. II of Res. in Effects and Influences of the Nuclear Bomb Test Explosions, pp. 1225-1229.
Development of the Zebra fish is not affected if the dose rate is less than 4.2×10^4 microcurie per liter.
- 972 Miwa, M., H. Yamashita and K. Mori. 1939. Lethal action of Alpha rays on sea urchin eggs. Nature 144:378.
X-rays increase cleavage for a time, then all eggs died.
- 973 Miyake, Y. and K. Saruhashi. 1958. Distribution of man-made radioactivity in the North Pacific through summer 1955. Jour. Mar. Res. 17:383-389.
Radioactive materials moved in circles and was down to a level of 600 meters and was picked up by plankton.
- 974 _____ and Y. Sugiura. 1955. The radiochemical analysis of radionuclides in sea water collected near Bikini Atoll. Pap. in Meteorol. and Geophysics 6:33-37.
Another uptake paper.
- 975 Mori, T. and M. Saiki. 1954. Studies on the distribution of administered radioactive zinc in the tissues of fishes. Vol. II of Res. in Effects and Influences of the Nuclear Bomb Explosions, pp. 1205-1208.
In carp the kidney and scale took up most of the zinc. Meretrix in Zn^{65} lost 40% of the uptake material in 2 days.
- 976 _____ and _____. 1957. Radioactivity of fishes contaminated by nuclear-bomb test explosions with special reference to the nuclides. Nippon Nogei Kagaku Kaishi 31, A76-A86.
- 977 Morita, T., K. Saito and T. Genka. 1955. IV. On the inspection of radioactivity in the Equatorial Sea and the Coral Sea. Mem. Pac. Fish. Kagoshima Univ. 4:151-156. (In Japanese with English summary).
Many fishes, crustaceans and jellyfishes from these areas were contaminated and radioactive.
- 978 Munk, W. H., G. C. Ewing and R. R. Revelle. 1949. Diffusion in Bikini Lagoon. Tr. Am. Geophys. Union 30(1):59-66.
The rate of water uptake of radioactivity at Bikini and its possibly being picked up by food chains is discussed.

N

- 979 Nagasawa, K., Y. Kido and Y. Kashida. 1960. Radionuclides found in livers of tunas of the Pacific in 1958. In: Radioactive Contamination of Marine Products in Japan, pp. 1-2. (A/AC/82/G/L-394; NP-8862). Jap. Nat. Hygiene Lab., Tokyo. May.
- 980 Nakai, Z., R. Fukai, H. Tozawa, S. Hattin, K. Okubo and T. Kidachi. 1960. Radioactivity of marine organisms and sediments in Tokyo Bay and its southern neighborhood. In: Radioactive Contamination of Marine Products in Japan, pp. 18-38. (A/AC/82/G/L-394; NP-8862). Tokai Reg. Fish. Res. Lab. May.
- 981 Nakamura, H., H. Yabe, T. Kamuniura, Y. Yabuta, A. Suda, S. Uyeyanagi and H. Yananaka. 1954. The occurrence of the fishes contaminated with radioactivity according to the species of fishes. Vol. II of Res. in Effects and Influences of the Nuclear Bomb Test Explosions, pp. 1067-1078. Ueno, Tokyo, Jap. Soc. for Prom. Sci.
- 982 Nehru, Jawaharlal. 1958. Nuclear explosions and their effects. Publ. Div. Min. Inf. and Broadcasting Gov't. India, xvi + 276 / A1-64. All aspects of contamination are presented.
- 983 Neyfakh, A. A. 1956. The changes of radio-sensitivity in the course of fertilization in the loach *Misgurnus fossilis*. Doklady Akad. Nauk SSSR 109:943-946. (In Russian).
- 984 _____. 1956. Effect of ionizing radiation on gametes of the loach, *Misgurnus fossilis*. Doklady Akad. Nauk SSSR, 111:585-588. (In Russian).
- 985 _____ and N. N. Rott. 1958. Study of pathways of realization of radiation injuries in the early development of fishes. Doklady Akad. Nauk SSSR 83:921-924. (In Russian).

O

- 986 Obo, F. 1954. Radioactive rains and fishes in the Kagoshima area. Igaku to Seibutsugaku (Med. and Biol.) 33:19-23.
- 987 _____, C. Wakamatsu and Y. Hiwatashi. 1955. Radioactivity of fishes. IV. Analysis of fish ashes. Med. and Biol. (Jap.) 30:32-35.
- 988 _____, _____, T. Tamari, Y. Nakae and D. Tajima. 1955. Radioactivity of fish II. Igaku to Seibutsugaku 34:255-258.

- 989 Odum, E. P. and R. W. Bachmann. 1959. Uptake of Zn^{65} and primary productivity in marine benthic algae. Biol. Bull. 117(2):421. The use of Zn^{65} as a tool in algae is useful when following the fate of benthic foods or organisms in a food chain.
- 990 _____, E. J. Kuenzler and Sister Marion Xavier Blunt. 1958. Uptake of P^{32} and primary productivity in marine benthic algae. Limnol. and Oceanog. 3(3):340-345. A useful tool when studying the fate of food chains.
- 991 Oliveureau, Madeleine. 1957. Radiothyroïdectomie chez l'anguille (*Anguilla anguilla* L.). Arch. Anat. Micros. et Morphol. Exp. 46 (1):39-59.
- 992 _____. 1957. Presence d'iode lié organique dans certaines cellules endostylaires et dans la thyroïde. Comp. Rend. Bull. de l'Assoc. des Anatomistes. Bull. Assoc. Anat. 92:1113-1132 (1955). Radioactive I^{131} is picked up by the thyroid of lampreys. A good bibliography to other animals and radioactivity is given.
- 993 Olson, P. A., Jr. 1952. Observation on the transfer of pile effluent radioactivity to trout. Biol. Res. Ann. Rept. for 1951 (HW-25021), pp. 30-40. Snails and crabs picked up radioactive substances when dumped into a stream. These foods were the means by which carp and trout picked up the radioactivity.
- 994 _____ and R. F. Foster. 1951. Effect of pile effluent water on fish. Biol. Res. Ann. Rept. for 1951 (HW-25021), pp. 41-52. Effluent at 2% level was not injurious to chinook eggs. A loss did occur if the level was above 10%.
- 995 _____ and _____. 1952. Accumulation of radioactivity in Columbia River fish in the vicinity of the Hanford Works. A. E. C. Rept. (HW-23093), pp. 1-59. Most accumulation occurred in the scales, bones, fins and internal organs. The amount was dependent on the size of the fish, the feeding habits and metabolic rate.
- 996 _____ and _____. 1954. Reactor effluent monitoring with young chinook salmon. Biol. Res. Ann. Rept. for 1953 (HW-30137) pp. 24-35.
- 997 _____ and _____. 1955. Reactor effluent monitoring with young chinook salmon - 1954. In: Biol. Res. Ann. Rept. (1954), Biol. Sec. Radiol. Sci. Dgt. Gen. Elec. Hanford Atomic Products Operation (U.S.A.E.C. Doc. HW-35917, pp. 11-18. The growth rate of young chinook salmon was retarded and the mortality rate was up 5%.

