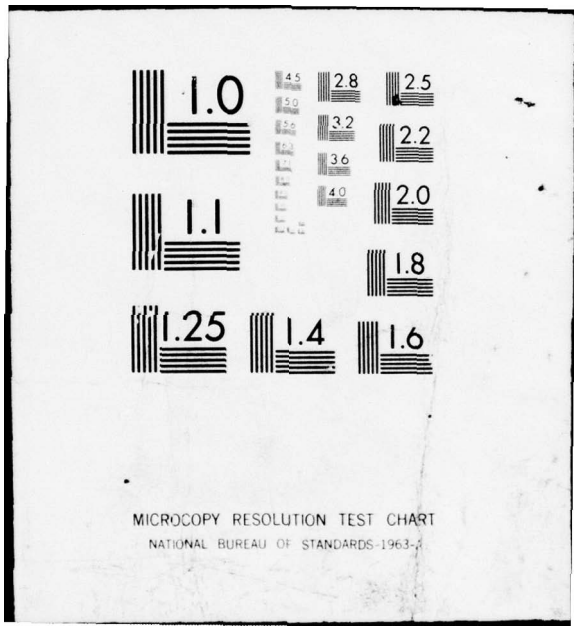
AD-A051 295 ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND ABERD--ETC F/G 6/6
A GLOSSARY OF SELECTED AQUATIC ECOLOGICAL TERMS.(U)
JAN 78 E S BENDER

UNCLASSIFIED ARCSL-SP-78002 SBIE-AD-E400 083 NL

| OF |
AD
A051295

END
DATE FILMED
4-78
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

(12)

SPECIAL PUBLICATION ARCSL-SP-78002

A GLOSSARY OF SELECTED AQUATIC ECOLOGICAL TERMS

Compiled by

Edward S. Bender

Environmental Technology Division

January 1978

US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
Chemical Systems Laboratory
Aberdeen Proving Ground, Maryland 21010

Disclaimer

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

Disposition

Destroy this report when it is no longer needed. Do not return it to the originator.

(18) SBIE (19) AD-E400083

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

(14)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: ARCSL-SP-78002	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): (6) A GLOSSARY OF SELECTED AQUATIC ECOLOGICAL TERMS.	5. TYPE OF REPORT & PERIOD COVERED: (9) Special Publication
6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s): (10) Edward S. Bender	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Director, Chemical Systems Laboratory, Attn: DRDAR-CLT-E, Aberdeen Proving Ground, Maryland 21010	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: PAA67T4114, Subproject 3, Task 2
11. CONTROLLING OFFICE NAME AND ADDRESS: Director, Chemical Systems Laboratory, Attn: DRDAR-CLJ-R, Aberdeen Proving Ground, Maryland 21010	12. REPORT DATE: (11) Jan 78
	13. NUMBER OF PAGES: 25 (12) 24 P.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): UNCLASSIFIED
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: NA

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

DDC RECEIVED MAR 16 1978 B

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

(U) Aquatic ecology
Glossary

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(U) A glossary of aquatic ecological terms has been completed to provide a convenient reference for readers of reports on ecological surveys published by the Ecology Branch, CSL. The terms are organized alphabetically and related terms are cross-referenced.

A

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

410179

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

BLANK PAGE

PREFACE

This glossary was prepared to supplement the reports of aquatic ecological surveys published by the Ecology Branch, Environmental Technology Division, CSL.

This glossary is intended to provide familiarity and understanding of technical terminology specific to the discipline of aquatic ecology and will serve as a convenient reference for all professionally trained persons concerned with water pollution control.

Definitions have been extracted from selected references as listed.

Terms specifically identifying or describing organisms have generally been excluded from this work. For this information the reader is referred to the selected references presented in the appendix. Glossaries of terminology related to other disciplines concerned with water pollution control are also listed in the appendix.

Terms underscored in a definition are separately defined in this glossary. Where appropriate, closely associated or related terms are cited parenthetically, (see _____), following the definition. Specific synonyms are noted, in italics, with the listed word.

A GLOSSARY OF SELECTED AQUATIC ECOLOGICAL TERMS

abiotic — Pertaining to factors or influences which have no biological origin.

acclimation — Physiological and behavioral adjustments of an organism in response to a change in environment, or (see adaptation) the presence of a contaminant.

acute toxicity — Any toxic effect that is produced within a short period of time, usually 24 to 96 hours. Although the effect most frequently considered is mortality, the end result of acute toxicity is not necessarily death; any harmful biological effect may be the results (see chronic toxicity, direct toxicity).

adaptation — Change in the structure, form or habits of an organism to adjust to changes in the existing environmental conditions (see acclimation).

aerobic — Of or pertaining to organisms which live only in the presence of free oxygen; also processes which occur only in the presence of free oxygen; also modifies a condition characterized by an excess of free oxygen in the aquatic environment (see anaerobic).

alga (Pl. Algae) — A simple plant, often microscopic, containing chlorophyll. Algae form the base of the food chain in aquatic environments. Some species create a nuisance when environmental conditions are suitable for prolific growth (see chlorophyll, food chain).

allochthonous — Pertaining to those substances, materials or organisms in a particular waterway which originate from runoff into that waterway or from tributaries of that waterway (see autochthonous).

alluvial — Pertaining to material (particularly sediment) that is transported and deposited by running water.

anaerobic — Of or pertaining to living organisms or processes which occur in the absence of free oxygen; also conditions that are characterized by the absence of free oxygen (see aerobic).

aphotic zone — That layer in a body of water to which light does not penetrate with sufficient intensity to have any biological significance (see euphotic zone).

aquatic vascular plants — *Higher aquatic plants.*

artificial substrate — A device placed in the water (for a specified period of time) that provides living spaces for a multiplicity of organisms; e.g., glass slides, concrete blocks, multiplate samplers, rock-filled baskets, etc. The primary purpose of artificial substrates is to allow the investigator to collect organisms in areas where the physical habitat

	is limiting or cannot be adequately sampled using conventional methods. Results obtained from this sampling method are quantitative and can be compared to other artificial substrate samples gathered during the same period.
assimilation	1. Removal of dissolved or suspended materials from a water mass by biological, chemical and physical processes. 2. Conversion or incorporation of absorbed nutrients into body substances (see synthesis).
association	All organisms occupying a given habitat (see habitat).
autochthonous	Pertaining to those substances, materials, or organisms that originate within a particular waterway and remain in that waterway (see allochthonous).
aufwuchs	*Periphyton*.
autotrophic (holotrophic)	Self-nourishing; denoting those organisms that do not require an external source of organic material but can utilize light energy and manufacture their own food from inorganic materials; e.g., green plants, pigmented flagellates (see heterotrophic).
autotrophic index	A measure of the effect of organic matter in the stream, a value of 100 or greater indicates organic pollution. The index is the ratio of chlorophyll containing biomass (autotrophs) to nonchlorophyll biomass (heterotrophs) multiplied by 100 (see biomass, chlorophyll, autotrophic, heterotrophic).
bacteria	Microscopic, single-celled or noncellular plants, usually saprophytic or parasitic.
benthic region	The bottom of a waterway; the substratum that supports the benthos.
benthos	Organisms growing on or associated principally with the bottom of waterways. These include: (1) sessile animals such as sponges, barnacles, mussles, oysters, worms, and attached algae; (2) creeping forms such as snails, worms and immature insects; (3) burrowing forms, which include clams, worms, and some immature insects; and (4) fish; e.g., flounders, whose habits are more closely associated with the benthic region than other zones.
bioassay	A determination of the biological effect of some substance, factor or condition employing living organisms or cells as the indicator (see biomonitoring).

biological control	1. Use of natural predators, parasites, diseases, or viruses, to reduce or eliminate pest organisms; e.g., use of Gambusia to feed on mosquito larvae. 2. Control of organisms by interference with their physiological processes; e.g., sterilization of male flies.
biological magnification	The ability of certain organisms to remove substances from their environment and store them in their tissues at nontoxic levels. The concentration of these substances becomes greater in each higher step in the food chain (see enrichment factor).
biomass	The total amount of living material in a given habitat or area; or, an expression dealing with the total weight of a given population of organisms.
biomonitoring	1. Continuous surveillance of an effluent (or dilution thereof) by using living organisms into a receiving water. 2. Use of living organisms to test the quality of a receiving waterway downstream from a waste discharge (see bioassay).
biostimulation	A general term used to describe the complex set of factors involved in the growth of algae (and other organisms) in a receiving waterway due to the addition of nutrients.
biota	All life (plants and animals) of a region.
biotic factors (*biological factors*)	In ecology, those environmental factors; e.g. competition, predation, etc.; which are the result of living organisms and their activities; distinct from physical and chemical factors (see ecological factor).
bloodworms	Midge larvae (family Chironomidae). Many of the species have hemoglobin in the blood causing a red color and are often associated with rich organic deposits. This is also the common name for certain of the segmented true worms (family Tubificidae) (see sludgeworms).
bloom	A readily visible concentrated growth or aggregation of minute organisms, usually algae, in bodies of water. This may be caused by natural seasonal processes of nutrient cycling or by nutrients from a discharge of polluted wastewater.
carnivore	An animal that feeds on other animals (see herbivore).
carrying capacity	The maximum quantity of organisms a particular habitat can support over an extended period.