- 998 _____ and _____. 1955. Effect of reactor area effluent water on chinook salmon fingerlings. Biol. Res. Ann. Rept. for 1954 (HW-35917), pp. 19-23.
Continuation of 997.
 - 999 _____ and _____. 1955. Effect of reactor area effluent water on migrant juvenile blueback salmon. Biol. Res. Ann. Rept. for 1954 (HW-35917), pp. 24-27.
Highest mortality occurred in a 2-1/2% effluent.
 - 1000 _____ and _____. 1956. Effect of chromic exposure to sodium dichromate on young chinook salmon and rainbow trout. Biol. Res. Ann. Rept. for 1955 (HW-41500).
Chromic content of 33% caused mortalities.
 - 1001 _____ and _____. 1957. Further studies on the effect of sodium dichromate on juvenile chinook salmon. Biol. Res. Ann. Rept. for 1956 (HW-47500), pp. 214-227.
Continuation of 1000.
 - 1002 Oppermann, K. 1913. Die entwicklung von forelleneieren nach befruchtung mit radiumbestrahlten samenfaden. Arch. Microsc. Anat. 83(2):141-189, pls. 5-7.
 - 1003 Orbell, L. A. 1955. Action of ionizing radiations on the animal organism. In: English Transl. of Akad. Nauk USSR, 6:15-19.
A general discussion.
 - 1004 Orton, Grace L. 1954. Fish eggs and larvae in pelagic-area-survey plankton samples 1954. In: Effects of Nuclear Explosion on Mar. Biol. (WT-1013), pp. 39-50.
- P
- 1005 Pendleton, R. C. 1956. Labeling animals with radioisotopes. Ecology 37(4):686-689.
 - 1006 _____ and W. C. Hanson. 1959. Absorption of Am-137 by components of an aquatic community. Gen. Elec. Co. Hanford Atomic Products Operation, Richland, Wash. (A/Conf. 15/P/392).
 - 1007 _____ and E. W. Swart. 1954. A study of the food relations of the least chub *Lotichthys phlegenthonis* (Cope) using radioactive phosphorus. Jour. Wildl. Mgt. 18(2):126-128.
Adult chubs were found to feed on small aquatic crustaceans which had been tagged with radioactive isotopes.
 - 1008 Postell, P. E. and H. E. Voren. 1953. Unclassified bibliographies of interest to the atomic energy program. Tech. Inf. Serv., Oak Ridge, vi / 56 pp. U.S.A.E.C. (TID-3043).
 - 1009 Pritchard, D. W. 1959. Factors affecting the dispersal of fission products in estuarine and inshore environments. Proc. 2nd Internat. Conf. on Peaceful Uses of Atomic Energy, held Sept. 1-13, Sess. D-19, pp. 410-413.
A discussion of how products would be dispersed in 4 types of estuaries, using models.
 - 1010 _____. 1959. Problems related to disposal of radioactive wastes in estuarine and coastal waters. Tr. 2nd Seminar on Biol. Problems in Water Pollution, held Apr. 20-24.
Discusses how and where pollutant would go and what kind should be thought of or maintained. Food chain information is given.
 - 1011 Prosser, C. L., W. Pervinsek, A. Jane, G. Svikle and P. C. Tonyshins. 1945. Accumulation and distribution of radioactive strontium, barium-lanthanum, fission mixture and sodium in goldfish. U.S.A.E.C., Oak Ridge, Tenn. MDDC-496 Tech. Info. Sec.
- R
- 1012 Revelle, R., et al. 1956. Oceanography, fisheries and atomic radiation. Science 124:13-16.
A general broad discussion of radioactive-biological interactions.
 - 1013 _____, et al. 1956. Nuclear Science and Oceanography. Proc. Internat. Conf. on Peaceful Uses of Atomic Energy, Geneva, 1955. P/277, 13:371. U.N., N.Y.
 - 1014 _____, et al. 1957. The effects of atomic radiation on oceanography and fisheries. Rept. of the Comm. on Effects of Atomic Radiation on Oceanography and Fisheries. Nat. Acad. Sci. Nat. Res. Council Publ. 551: 137 pp.
A general paper on the subject of radiation effects on biological systems.
 - 1015 _____ and M. B. Schaefer. 1959. Oceanic research needed for safe disposal of radioactive wastes at sea. 2nd U.N. Conf. Pergamon Press, London. Sess. D-19: P/2431, pp. 354-370.
/ review.
 - 1016 Rice, T. K. and R. J. Smith. 1958. Filtering rates of *Venus mercenaria* (L.) determined with radioactive plankton. U.S. Fish & Wildl. Serv. Fish. Bull. 56:73-82.
Determines filter rate with radioactive plankton. More water per gram of meat was filtered by small clams than by large.

- 1017 Rinehart, P. W., S. H. Cohn, J. A. Seiler, W. H. Shipman and J. K. Gong. 1955. Residual contamination of plants, animals, soil and water of the Marshall Islands one year following operation castle fallout. (USNRDZ-454) San Francisco, 39 pp.
 - 1018 Rosenthal, H. L. 1956. The uptake and turnover of calcium ⁴⁵ by the guppy, *Lebistes reticulatus*. Science 124:571-574.
Uptake of calcium ⁴⁵ was rapid with deposition in the bones. A good study.
 - 1019 _____. 1957. Uptake of calcium ⁴⁵ and strontium ⁹⁰ from water by fresh-water fishes. Science 126:699-700.
Freshwater fishes don't discriminate against the radioactive substance. Marine fishes do.
- S
- 1020 Sacki, A. and K. Sano. 1954. Absorption and metabolism of fission products in goldfish. Vol. II of Res. in Effects and Influence of the Nuclear Bomb Test Explosions, pp. 1105-1117. Ueno, Tokyo, Jap. Soc. Prom. Sci.
Radioactive material was absorbed via the gills in goldfish.
 - 1021 Saiki, M. 1957. On the radioelements of fishes contaminated by the nuclear bomb test. Bunseki Kagaku (Japan Analyst) 7(7):443-449.
 - 1022 _____, S. Orano and T. Mori. 1955. Studies on the radioactive material in the radiologically contaminated fishes caught at the Pacific Ocean in 1954. Jap. Soc. Sci. Fish. Bull. 20:902-906. (In Japanese).
Highest absorption was in the viscera, least in bones, skin and scales of dolphins and tunas. A good study.
 - 1023 _____, S. Yoshino, R. Ichikawa, Y. Hi-yama and T. Mori. 1956. Studies on the radioactivity of fishes caught from the Pacific Ocean in 1954. Vol. II of Res. in Effects and Influences of the Nuclear Bomb Test Explosions, pp. 825-838. Ueno, Tokyo, Jap. Soc. Prom. Sci.
Most active organs after uptake were liver, kidney, spleen, caeca, stomach and rectum.
 - 1024 Saito, K. and M. Sameshima. 1954. Studies on the radiologically contaminated fish caught at Kagoshima Sea region. Vol. II of Res. in Effects and Influences of the Nuclear Bomb Explosions, pp. 875-882. Ueno, Tokyo, Jap. Soc. Prom. Sci.
 - 1025 _____ and _____. 1955. I. Studies on the radiologically contaminated fishes caught at Kagoshima Sea region. Mem. Fac. Fish. Kagoshima Univ. 4:124-142. (In Japanese with English summary).
Radioactivity was concentrated in liver, kidney and spleen. A good comparison of the level of activity change with time.
 - 1026 Saurov, M. M. 1957. Radioactive contamination of fish in water containing strontium. (O Radioaktsionoi Zagryozhennosti Ryby pri Obityanii v Vode Sodruzhashchei Strontsiu). Transl. from Trudy Vsesoyuz. Konf. po Med. Radio. Voprosy Gigreny i Dozimetrii 66-73 (1957), 14 pp.
 - 1027 Scaper, A. 1904. Experimentelle untersuchungen über den einfluss der radium-strahlen und der radiumenation auf embryonale und regenerative entwicklungsvorgänge. Anat. Anz. 25:298-314, 326-337.
 - 1028 Schaefer, M. B. 1957. Large-scale biological experiments using radioactive tracers. The effects of atomic radiation on oceanography and fisheries. Nat. Acad. Sci. Nat. Res. Council Publ. 551:133-137.
A review of the subject.
 - 1029 Schiffman, R. H. 1960. Effects of intramuscular injections of Sr⁹⁰-Y⁹⁰ on rainbowtrout. Gen. Elec. Hanford Biol. Res. Ann. Rept. for 1959, Richland, Wash., 56:56-59.
Injections of 1.5X10⁻² millicuries arterially twice weekly doesn't affect growth or mortality.
 - 1030 Saligman, A. 1956. The discharge of radioactive waste products into the Irish Sea, Pt. 1: First experiments for the study of movement and dilution of released dye in the sea. Proc. Internat. Conf. on Peaceful Uses of Atomic Energy, Geneva, 1955, P/418, 9:701. U.N., N. Y.
A review and discussion.
 - 1031 Seymour, A. H. 1958. The use of radioisotopes as a tag for fish. Proc. Gulf and Carib. Fish. Inst. 10th Ann. Sess., pp. 118-129.
 - 1032 _____, E. E. Held, F. G. Lowman, J. R. Donaldson and Dorothy J. South. 1957. Survey of radioactivity in the sea and in pelagic marine life west of the Marshall Islands, Sept. 1-20, 1956. Univ. Wash. Applied Fish. Lab. Rept. UWFL-47:57 pp.
 - 1033 Shekhenova, I. A. 1955. Priminenie p³² dlia mekhanicheskoi molodiosetrovykh ryb. (Utilization of p³² for marking young acipenserid fishes. Rybnoe Khozinstvo (31):51-53.
Use radioactive oligochaetes as food in order to introduce the radioactivity into sturgeons.

- 1034 Shimada, B. M. 1956. Results of long-line fishing by M/V Poolina-T. In: Effects of Nuclear Explosion on Mar. Biol. (WT-1013), pp. 56-59.
 - 1035 Shmalganzen, I. I. 1958. The ways in which radiation damage appears in early development in fish. Comp. Rend. Sci. URSS (Transl.) Biol. 119:134-137.
 - 1036 Skauen, D. M. and J. S. Rankin, Jr. 1960. Radioactive zinc⁶⁵ in marine organisms in Fishers Island Sound and its estuaries. Univ. Conn. (TID-6307:5 pp.
 - 1037 Smith, R. J. 1958. The filtering efficiency of hard clams in mixed suspensions of radioactive phytoplankton. Proc. Nat. Shellfish. Assoc. 49(1957):115-124.
Mercenaria fed labeled Gymnodium and Nitzia favored the latter as food.
 - 1038 Suyehrio, Y. 1954. Effect of radioactive substances upon fishes. Kagaku 24(12):619-622.
 - 1039 _____ and T. Hibiya. 1956. Effects of radioactive materials upon blood pictures of fish. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 1231-1232.
Sr was injected into goldfish. The leucocytes and erythrocytes died within 2 days, death of the fish followed.
 - 1040 _____, S. Yoshino, Y. Tsukamoto, M. Akamatsu, K. Takahashi and T. Mori. 1954. Transmission and metabolism of strontium-90 in aquatic animals. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci. pp. 1135-1142.
 - 1041 Suzuke, K. and T. Yamamoto. 1959. Uptake of Yttrium by microorganisms. Abstr. 3rd Jap. Conf. on Radioisotopes (JAIF, JR1A-59/P-203 B-2):1 pp.
- T
- 1042 Takase, A. 1955. Separation of the radioactive elements in the muscle of skipjack by ion-exchange resin and confirmation of the presence of radioactive zinc. Bull. Inst. Publ. Health (Tokyo) 4(3):22-26.
 - 1043 _____, T. Beto and A. Ishikara. 1959. The utilization of radioisotope-labeled bacteria in the food sanitation study. II. Y-90-labeled *E. coli* and bacterial contamination of living fish or shellfish. 3rd Jap. Conf. on Radioisotopes (JAIF, JR1A-59/P-81, A20)., 1 pp.
 - 1044 _____ and K. Yamada. 1955. Distribution of radioactivity in various tissues of fish and group separation of radioactive elements in them. Bull. Inst. Publ. Health (Tokyo) 4(3):17-21. (English summary pp. 27).
 - 1045 Takasa, K. and J. Nishimoto. 1957. VI. Behavior of fission products for the fish meat. Mem. Fac. Fish. Kagoshima Univ. 5:190-195. (In Japanese).
 - 1046 Taylor, W. R. 1960. Some results of studies on the uptake of radioactive waste materials by marine and estuarine phytoplankton organisms using continuous culture techniques. C.B.I. Tech. Rept. 21, Ref. No. 60-3, June, pp. 1-49, 22 figs.
 - 1047 Tomiyama, T., S. Ishio and K. Kobayashi. 1954. Absorption of dissolved Ca⁴⁵ by *Carassius auratus*. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci. pp. 1151-1156.
Most Ca⁴⁵ absorbed by goldfish was found localized in the head region.
 - 1048 _____ and _____. 1954. Absorption by *Carassius auratus* of Ca⁴⁵ contained in *Rhizodrilus levisus*. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 1157-1162.
Most of the Ca⁴⁵ was found in the intestine of goldfish after it was introduced as labeled *Rhizodrilus*.
 - 1049 _____ and _____. 1954. Absorption of dissolved Ca⁴⁵ by marine fishes. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 1163-1167.
The uptake and deposition of Ca⁴⁵ was determined by the swimming activity of the fish.
 - 1050 _____, K. Kobayashi and I. Ishio. 1954. Excretion of absorbed Ca⁴⁵ by goldfish. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 1169-1172.
Excretion of Ca⁴⁵ was via the kidney, gall bladder and gills in goldfish.
 - 1051 _____ and _____. 1954. Absorption of Sr⁹⁰ (Y⁹⁰) by carp. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 1181-1187.
Sr⁹⁰ and Y⁹⁰ were absorbed in 30 minutes each and deposited in the same areas generally noted: bones, skin, scales and body organs.
 - 1052 _____ and _____. 1954. Distribution and excretion of intramuscularly administered Sr⁹⁰ (Y⁹⁰) in carp. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 1189-1193.
Sr⁹⁰ was found in the caudal fin, scale, vertebrae, gill, blood, air bladder, gall bladder and muscle.