catastrophic drift — Massive drift of bottom organisms as a result of stress such as floods or toxicity (see drift organisms, incidental drift).

chemical stratification — The formation of layers of water in a lake that are of different densities. This density difference is caused by changes in the concentrations of dissolved substances in the water at different depths (see stratification).

chlorophyll — Green photosynthetic pigment present in many plant and some bacterial cells. There are seven known types of chlorophyll; their presence and abundance vary from one group of photosynthetic organisms to another.

chronic toxicity — Toxicity, determined from a long duration of testing, that produces an adverse effect on organisms. The end result of chronic toxicity can be death although the usual effects are sublethal; e.g., inhibition of reproduction, reduction of growth, etc. These effects are reflected by changes in the productivity and population structure of the community (see acute toxicity).

classification — The placing of organisms into groups (categories) according to established scientific procedures (see *taxonomy*).

clean water association — An association of organisms found in a natural, unpolluted environment. These associations are characterized by the presence of species that are sensitive to environmental changes caused by introduction of pollutants. In many cases the presence of a wide variety of species with relatively few individuals representing any one of them is also a characteristic of a clean water association (see sensitive organisms, tolerant association).

community — An aggregation of organisms within a specified area; all forms of life inhabiting a common environment.

competition — The effort of two or more individuals or species of a community to utilize some of the same environmental resources.

consumers — Heterotrophic organisms, chiefly animals, that ingest other organisms or particulate organic matter. Often they are divided into primary consumers (herbivores), secondary consumers (carnivores, which eat primary consumers), etc. (see heterotrophic, tropic level, producers).

critical — *Threshold*.

critical range — In bioassay, the concentration range which causes an effect for a factor. The concentration range lies between the minimum level or concentration at which no organisms die to the maximum level or concentration at which all organisms die under a given set of conditions in a given period of time.

cultural eutrophication	Acceleration by man of the natural process of enrichment (aging) of bodies of water.
density (population species)	The number of individuals in relation to the space (generally surface area) in which they occur; refers to the closeness of individuals to one another.
depositing substrates	Bottom areas where solids are being actively deposited because the velocity of the water has decreased. These substrates often occur in the vicinity of effluent discharges (see *sludge deposits*).
detritus	Fragments of organic material in the water or on the bottom of a waterway.
diatom	A ubiquitous, unicellular alga of the phylum Chrysophyta, which is sampled in water quality surveys as the main constituent of the periphyton community. They are attached to substrates and are the major producers of oxygen in aquatic environments (see periphyton).
direct toxicity	Toxicity that has an effect on organisms themselves instead of effecting an alteration of their habitat or interference with their food supply (see acute toxicity, chronic toxicity, indirect toxicity).
diurnal	1. An event, process, or specific change that occurs every day; usually associated with changes from day to night. 2. Pertaining to those organisms that are active during day time (see nocturnal).
diversity (species diversity)	Pertaining to the variety of species within a given association of organisms. Areas of high diversity are characterized by a great variety of species; usually relatively few individuals represent any one species. Areas with low diversity are characterized by a few species; often relatively large numbers of individuals represent each species.
dominant species	Species of a community which by their activity, behavior, or number, have considerable influence or control upon the conditions that affect the existence of associated species; a species which "controls" its habitat and food web (see *predominant*).
drift organisms	Benthic organisms temporarily suspended in the water and carried downstream by the current (see incidental drift, catastrophic drift).
EC_{50}	The concentration of a substance producing 50% decrease in some observable parameter, e.g., shell growth.
ecological factor	Any part of condition of the environment that influences the life of one or more organisms (see biotic factor).