- 1053 _____ and _____. 1954. Absorption of $^{32}\text{PO}_4$ ion by carp. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno Tokyo, Jap. Soc. Prom. Sci., pp. 1195-1200.
In carp P^{32} was found in the kidney while PO_4 was localized in the head region only.
 - 1054 _____ and _____. 1954. Distribution and excretion of intramuscularly administered $^{32}\text{PO}_4$ by carp. Vol. II Res. in Effects and Influence of Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 1201-1203.
 P^{32} in the blood of carp was localized in the corpuscles.
 - 1055 Toyama, T. 1954. Fishes and radioactivity in water. Kagaku-Asahi 6:86.
 - 1056 Tozawa, H. 1960. A radiochemical study of the pelagic fishes contaminated by a nuclear test. In: Radioactive Contamination of Marine Products in Jap. Tokai Reg. Fish Res. Lab. (A/AG/82/G/L-394; NP-8862):13-17.
 - 1057 Troshin, A. S. 1956. Radioaktivnye indikatory v gidrobiologii (Radioactive indicators in hydrobiology). Zhizn. greanykh vod SSSR Vol. 4 izd AN SSSR.
 - 1057a _____ and V. I. Zhadin. 1957. Radiomarkirovka rybtsa i shemai kak metod ustanovleniya effektivnosti raboty Rybtsovo-She-mainogo petomnika. (Radiomarking of vimba and bleak for disclosing the operational efficiency of the vimba bleak nursery). Trud. Probl. Temot. Soveshrch. Zool. Inst. Akad. Nauk SSSR 7:57-61.
- V
- 1058 Vinogradov, A. P. 1953. The elementary chemical composition of marine organisms. Sears Found. Mar. Res. Mem. (11):536.
Radium is found in the same order in fish as in invertebrates, higher than in sea water, but lower than marine algae.
- W
- 1059 Watson, D. G. and J. J. Davis. 1957. Concentrations of radioisotopes in Columbia River whitefish in the vicinity of the Hanford Atomic Products operations. A. E. C. Rept. (HFW-48523(Dd)):133 pp.
A 1950-56 study. Maximum radioactivity in whitefish was near Hanford Atomic Reservoir.
 - 1060 Weiss, H. V., S. H. Cohn, W. H. Shipman and J. K. Gong. 1956. Residual contamination of plants, animals, soils and water of the Marshall Islands two years following operation castle fallout. Res. and Develop. Rept., U.S. Naval Radiobiol. Def. Lab., San Francisco 24, Calif., Doc. 455NS081-001:52 pp.
Radioactivity decreased by 80% in one year. Fish had only 25% of radioactivity one year later. The skeleton of fish was not high in radioactive materials.
 - 1061 _____ and W. H. Shipman. 1957. Biological concentration by killer clams of Cobalt ^{60} from radioactive fallout. Science 125(3250):695.
 - 1062 Welander, A. D. 1957. Radioactivity in the reef fishes of Belle Island, Eniwetok Atoll April 1954 to Nov. 1955. A. E. C. Rept. UWFL-49:42 pp.
A study of the levels of contamination in fishes right after a bomb blast.
 - 1063 _____. 1957. Radiobiological studies of the fish collected at Rongelap and Ailinginae Atolls, July 1957. U.S. A. E. C. UWFL Appl. Fish. Lab. 55:1-30.
Most radiation was in muscle, bone, liver and stomach content: Zn ^{65} and Mn ^{54} in bone; Zn ^{65} , Co ^{57} , Co ^{60} and Mn ^{54} in soft tissues.
 - 1064 Wichterman, R. 1957. Biological effects of radiations on protozoa. Bios 28:3-20.
 - 1065 Wiercinski, F. J. and J. K. Taylor. 1960. Experiments with Ca ^{45} in marine egg cells. Abstr. Biol. Bull. 119(2):299.
Little uptake by *Arbacia* and *Spissula* in Ca ^{45} solution. If exposed to ultraviolet light for long periods of time the uptake of Ca ^{45} increased.
 - 1066 Williams, L. G. 1960. Uptake of Cesium ^{137} by cells and detritus of *Euglena* and *Chlorella*. Limnol. and Oceanog. 5(3):301-311.
 - 1067 _____ and Q. Pickering. 1961. Direct and food-chain uptake of Cesium ^{137} and strontium ^{85} in bluegill fingerlings. Ecology 42(1):205-206.
Higher content of Ce and Sr was obtained in bluegills by the *Euglena*-*Daphnia* food chain method than absorption from the water. The counts were exponential for the first 4 days and by 20 days had dropped to only 8% of the initial reading. K or Ca in the water affected the amount and rate of Ce uptake.
 - 1068 _____ and H. D. Swanson. 1958. Concentration of Cesium ^{137} by algae. Science 127(3291):187-188.
Dead *Chlorella* and *Euglena* react differently than when alive in its uptake of Ce ^{137} .

- 1069 Wooster, W. S. and B. H. Ketchum. 1957. Transport and dispersal of radioactive elements in the sea. The Effects of Atomic Radiation on Oceanography and Fisheries. Nat. Acad. Sci. Nat. Res. Council Publ. 551:43-51. A discussion of diffusion rates of radioactive material and then possible uptake by aquatic organisms.

Y

- 1070 Yamada, K., H. Tozawa, K. Amano and A. Takase. 1955. Radioactivity in the pelagic fish. II. Group separation of radioactive elements in fish tissues. Bull. Jap. Soc. Sci. Fish 20(10):916-920. (In Japanese).

- 1071 _____, _____, _____ and _____. 1955. Studies on the radioactivity in certain pelagic fish. III. Separation and confirmation of Zn^{65} in the muscle tissue of a skipjack. Bull. Jap. Soc. Sci. Fish 20(10):921-926.

A paper discussing tests for radioactivity extraction method determinations.

- 1072 Yoshii, G. 1956. Studies on the radioactive samples (especially "*Katsuwonus vagans*") in the Pacific Ocean in 1954. Vol. II Res. in Effects and Influences of the Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci., pp. 917-936.

Z

- 1073 Zirkle, R. E. 1936. Biological effects of Alpha particles. In: Biol. Effects of Radiation. McGraw Hill, N.Y., 1st Ed. pp. 559-572.

A review.

Radiation: X-ray

A

- 1074 Allen, B. M. 1958. Effects of x-irradiation upon the limb-buds of *Bufo boreas*. Anat. Rec. 130:391.
- 1075 _____ and L. M. Ewell. 1960. Resistance to x-irradiation by embryonic cells of the limb-buds of tadpoles. Jour. Exp. Zool. 142:309-329.
In tadpoles receiving 1000-30000 R the younger cells were more sensitive than older cells.
- 1076 Anon. 1955. Section 10 on series of experiments involving the effect of x-ray on fishes: fingerling chinook salmon (*Oncorhynchus tshawytscha* Walbaum). A. E. C. Rept. (UWFL-3):71 pp.
In 4 weeks 2500 and 5000 roentgens caused 100% death. The 1250 R group after 12 weeks had only 70% of the weight the controls did.

B

- 1077 Baldwin, W. M. 1915. The action of ultraviolet rays upon the frog's egg. Anat. Rec. 9:385-391.
Ultraviolet rays affects the eggs of frogs and all body parts disastrously.
- Baldwin, W. M. 1919. See Light.

- 1078 Bordeen, C. R. 1907. Abnormal development of toad ova fertilized by spermatozoa exposed to the Roentgen rays. Jour. Exp. Zool. 4(1): 1-44 / 5 pls.

Beyond the gastrula stage, toad egg development was retarded.

- 1079 _____ 1909. Variations in susceptibility of Amphibian ova to x-rays at different stages of development. Anat. Rec. 3(4):163-165.

- 1080 _____ 1911. Further studies on the variation in susceptibility of Amphibian ova to the x-rays at different stages of development. Am. Jour. Anat. 11:419-498.

The exposure and amount of x-ray dose is important to amphibian eggs for later development. The after effects of exposure do not appear for some time.

- 1081 _____ and F. H. Baetjer. 1904. The inhibitive action of the Roentgen rays on regeneration in Planarians. Jour. Exp. Zool. 1(1):191-195.

Radiation of *Planaria* inhibits all development or regeneration. The full after effects do not appear for several days.

- 1082 Barrington, E. J. W. and L. L. Franchi. 1956. Some cytological characteristics of thyroidal function in the endostyle of the ammocoete larva. Quart. Jour. Micr. Sci. 97:393-409.