ecological niche	The role of an organism in an ecosystem; its activities and relationships to the living and nonliving environment; (feeding and nutritional relationships are of primary importance (see habitat).
ecology	The study of the interrelationships between organisms and their environment.
ecosystem	A community, including all the component organisms, together with the environment forming an interacting system.
ecotype (habitat form)	A locally adapted population of a species which has a distinctive limit of tolerance to environmental factors. (Individuals of the same species may appear different morphologically, physiologically in various habitats.)
emergent aquatic plants	Plants that are rooted at the bottom of a body of water, but project above the surface; e.g., cattails, bulrushes, etc. (see floating aquatic plants, submersed aquatic plants).
enrichment	An increase in the quantity of nutrients available to aquatic organisms for their growth (see eutrophication).
enrichment factor	The number of times a substance is concentrated in the tissue of an organism over the concentration in its environment (see biological magnification).
environment	All external influences and conditions affecting the life and development of an organism or community.
equilibrium	The condition in which a population or community is maintained with only minor fluctuations in composition over an extended period of time.
euphotic zone	The lighted region of a body of water that extends vertically from the water surface to the depth at which photosynthesis fails to occur because of insufficient light penetration.
eutrophic lakes	Lakes which are rich in nutrients and organic materials, and, therefore, highly productive. These lakes are often shallow and seasonally deficient of oxygen in the hypolimnion (see oligotrophic lakes).
eutrophication	The natural process of the maturing (aging) in a lake: the process of enrichment with nutrients, especially nitrogen and phosphorus, leading to increased production of organic matter (see cultural eutrophication, oligotrophic lakes, eutrophic lakes).

fall overturn	A physical phenomenon that may take place in a lentic body of water during early autumn. The sequence of events leading to fall overturn include: (1) cooling of surface waters, (2) density change in surface waters producing convection currents from top to bottom, (3) circulation of the total water volume by wind action, and (4) vertical temperature equality. The overturn results in uniform conditions of physical and chemical properties throughout the water mass (see overturn, spring overturn).
flora	Plant life.
floating aquatic plants	Rooted plants that wholly or partly float on the surface of the water; e.g., water lilies, water hyacinth and duckweed (see emergent aquatic plants, submersed aquatic plants).
food chain	The dependence of a series of organisms, one upon the other, for food. The chain begins with plants and ends with the largest carnivores; e.g., phytoplankton, zooplankton, forage fish, game fish.
game fish (*sport fish*)	Those species of fish considered to possess sporting qualities on fishing tackle; e.g., salmon, trout, black bass, striped bass, etc. Game fish are usually considered to be more sensitive to environmental changes than rough fish.
habitat	A specific type of place that is occupied by an organism, a population, or a community.
herbicide	A chemical substance used for killing plants, especially weeds.
herbivore	An organism that feeds on plant material (see carnivore).
heterotrophic (*holozoic*)	Pertaining to organisms (primarily animals) that are dependent on organic material for food (see autotrophic).
higher aquatic plants (pond weeds, aquatic vascular plants)	Those plants composed of complex and differentiated tissues whose seeds germinate in the water or substrate of a body of water. They must spend part of their life cycle in water. This group includes plants which grow completely submersed as well as emersed and floating-leaf types (see macrophyte).
hypolimnion	The region of a body of water that extends from the thermocline to the bottom and is essentially removed from major surface influences.
identification	The use of a taxonomic key or the equivalent to determine the scientific name of an organism.

incidental drift	Random drift of benthic organisms in the water (see drift organisms, catastrophic drift).
incipient lethal level (ILL)	That concentration or level of an abiotic factor beyond which an organism could not survive.
indicator organisms	A species, whose presence or absence may be characteristic of environmental conditions in a particular kind of habitat. Species composition and the relative abundance of those species in a community are also reliable indicators of water quality.
indirect toxicity	Toxicity that affects organisms by interfering with their food supply or modifying their habitat instead of directly acting on the organisms themselves (see direct toxicity).
instar	A stage of tissue manufacture and growth in the life cycle of an insect or other arthropod between two successive molts; e.g., the first instar is the stage between the egg and the first molt.
interaction	Mutual action or influence among organisms, between organisms and environment, or among environmental factors.
interspecific	Refers to relations or conditions among different species.
intertidal zone	(Tidal zone).
intolerant organisms	(*Sensitive organisms*)
invertebrates	Animals without an internal skeletal structure; e.g., insects, mollusks, and crustaceans (see vertebrate).
larva (pl. larvae)	The immature form of an animal which is unlike its parents. Larvae are usually self-feeding stages which undergo complete metamorphosis into an adult; in insects, the stage between the egg and the pupa in metamorphosis (see metamorphosis, nymph, pupa).
Law of the Minimum, Liebig's	The growth and reproduction of an organism is dependent on the nutrient substance (such as oxygen, carbon dioxide, calcium, etc. . . . .) that is available in the minimum quantity (see limiting factor).
Law of Tolerance, Shelford's	When one environmental factor or condition is near the limits of tolerance for a species, either maximum or minimum, that factor or condition will determine the success of a species (see limiting factor).
lentic	Pertaining to standing (nonflowing) waters such as lakes, ponds, and swamps (see lotic).