- 1083 Bell, G. M. and W. S. Hoar. 1950. Some effects of ultra-violet radiation on sockeye salmon eggs and alevins. *Can. Jour. Res.* 28(10):35-43.
Sockeye salmon eggs if irradiated will yield deformed specimens as well as the epidermal cells are usually destroyed.
- 1084 Belyayeva, V. N. and G. L. Pokrovskaya. 1958. Mitotic disturbance observed at early development stages in *Misgurnus fossilis* subjected to x-ray treatment. *Doklady Akad. Nauk SSSR* 125:632-635. (In Russian).
The cleavage stage is most susceptible to irradiation in *Misgurnus* with 100% death usually the result.
- 1085 Bohn, G. 1903. Influence des rayons du radium sur les animaux en voie de Croissance. *Compt. Rend. Acad. Sci. (Paris)* 136:1012-1013.
X-radiation of eggs of *Bufo vulgaris* produced monsters.
- 1086 _____. 1903. Influence des rayons du radium sur les oeufs vierges et fécondés et sur les premiers stades de développement. *Compt. Rend. Acad. Sci. (Paris)* 136:1085-1086.
A poor paper which discusses the development of *Strongylocentrotus* eggs after irradiation.
- 1087 Bonham, K. 1949. Effects of x-rays on the fresh-water snail *Radix japonica*. A.E.C. Rept. (UWFL-21):30 pp., mimeo.
- 1088 _____. 1955. Sensitivity to x-rays of the early cleavage stages of the snail *Heliosoma subcrenatum*. *Growth* 19:9-18.
Hard and soft rays effect didn't differ to this snail. However, the resting stage of developing eggs withstood greater roentgen doses than the mitotic stages, 300-400 R for resting and 100 R for mitotic before serious effects occurred.
- 1089 _____. 1955. Lethal effects of x-rays on marine amphipods. A.E.C. Rept. (UWFL-14):18 pp.
Doses of 500 R and 1250 R increased the number of young which had higher mortalities.
- 1090 _____. R. R. Donaldson, H. F. Foster, A. D. Welander and A. H. Seymour. 1948. The effect of x-ray on mortality, weight, length and counts of erythrocytes and hematopoietic cells in fingerling chinook salmon, *Oncorhynchus tshawytscha* Walbaum. *Growth* 12:107-121.
A good study of the effects of x-rays between 100-500 R. The lowest dose to yield mortality was 250 R, 500 R to affect weight and 100 R to affect length.
- 1091 _____. and R. F. Palumbo. 1951. Effects of x-rays on snails, crustacea and algae. *Growth* 15:155-188.
A good study of *Radix*, *Thais*, *Artemia* and amphipod reactions to x-ray doses. All *Radix* died in a week if exposed to 20 R, *Artemia* eggs, if dry, 93 R, soaked 50 R, in 5 days while most amphipods withstood 550 R.
- 1092 _____. and A. H. Seymour. 1947. Sections I and II on series of experiments involving the effect of x-ray on fishes: chinook salmon (*Oncorhynchus tshawytscha* Walbaum) observed through more than one generation. A.E.C. Rept. (UWFL-6).
Chinook salmon were most susceptible to x-rays while in the fry stage.
- 1093 _____. L. R. Donaldson and A. Welander. 1947. Lethal effects of x-rays on marine microplankton organisms. *Science* 106(2750):245-246.
Mastigophorans would die if exposed to x-ray doses above 25000 R.
- 1094 Borstel, R. C. 1955. Feulgen-negative nuclear division in *Habrobracon* eggs after lethal exposure to x-rays or nitrogen mustard. *Nature* 175:342-343.
Habrobracon eggs were most susceptible to 10 KV during the metaphase. The Feulgen-negative nucleus appeared in 10 hours at this exposure.
- 1095 Briggs, R., E. U. Cuene and T. Y. King. 1951. An investigation of the capacity for cleavage and differentiation in *Rana pipiens* eggs lacking "functional" chromosomes. *Jour. Exp. Zool.* 116:455-499.
R. pipiens eggs fertilized with sperm of *R. catesbeiana* or *R. pipiens* which were subjected to 65-300 R yielded gynogenetic haploids.
- 1096 Brunst, V. V. 1950. Influence of x-rays on limb regeneration in *Urodele* amphibians. *Quart. Rev. Biol.* 25:1-29.
- 1097 Burkner, E., M. Shapiro and K. Bronstein. 1929. Radiumgehalt einiger nahrungsmittel. *Biochem. Zeitschr.* 211:323-325.
A general paper dealing with the effects to *Cottus gobio*.
- 1098 Butler, E. G. 1933. The effects of x-radiation on the regeneration of the fore limb of *Amblystoma* larvae. *Jour. Exp. Zool.* 65:271-315.
- 1099 _____. 1936. The effects of radium and x-rays on embryonic development. In: *Biol. Effects of Radiation*. McGraw Hill Co., N. Y. 1st Ed. pp. 389-410.
A good review of the subject from the aspect of x-ray effects to development. Best review of the literature to 1936.

- 1100 _____ and J. P. O'Brien. 1943. Effect of localized x-radiation on the Urodele limb. *Anat. Rec.* 84:407-413.

C

- 1101 Chase, A. M. and A. C. Giese. 1940. Effects of ultraviolet radiation on Cypridina luciferin and luciferase. *Jour. Cell. and Comp. Physiol.* 16:323-340.
A good study where short waves of radiation were found not to affect the extract.
- 1102 Colwell, H. A. and M. S. Thomson. 1926. On some effects of primary and secondary x-rays on the skin of the frog tadpole. *Lancet* 211(5367):59-61.
Those cells of R. temporaria which were directly in the x-ray beam were completely destroyed.
- 1103 Corbella, E. 1930. Influsso delle radiozioni roentgen sullo sulluppio embrionale du teleostei (Salmo lacustris L., Salmo iridis Gibb, Perca fluviatilis L.). *Riv. Biol. Milano* 12:93-117.
A good bibliography follows this study.
- 1104 Curtis, W. C. 1936. Effects of x-rays and radium upon regeneration. In: *Biol. Effects of Radiation*. McGraw Hill Co., N.Y. 1st Ed. pp. 411-457.
A good review of the x-ray effects to Porifera through amphibia.

D

- 1105 Daniels, E. W. 1955. X-irradiation of the giant amoeba Pelomyxa illinoensis. I. Survival and cell division following exposure. Therapeutic effects of whole protoplasm. *Jour. Exp. Zool.* 130:183-197.
- 1106 _____. 1958. X-irradiation of the giant amoeba, Pelomyxa illinoensis. II. Further studies on recovery following supralethal exposure. *Jour. Exp. Zool.* 137:425-442.
Continuation of 1105.
- 1107 Davison, C. and F. Ellinger. 1942. Radiation effects on nervous system and roentgen-pigmentation of goldfish (Carassius auratus). *Proc. Soc. Exp. Biol. and Med.* 49(3):491-495.
The medulla oblongata and anterior horns of the spinal chord were the structures most affected by x-rays.
- 1108 Donaldson, L. R. 1955. A radiological study of Rongelap Atoll, Marshall Islands, during 1954-55. *Univ. Wash. Appl. Fish. Lab. Rept.* UWFL-42:46 pp.

E

- 1109 Ellinger, F. 1939. Note on the action of x-rays on goldfish (Carassius auratus). *Proc. Soc. Exp. Biol. and Med.* 41(2):527-529.
Latent affects of x-rays didn't appear for 12 days.
- 1110 _____. 1940. The goldfish as a biologic test object in experimental radiation therapy. *Radiology* 35(5):563-574.
- 1111 _____. 1940. Roentgen-pigmentation in the goldfish. *Proc. Soc. Exp. Biol. and Med.* 45(1):148-150.
- 1112 _____ and C. Davison. 1942. Changes in the central nervous system of goldfish irradiated in the depths of a water phantom. *Radiology* 39(1):92-95.

F

- 1113 Foster, R. F. 1949. Some effects on embryo and young rainbow trout (Salmo gairdnerii Richardson) from exposing the parent fish to x-rays. *Growth* 13:119-142.
- 1114 _____, L. R. Donaldson, A. D. Welander, K. Bonham and A. H. Seymour. 1949. The effect on embryos and young of rainbow trout from exposing the parent fish to x-rays. *Growth* 13:119-142.
A good study. The more parents were radiated the more mortalities one had. At 1500 R 100% mortalities occurred. The first year growth of young was also affected.

G

- 1115 Gilman, P. K. and F. H. Baetjer. 1904. Some effects of the roentgen rays on the development of embryos. *Am. Jour. Physiol.* 10:226-234.
Accidental growth occurred for the first 36 hours after exposure. Most specimens were deformed. The eyes were usually retarded.
- 1116 Goodrich, H. B. and Priscilla L. Anderson. 1939. Variations of color patterns in hybrids of the goldfish, Carassius auratus. *Biol. Bull.* 77(2):184-191.
- 1117 _____ and J. P. Trinkaus. 1939. The differential effect of radiations on Mendelian phenotypes of the goldfish, Carassius auratus. *Biol. Bull.* 77(2):192-199.

H

- 1118 Hinrichs, M. A. 1955. Modification of development on the basis of differential susceptibility to radiation. I. Fundulus heteroclitus and ultra-violet radiation. Jour. Morph. 41:239-265.

K

- 1119 Kessler, R. and W. Luther. 1957. Die Wirkung der Röntgenstrahlen auf den Hoden und die sekundären Geschlechtsmerkmale von Lebistes reticulatus Peters. Zeitschr. Verg. Physiol. 40(5):492-528.

A good bibliography ends this paper. Larvae and juveniles were exposed to 500, 1000, 2000, 3000, 4000 R; 1000 R proved most lethal. The histology is also presented.

L

- 1120 Litschko (Licko), E. J. 1932. Further observations on the effect of x-rays on regeneration in Axolotl. Compt. Rend. Acad. Sci. URSS Ser. A, 3:65-70, 1 pl. (In Russian).

M

- 1121 McGregor, J. H. 1908. Abnormal development of frog embryos as a result of treatment of ova and sperm with roentgen rays. Science 27:445.

Only 5% of the R. sylvatica embryos exposed to x-rays were abnormal.

- 1122 Meserve, F. G. and M. J. Kenney. 1934. The effects of x-rays on Planaria doratoccephala. Science 79:408-409.

X-rays affect the cell growth in Planaria.

- 1123 Murachi, K. 1944. The influence of radiation upon fish eggs. (1) The influence of KCL upon the heart of an embryo which has been kept under radiation of x-rays. Zool. Mag. (Dobutsugaku Zasshi) 56(8):5-7. (In Japanese).

N

- 1124 Neyfakh, A. A. 1959. X-ray inactivation of nuclei as a method for studying their function in the early development of fishes. Jour. Embryol. and Exp. Morphol. 7(2):173-192.

If anytime between fertilization and early gastrula stages the specimen is x-rayed, growth and development are arrested.

- Noddach, Ida and W. Noddach. 1939. See Electricity.

O

- 1125 Okada, I., I. O. Sakabe, T. Kikuchi and K. Konno. 1954. On the influence of x-ray radiation on the aquatic animals. On the influence in the early development of goldfish (Carassius auratus L.). Vol. II Res. in Effects and Influences of the Nuclear Bomb Test Exp. Ueno, Tokyo, Jap. Soc. Prom. Sci. pp. 1211-1218.

If one increases the x-ray strength, there is a decrease in the hatching rate.

P

- 1126 Packard, C. 1914. The effect of radium radiations on the fertilization of Nereis. Jour. Exp. Zool. 16:85-129.

X-rays stimulate Nereis to spawn. An egg nucleus develops without an aster.

- 1127 _____ . 1918. The effect of radium radiations on the development of Chaetopterus. Biol. Bull. 35:50-70.

- 1128 _____ . 1931. The biological effects of short radiations. Quart. Rev. Biol. 6:253-280.

A good review.

- 1129 Powers, E. L. and D. Shefner. 1950. Effects of high dosages of x-rays in Paramecium aurelia. Genetics 35:131.

If one uses 1,000,000 R at 62,000 per minute, 50% mortality occurs at 62,000 R. After this strength the mortality rate decreases.

- 1130 Puckett, W. O. 1936. The effects of x-radiation on limb development and regeneration in Amblystoma. Jour. Morph. 59:173-213.

R

- 1131 Rugh, C. 1955. Effects of various levels of x-irradiation on the gametes and early embryos of Fundulus heteroclitus. Biol. Bull. 108(3):318-325.

F. heteroclitus sperm radiated with 200,000 R wasn't affected.

- 1132 Rugh, R. 1949. Some prenatal effects of Amblystoma opacum larvae exposed to 25,000 R x-radiation. Anat. Rec. 103:500-501.

Deformed specimens were the result of irradiation.

- 1133 _____ and Helen Clugston. 1955. Effects of various levels of x-irradiation on the gametes and early embryos of Fundulus heteroclitus. Biol. Bull. 108(3):318-325.

Fundulus heteroclitus unfertilized eggs did not cleave. Males subjected to 200,000 R had viable sperm. Eggs fertilized with this sperm developed normally.

- 1134 Rushton, W. 1936. Biological notes, some experiments with fry. *Salmon and Trout Mag.* (82-85):57-67.

Fry subjected to lethal doses of x-ray survive 6 weeks before death occurs.

- 1135 Rustad, R. C. 1960. X-ray induced dissociation of the mitotic and micromere "clocks." *Abstr. Biol. Bull.* 119(2):284.

Sea urchin gametes irradiated produces micromeres at 1, 2 and 3 cleavage stages rather than 4th. The biological clock that controls micromere formation is independent of division per se.

- 1136 _____. 1960. X-ray induced mitotic delay in the *Arbacia* egg. *Abstr. in Biol. Bull.* 119(2):337.

Radioactive sperm doesn't affect the mitotic delay, but extends the x-ray sensitive portion of the mitotic cycle which corresponds roughly to the early streak, the period of multiplication and separation of the centrioles.

S

- 1137 Schuster-Wolden, E. 1936. X-ray studies of the intestine of *Cyprinus carpio* and *Tinca vulgaris* as a contribution to the problem of the significance of smell and sight in fish in the search for food. *Zeitschr. Fischerei* 34:245.

These fish were x-rayed to show that BaCl was picked up directly from the water.

- 1138 Smith, G. M. 1932. Eruption of Corial melanophores and general cutaneous melanosis in the goldfish (*Carassius auratus*) following exposure to x-ray. *Am. Jour. Cancer* 16(2): 863-870.

X-irradiation caused cancer of the tail in 5 days; entire body in 6.

- 1139 _____. 1932. Melanophores induced by x-ray compared with those existing in patterns as seen in *Carassius auratus*. *Biol. Bull.* 63:484-491.

- 1140 Snider, G. and H. Kersten. 1935. The action of soft x-rays on Cladocera (*Daphnia magna*). *Phys. Zool.* 8:530.

New eggs of *D. magna* disintegrated and in one day yielded distorted individuals. If the first instar was subjected to 45 KV, 10 millampat 3 centimeters from the focal point, death resulted.

- 1141 _____ and _____. 1936. Susceptibility to soft x-rays of *Daphnia magna* during its development from eggs to young in the brood pouch. *Jour. Exp. Zool.* 74(1):1-6.

If eggs 18-32 hours old were irradiated most survived. Eggs older than 32 hours all survived. A good study.

- 1142 Solberg, A. N. 1938. The susceptibility of *Fundulus heteroclitus* embryos to x-radiation. *Jour. Exp. Zool.* 78:441-469.

A general study of *Fundulus* subjected to 4 increasing doses. The higher the dose the lower the sensitivity. The head and tail tip were the most sensitive.

- 1143 _____. 1938. The susceptibility of the germ cells of *Oryzias latipes* to x-radiation and recovery after treatment. *Jour. Exp. Zool.* 78(4):417-439.

Sperm of *Oryzias* were 3-4 times more sensitive to x-rays than the eggs; 1,980 R lasts for 23 days. The ovaries were reduced after a dose, but returned to normal shortly thereafter.

- 1144 Sonehara, S. 1933. Studies on the effects of x-rays upon the development of a pond snail *Lymnaea (Radix) japonica*. *Jour. Sci. Hiroshima Univ. Ser. B. Div.* 1:151-169.

Growth rates were affected after irradiation.