life cycle	The various phases, changes, or stages through which an individual passes from the fertilized egg to death of the mature organism (see metamorphosis).
limiting factor	A factor whose absence, or excessive concentration, exerts some restraining influence upon a population through incompatibility with requirements or tolerance of a species (see Law of the Minimum, Law of Tolerance).
limnology	The science of inland waters.
lotic	Pertaining to flowing waters such as streams and rivers (see lentic).
macroorganisms (*macroinvertebrates*)	Those invertebrates visible to the unaided eye and which are retained on a U.S. standard sieve No. 30 (openings of 0.589 mm); e.g., clams, insects (see microorganisms).
macrophyte	Plants that can be seen with the unaided eye; e.g., aquatic mosses, ferns, liverworts, rooted plants, etc.
marsh	A periodically wet or continually flooded area with the surface not deeply submerged. It is often predominated by emergent aquatic plants; e.g., sedges, cattails, rushes.
median tolerance limit (TL_m)	The concentration of a substance tested in water at which 50% of the test organisms survive for a specified period of exposure (see tolerance limit).
metamorphosis	Transformation of an animal from one distinctive life history stage to another in its postembryonic development; e.g., in insects, a larva transforming to a pupa. Complete metamorphosis includes the egg, larva, pupa, and adult stages; incomplete metamorphosis lacks one or more stages (see life cycle).
microorganisms (*microinvertebrates*)	Those organisms which are invisible or only barely visible with the unaided eye. Microorganisms pass through a U.S. standard Series No. 30 sieve but are retained on a series No. 100 sieve (mesh openings of 0.149 mm).
molt	A process of casting or shedding the outer body covering to permit an increase in body size. This is characteristic of arthropods (see instar).
native species	A species that is part of an area's original biota.
natural selection	Processes occurring in populations of species in nature which impose a rigorous test on the fitness of an organism, and which determine which genetic changes will persist and which will perish in the environment.

nekton	Macroscopic organisms, e.g., fish, which swim actively in the water (see plankton).
niche	(See ecological niche, habitat).
nocturnal	Pertaining to those organisms that are active at night (see diurnal).
nuisance organism (pests)	Those organisms capable of interfering with man's use of water.
nutrients	Elements, or compounds, that are essential as raw materials for organism growth and development; e.g., carbon, oxygen, nitrogen, phosphorus, etc.
nymph	An immature life cycle stage of insects that do not have complete metamorphosis; e.g., mayflies and stoneflies (see larva, metamorphosis).
oligotrophic lakes	Deep lakes which contain limited nutrients, thus organic production is low. Dissolved oxygen is present throughout the lake, year round (see Eutrophic lakes).
organism	Any living plant, animal or bacteria.
overturn (turnover)	The period of mixing, by top and bottom circulation, of previously stratified lentic water masses. This phenomenon may occur in spring and/or fall; it causes the physical and chemical properties of the water to be uniform at all depths (see chemical stratification, thermal stratification, spring overturn, fall overturn).
parasite	An organism that lives on or in a host organism during all or part of its existence. Nourishment is obtained at the expense of the host.
pathogen	An organism or virus that causes a disease.
pesticide	Any chemical preparation used to kill pests, including insecticides, herbicides, fungicides, etc.
periphyton	The aquatic community, composed of diatoms and other algae, bacteria, fungi and protozoa, which is attached to substrates such as plants, rocks, mud, and glass.
photosynthesis	The metabolic process by which simple sugars are manufactured from carbon dioxide and water by plant cells using light as an energy source (see chlorophyll).
photic zone	(Euphotic zone)