- 1145 Spiedel, C. C. and R. H. Cheney. 1960. Comparative effects of x-ray and ultraviolet radiation of gametes on the developing sea urchin *Arbacia*. *Abstr. Biol. Bull.* 119(2):338.

Damage was greatest after gradual x-ray dosages than UV exposures. An x-ray dose to sperm was equal to a dose of only 1.5-2X as much to eggs.

- 1146 Ssmokhvalova, G. V. 1935. Vliyanie rentgenovskikh luchei na polovuuyu zhelezu i vtorichnyye polovye priznaki *Lebistes reticulatus*. (The influence of x-rays on the sex glands and the secondary sexual characters in *Lebistes reticulatus*). *Trudy po Dinamike Razvitiia* (Trans. Dynamics Develop.) 10:213-229.

- 1147 _____. 1938. Effect of x-rays on fishes (*Lebistes reticulatus*, *Zipphorus helleri* and *Carassius vulgaris*). *Biol. Zh. Moscow* 7:1023-1024.

- 1148 Stone, R. G. 1932. The effects of x-rays on regeneration in *Tubifex tubifex*. *Jour. Morph.* 53(2):389-432.

Normal regeneration in *Tubifex* is 35 days. This is inhibited if the specimen is subjected to x-rays.

T

- 1149 Tanaka, P. 1942. (Influence of the ray of heliolamp upon the hatchability of *Oncorhynchus keta* (Walbaum)). *Zool. Mag. (Tokyo)* 54(8):313-314. (In Japanese).

- 1150 Tur, J. 1904. Malformations embryonnaires obtenus par l'action du radium sur les oeufs de la ponle. *Comp. Rend. des Seances Tr.* 57:236-238.

V

- 1151 Vakrameyeva, N. V. and A. A. Neyfakh. 1959. Comparison of the changes in radio- and thermo-sensitivity during cleavage in the loach Misgurnus fossilis. Doklady Akad. Nauk SSSR.
- 1152 Vintemberger, P. 1928. Sur l'emploi des rayons X en embryologie comme agents de destruction localisee. Une technique nouvelle pour l'etude de la potentialite des deux premiers blastomeres dans l'oeuf de la grenouille rousse. Compt. Rend. Soc. Biol. 99 (33):1590-1592.

W

- 1153 Welander, A. D. 1945. Studies of the effects of roentgen rays on the growth and development of the embryos and larvae of the chinook salmon (Oncorhynchus tshawytscha). PhD Thesis, Univ. of Wash. 131 pp.
- 1154 _____. 1946. Studies of the effects of roentgen rays on the growth and development of the embryos and larvae of chinook salmon (Oncorhynchus tshawytscha). Univ. Wash. PhD Thesis, 128 pp. A. E. C. Rept. UWFL-2: 131 pp.
- Three lots of salmon eggs were subjected to x-rays of 25, 50 and 100 R. Those which were in the eyed stage hatched but showed signs of an effect for over a year. Most fry died in 30-51 days.
- 1155 _____. 1954. Some effects of x-irradiation of different embryonic stages of the trout (Salmo gairdneri). Growth XVIII:227-255.
- 1156 _____. 1955. Some effects of x-irradiation of different embryonic stages of the trout (Salmo gairdneri). Growth 18:227-255. A. E. C. Rept. (UWFL-38).
- A good report. Hubbs and Hubbs method is used to compare body proportions after irradiation.

- 1157 _____, L. R. Donaldson, R. F. Foster, K. Bonham and A. H. Seymour. 1948. The effect of roentgen rays on the embryos and larvae of the chinook salmon. Growth 12: 203-242.
- A very good study. List of effects on embryos are given. If subjected to 2800-10,000 R most larvae died in 30-51 days; 500 R had least pigment effect.
- 1158 _____ and F. G. Lowman. 1950. The effects of roentgen rays on adult rainbow trout. Univ. Wash. Appl. Fish. Lab. UWFL-17:1-7.
- Rainbow trout subjected to 1500 R yielded a 56% kill in 53 weeks, 87% in 64 weeks. Hemorrhages, neurosis, fungus and internal damage were the general results.
- 1159 Wichterman, R. 1959. Mutation in the protozoan Paramecium multimicronucleatum as a result of x-irradiation. Science 129:207-208.
- 1160 _____. 1960. Production of viable races of Paramecium caudatum after micronuclear elimination with x-rays. Abstr. in Biol. Bull. 119(2):348.
- Repeated doses decreased or eliminated the number of micronuclei. Macronucleus is little affected by irradiation.
- 1161 Willcock, E. G. 1904. The action of the rays from radium upon some simple forms of animal life. Jour. Physiol. 30:449-454.
- 1162 Williams, D. B. 1958. Effects of x-rays on fission in the predaceous Holotrich, Spathidium spathula. Jour. Protozool. 5 Suppl.:25.
- 1163 Wood, E. M. 1958. Fixation der radioiode par les oeufs et alevins de quelques Salmonides (Salmo fario L., Salmo iridis G. I. B., Salmo salar L.). Ann. Sta. Centrale Hydrobiol. Appl. 7:285-299.

Sound

A

- 1164 Anon. 1950. Underwater acoustics research panel on underwater acoustics. Comm. on Underwater Warfare. Nat. Res. Council, Wash., D. C.
- 1165 Autrum, H. and D. Poggendorf. 1951. Messung der absoluten Hörschwelle bei fischen (*Ameiurus nebulosus*). Naturwissenschaften 38:434-435.

B

- 1166 Bernoreilli, A. L. 1910. Zur frage des hörmögens der fische. Pflügers Archiv. f. d. ges. Physiol. 134:633-644.
- 1167 Bigelow, H. 1904. The sense of hearing in the goldfish *Carassius auratus*. Am. Nat. 38:275-284.
- 1168 Boutteville, K. V. 1935. Untersuchungen über den gehörsinn bei Characiniden und Gymnotiden und der Bau ihres Labyrinthes. Zeitschr. Verg. Physiol. 22:162-191.
- 1169 Bruning, C. 1906. Versuche über das Hören der fische. Natur und Haus 14:312-313.
- Sticklebacks do not respond to sound.
- Bull, H. O. 1928. See Light.
 - Burner, C. J. and H. L. Moore. 1953. See Explosives.

C

- 1170 Clark, Eugenie. 1959. Instrumental conditioning of sharks. Anat. Rec. 134(3):545.
- Sound was used to condition sharks to food.
- 1171 Clark, H. 1950. The effect of ultrasonic vibrations on molting in *Triturus viridescens*. Endocrinology 46(4):392-396.
- Sound increased the molting rates.
- 1172 Coles, R. 1914. Effect of thunder on fishes. Copeia (5):1.
- Thunder drives fishes into deeper water.
- 1173 Curry, B. and E. Hsi. 1949. Bibliography, supersonic or ultrasonic - 1926-1949. Okla. A. & M. Coll. Res. Found., Stillwater, 77 pp.

D

- 1174 Denker, A. 1931. Über das Hörvermögen der fisch. Acta Otologica. Stockholm 15:247-260.
- 1175 Dirsselhorst, G. 1938. Hörversuche an fischen ohne Weberian apparat. Zeitschr. Verg. Physiol. 25:748-783.
- Sound effects to different types of fish was evident either with or without a change in apparent behavior.

F

- 1176 Farkas, B. 1935. Untersuchungen über das Hörvermögen bei fischen. Állattani Közlemenyek 32:19-20. (Ungarisch mit deutscher Zusammenfassung). (In German).
- A review on sound perception.
- 1177 ———. 1936. Zur kenntnis des Hörvermögens und des Gehörorgans der fische. Acta Otologica. 23:499-532.
- 1178 Frisch, K. von. 1936. Ueber den Gehörsinn der fische. Biol. Rev. 11:210-246.
- An excellent bibliography and best review of the subject. *Phoxinus* and *Ameiurus* distinguish between octaves. Ostariophy-sene fishes are less sensitive to sound.
- 1179 Frisch, K. V. and H. Stetter. 1932. Untersuchungen über den sitz des Gehörsinnes bei der elritze. Zeitschr. Verg. Physiol. 17: 686-801.