phytoplankton	Microscopic plants that float on or in the water and are carried by the current (see zooplankton).
plankton	Suspended microorganisms that have relatively low powers of locomotion, or that drift in the water subject to the action of waves and currents. The name means wanderer (see benthos, periphyton, nekton).
pond weeds	(Higher aquatic plants)
population	A group of interacting individuals of the same species, area, or community.
predator	An animal that kills and consumes other animals (see prey).
predominant	Those organisms that are of greatest numerical abundance in a particular community for a given period of time (see dominant species).
prey	An animal that is killed and consumed by another animal (see predator).
primary productivity	The total quantity of protoplasm produced by autotrophic organisms per unit of time in a specified habitat.
producers	Organisms that synthesize organic material from inorganic substances, e.g., plants (see consumers, reducers).
production	The process of producing organic material. 1. Rate of protoplasm formation of energy utilization by one or more organisms; total quantity of organic material produced within a given period in a specified habitat. 2. Capacity or ability of an organism or trophic level to produce organic material (see primary productivity, secondary productivity).
protoplasm	The living material in cells of plants and animals.
pupa	An intermediate, usually quiescent, stage following the larval stage in insects; from it emerges the adult (see larva).
quality	The composite chemical, physical, and biological characteristics of a waterway describing its suitability for a particular use.
reducers (*decomposers*)	Those organisms, usually bacteria or fungi, that break down complex organic material into simpler compounds (see producers, consumers).

respiration — The complex series of chemical and physical reactions in all living organisms by which the energy and nutrients in foods is made available for use. Oxygen is used and carbon dioxide released during this process.

riffles — A shallow, usually rocky area, in an open stream where the water surface is broken into waves by wholly or partly submerged obstructions. Riffles usually support a wider variety of bottom-dwelling organisms than other stream sections.

rough fish — Those species of fish considered to be of poor fighting quality when taken on tackle; e.g., carp, gar, suckers, etc. These fish are considered undesirable by man in most situations. Most species in the group are more tolerant of widely changing environmental conditions than game fish.

scavenger — An organism that consumes decomposing organic matter.

secondary productivity — Total quantity of animal (and other heterotrophic protoplasm) produced per unit of time in a specified habitat (see primary productivity, productivity).

sensitive organisms (*intolerant organisms*) — Organisms that exhibit a rapid response to environmental changes and are killed, driven out of the area, or as a group are substantially reduced in numbers, when their environment is changed (see tolerant association).

sessile — Pertaining to those organisms that are attached to a substrate and not free to move about; e.g., periphyton.

seston — All material, both organic and inorganic, which is suspended in a waterway. Bioseston is the living material; abioseston is the nonliving portion.

sludge deposits — Accumulations of settled, usually rapidly decomposing organic material in the aquatic system. A deposit of solids of wastewater origin.

sludgeworms — Aquatic segmented true worms (class Oligochaeta) that exhibit marked population increases in waters polluted with decomposable organic wastes (see bloodworms).

species (pl. species) — An organism or organisms forming a natural population, or groups of populations, that transmit specific characteristics from parent to offspring. Each species is reproductively isolated from other species with which they might breed.

spring overturn	A physical phenomenon that may take place in a lentic body of water during the early spring. The sequence of events leading to spring overturn, include: (1) melting of ice cover; (2) warming of surface waters; (3) density changes in surface waters producing convection currents from top to bottom; (4) circulation of the total water volume by wind; and (5) vertical temperature equilibration. During the summer, thermal and chemical stratification of the water mass will occur (see fall overturn, overturn).
stimulus	An influence that causes a response in an organism (see taxis).
submersed (submerged) aquatic plants	Higher aquatic plants that grow, or are adapted to grow beneath the surface of the water; e.g., ponaweed, coontail, etc.
substrate	The bottom material of a waterway; the base or substance upon which an organism is growing.
stratification (density stratification)	Arrangement of water masses into separate, distinct, horizontal layers as a result of differences in density; this may be caused by differences in temperature, dissolved oxygen, dissolved or suspended solids (see thermal stratification, chemical stratification).
stress	The conditions resulting from an environmental change that disturbs the normal functioning of an animal to such an extent that its chances for survival are reduced.
surface aquatic plants	(*Floating aquatic plants*).
synergism	The joint action of two or more substances which is greater than the sum of the action of each of the individual substances; e.g., action of certain combinations of toxicants.
synthesis	The production of a substance by the union of elements or simpler chemical compounds.
systematics	(Taxonomy)
taxis	A response to a stimulus; e.g., rheotaxis is a response to current.
taxon (pl. taxa)	Any taxonomic unit or category of organisms; e.g., species, genus, family, order, etc.
taxonomy (systematics)	The science of organism classification with reference to their evolutionary relationship in the plant or animal kingdom; includes the base, principles, procedures and rules of classification.

terrestrial	Growing on, living on, or peculiar to the land, as posed to the aquatic or marine environments.
territory	The area which an animal defends against intruders.
thermal stratification	The layering of water masses owing to different densities in response to temperature. The condition of a body of water in which the successive horizontal layers have different temperatures, each layer more or less sharply differentiated from the adjacent ones, the warmest (or the coldest) at the top (see overturn, fall overturn, spring overturn).
threshold (critical level)	The maximum or minimum duration or intensity of a stimulus that is required to produce a response in an organism.
TL_m (TL_{50})	(Median Tolerance Limit)
tolerance	Relative capability of an organism to endure or adapt to an unfavorable environmental factor.
tolerance limit (TL_{10}. . .100)	*The concentration of a substance which some specified portion of* an experimental population can endure for a specified period of time with reference to a specified type of response; e.g., TL_{100} means that all test organisms endured the stress for the specified time; TL_{10} means only 10% of the test organisms could tolerate the imposed stress for the specified time (see median tolerance limit).
tolerance range	The range of one or more environmental conditions within which an organism can function; range between the highest and lowest value of a particular environmental factor in which an organism can live.
tolerant association	An association of organisms capable of withstanding adverse conditions within the habitat. These associations are often characterized by having a lower number of species (compared to a clean water association) and, in the case of organic pollution, an increase in individuals representing certain species.
toxicant	A substance that through its chemical or physical action kills, injures, or impairs an organism; any environmental factor which, when altered, produces a harmful biological effect (see pesticide).
toxicity	Quality, state or degree of the harmful effect resulting from alteration of an environmental factor.
tripton	The dead suspended particulate matter in an aquatic habitat; the nonliving portion of the seston.

trophic level	One of the parts in a food chain in an ecosystem in which all organisms of that level secure food in the same general manner. The first or lowest trophic level consists of producers (green plants); the second level of herbivores; the third level of secondary carnivores, etc. Most bacteria and fungi are organisms in the reducer (decomposer) trophic level.
ubiquitous organisms	Organisms that can tolerate a wide range of environmental conditions or variations; organisms that are so active or numerous as to seem to be present or existent in all types of environments (see tolerant association, sensitive organisms).
unicellular	Refers to an organism that consists of only one cell; e.g., blue-green algae, protozoa, bacteria. These organisms may be filamentous or colonial in form.
vertebrates	Animals that have an internal skeletal system; e.g., fish, snakes (see invertebrate).
water pollution	Alteration of the aquatic environment in such a way as to interfere with a designated use.
water quality criteria	A scientific requirement on which a decision of judgment may be based concerning the suitability of water quality to support a designated use (see water quality standard).
water quality standard	A plan that is established by governmental authority as a program for water pollution prevention and abatement (see water quality criteria).
zooplankton	The animals which are part of the plankton.

BLANK PAGE

APPENDIX

SELECTED REFERENCES

1. Abercrombie, M., Hickman, E. J., and Johnson, M. L. A Dictionary of Biology. Revised Edition. Penguin Books. Baltimore, Maryland. 1957.

2. Edmondson, W. T. (Editor). Ward and Whipple's Freshwater Biology. Second Edition. John Wiley & Sons, Inc. New York, New York. 1959.

3. Hanson, H. C. Dictionary of Ecology. Philosophical Library. New York, New York. 1959.

4. Ingram, W. M., Mackenthun, K. M., and Bartsch, A. F. WP-13. Biological Field Investigative Data for Water Pollution Surveys. US Dept. Interior. Fed. Water Pollution Control Admin. Pages 17-46. Washington, DC. 1966.

5. Kenneth, J. H. (Editor). A Dictionary of Biological Terms. Eighth Edition. D. Van Nostrand Company, Inc. New York, New York. 1963.