G

- 1180 Griffin, D. R. 1955. Hearing and acoustic orientation in marine animals. In Papers in Mar. Biol. and Oceanog. Deep Sea Res. (3 Suppl.), pp. 406-417.
- The best review of sound and fishes. The lowest threshold was 2000-4000 cps. Porpoises hear at well above 400 KC.

H

- 1181 Haempel, O. 1911. Zur frage der Hörvermögens der fische. Int. Rev. Hydrobiol. 4:315.
- 1182 Harvey, E. N., Ethel B. Harvey and A. L. Loomis. 1928. Further observations on the effect of high frequency sound waves on living matter. Biol. Bull. 55(6):459-469.
- Hsiao, S. C., I. Miyake and A. L. Tester. 1952. See Electricity.

K

- 1183 Kellogg, W. N. and R. Kohler. 1952. Reactions of the porpoise to ultrasonic frequencies. Science 116:250-252.
- 1184 Kicerekoper, H. and E. C. Chagnon. 1954. Hearing in fish with special reference to *Semotilus atromaculatus atromaculatus* (Mitchell). Jour. Fish. Res. Bd. Can. 11: 130-152.
- The creek chub hears sounds of 280 cps as well as 200 and 2000 /s. A good review of the literature and an excellent paper on the subject.

- 1185 Korner, O. 1905. Können die fische hören. Beitrage Zeitschr. Ohrenheilkunde Festschr. Gewidnet August Lüne 93-17.
- 1186 Krausse, A. 1918. Kritische Bemerkungen und neue versuche über das Hörvermögen der fische. Zeitschr. Allg. Physiol. 17:263-286. Twenty-eight experiments were conducted on fishes in the field.
- 1187 Kriedl, A. 1896. Ueber die perception der Schallwellen bei den fischen. Pflügers Archiv. f. d. ges. Physiol. 61:450-464. (1895). Goldfish perceive sounds through their lateral line.
- 1188 Kuroki, T. 1957. Fundamental studies on the relation between underwater sound and fish behavior. II. About the sound by ropes in water. Mem. Fac. Fish. Kagoshima Univ. 6:89. (In Japanese with English summary). A study of sounds emitting from long lines and its influence on fish behavior.
- 1189 _____, 1958. Fundamental studies on the relation between underwater sound and fish behavior. VII. About the wall of an aquarium. Mem. Fac. Fish. Kagoshima Univ. 7:102. Use for fish sounds.
- 1197 _____, 1913. Effects of explosive sounds, such as those produced by motor boats and guns upon fishes. Rept. U.S. Comm. Fish 1911 (Doc. 752), pp. 1-9. Tunas exhibit no affect to sound. A gong may startle them.
- 1198 _____ and A. P. Van Heusen. 1917. The reception of mechanical stimuli by the skin lateral-line organs and ears in fishes, especially in Ameiurus. Am. Jour. Physiol. 44:463-489. Catfish were stimulated by phone vibrating 43-688 tones. No reaction was exhibited to 1376 or 2752 vibrations or by dripping water, but to a whistle blown in air.
- 1199 Piper, H. 1906. Aktionsströme von gehörorgan der fische bei schallreizung. Zentralb. Physiol. 20:293. A general discussion of learning to a sound source.
- 1200 Poggendorf, D. 1952. Die absoluten Hirschenwellen des Zwergwelses (Ameiurus nebulosus) und Beitrage zur Physik des Weberschen Apparates der Ostariophysen. Zeitschr. Verg. Physiol. 34:222-257. Vibrations of 60-10,000 frequencies are perceived by the head of catfish.

R

- 1201 Reinhardt, F. 1935. Ueber richtungswahrnehmung bei fischen, besonders bei der elritze (Phoxinus laevis) und beim Zwergwels (Ameiurus nebulosus Raf). Zeitschr. Verg. Physiol. 22:570-604.
- 1202 Rumbaugh, L. H. 1946. Further requirements in oceanographic research for Naval ordnance application. Tr. Am. Geophys. Union 27(4):564-566. A call for more publications in this field.

S

- 1203 Sabine, P. E. 1942. Bibliography on noise. Jour. Acoustical Soc. Am. 13:210. A bibliography, but deals mostly with human reactions to sound.
- 1204 Shemanskij, Y. A. 1958. Fishing with sound. Priroda 2:104-105. A use for sound as a bait to catch calling fish.
- 1205 _____, 1958. Fishing with sound. Can. Fish. Rev. 13(11):23. Review of original article - no. 1204.
- 1206 Silverman, D. 1939. Bibliography of noise references. Electronics 12, 34.
- 1207 Stetter, H. 1929. Untersuchungen über den Gehörsinn der fische, besonders von Phoxinus laevis L. und Ameiurus nebulosus Raf. Zeitschr. Wiss. Biol. Abt. C. Zeitschr. Verg. Physiol. 9(2/3):339-477.

M

- 1190 Maier, H. N. 1909. Neue Biobachtungen über das Hörvermögen der fische. Arch. Hydrobiol. Planktonkunde 4:393-397.
- 1191 Munning, F. B. 1924. Hearing in the goldfish in relation to the structure of the ear. Jour. Exp. Zool. 41:5-20. Goldfish hear 43-2752 vibrations per second.
- 1192 Marage, E. 1906. Contribution a l'etude de l'audition des poissons. Compt. Rend. Acad. Sci. Paris, 143:852-853.
- 1193 McDonald, H. E. 1922. Ability of Pinephales notatus to form associations with sound vibrations. Jour. Comp. Psychol. and Physiol. 2:191-193.
- 1194 Moorehouse, V. H. K. 1932. Do fish react to noise. Prog. Rept. Pacific Biol. Sta. 13.
- 1195 _____, 1933. Reactions of fish to noise. Contr. Can. Biol. (n.s.) 7:465-475. Marine fishes showed little reaction to sounds.
- * Moorehouse, V. H. K. 1933. See Electricity.

P

- 1196 Parker, G. H. 1903. Hearing and allied senses in fishes. Bull. U.S. Fish Comm. 22:45-46. Repeats Kriedle's experiments. Shows that Fundulus can hear sounds.

- 1208 Stipetic, E. 1939. Ueber des Gehörorgan der Mormyridan. Zeitschr. Verg. Physiol. 26:740-752.

The upper limit of perception was 2794-3136 cps in Mormyrids.

T

- 1209 Tester, A. L. 1959. Section 12: Attraction of fish. Summary of experiments on the response of tuna to stimuli. In: Modern Fishing Gear of the World. Fishing News Ltd., London, pp. 538-542.

W

- 1210 Warner, L. H. 1932. The sensitivity of fishes to sound and to other mechanical stimulation. Quart. Rev. Biol. 7:326-339.

A review. Underwater sounds were found more stimulating to fishes than those above the water.

- 1211 Westerfield, Florence A. 1922. The ability of mud-minnow to form associations with sound. Jour. Comp. Psychol. 2:187-190.

- 1212 Wohlfahrt, T. A. 1936. Untersuchungen über das Toncenterscheidungsvermögen der Elritze (*Phoxinus laevis* Agass.) Zeitschr. Verg. Physiol. 26:570-604.

A good study of the sound effects to this species.

Z

- 1213 Zenneck, J. 1903. Reagieren die fische auf töne. Pflügers Archiv. f. d. ges. Physiol. 95:346-356.

Fishes were conditioned and responded to bell sounds in sea water.

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