6. Matthews, J. E. Glossary of Aquatic Ecological Terms, EPA, Robert Sken Water Research Center, Ada, Okla. 1972.

7. Needham, J. G., and Needham, P. R. A Guide to the Study of Freshwater Biology. Fifth Edition. Holden-Day, Inc. San Francisco, California. 1962.

8. Odum, E. P. Fundamentals of Ecology. Third Edition. W. B. Saunders Company. Philadelphia, Pennsylvania. 1971.

9. Pennak, R. W. Freshwater Invertebrates of the United States. The Ronald Press Co. New York, New York. 1953.

10. Rein, G. K. Ecology of Inland Waters and Estuaries. Reinhold Publishing Corporation, New York, New York. 1961.

11. Ruttner, F. Fundamentals of Limnology. University of Toronto Press. Third Edition. Toronto, Ontario. 1963.

12. Storer, T. I., and Usinger, R. L. General Zoology. McGraw-Hill Book Co., Inc. New York, New York. 1957.

13. Sverdrup, H. U., Johnson, M. W., and Fleming, R. H. The Oceans: Their Physics, Chemistry, and General Biology. Prentice Hall, Inc. New York, New York. 1942.

14. Welch, P. S. Limnology. Second Edition. McGraw-Hill Book Co., Inc. New York, New York. 1952.

DISTRIBUTION LIST FOR ARCSL-SP-78002

Names	Copies
CHEMICAL SYSTEMS LABORATORY	
OFFICE OF THE DIRECTOR	
Attn: DRDAR-CLG	1
SAFETY OFFICE	
Attn: DRDAR-CLF	1
PLANS & PROGRAMS OFFICE	
Attn: DRDAR-CLR	1
AUTHOR'S COPIES: Environmental Technology Division, Attn: DRDAR-CLT-E	50
BIOMEDICAL LABORATORY	
Attn: DRDAR-CLL	1
CB DETECTION & ALARMS DIVISION	
Attn: DRDAR-CLC-C	1
DEVELOPMENTAL SUPPORT DIVISION	
Attn: DRDAR-CLJ-R	3
Attn: DRDAR-CLJ-L	3
Attn: DRDAR-CLJ-M	1
ENVIRONMENTAL TECHNOLOGY DIVISION	
Attn: DRDAR-CLT-P	1
MUNITIONS DIVISION	
Attn: DRDAR-CLN	1
PHYSICAL PROTECTION DIVISION	
Attn: DRDAR-CLW	1
RESEARCH DIVISION	
Attn: DRDAR-CLB	1
DEPARTMENT OF DEFENSE	
Administrator	
Defense Documentation Center	
Attn: Accessions Division (DDC-TC)	12
Cameron Station	
Alexandria, VA 22314	
Director	
Defense Intelligence Agency	
Attn: DB-4G1	1
Washington, DC 20301	
DEPARTMENT OF THE ARMY	
HQDA (DAMO-SSC)	1
WASH DC 20310	
OFFICE OF THE SURGEON GENERAL	
OFFICE OF THE SURGEON GENERAL	
Commander	
US Army Medical Bioengineering Research & Development Laboratory	
Attn: SGRD-UBC	1
Attn: LTC L. Reuter	1
Fort Detrick, Bldg 568	
Frederick, MD 21701	

Names	Copies
HQDA (SGRD-EDE)	
Attn: LTC Charles Dettor	1
WASH DC 20314	
US ARMY HEALTH SERVICE COMMAND	
Commander	
US Army Environmental Hygiene Agency	
Attn: HSE-AA-L, Librarian, Bldg 2100	1
Attn: HSE-AA-E	2
APG-Edgewood Area	
Superintendent	
Academy of Health Sciences	
US Army	
Attn: HSA-CDC	1
Attn: HSA-IHE	1
Fort Sam Houston, TX 78234	
Commander	
US Army Institute of Surgical Research	1
Brook Army Medical Center	
Fort Sam Houston, TX 78234	
US ARMY MATERIEL DEVELOPMENT AND READINESS COMMAND	
Commander	
US Army Materiel Development and Readiness Command	
Attn: DRCSF	1
Attn: DRCRD-WB	1
Attn: DRCRD	1
Attn: DRCRD-ES	1
Attn: DRCIS-MD	1
Attn: DRCPA-E	1
Attn: DRCRO-I	1
5001 Eisenhower Ave	
Alexandria, VA 22333	
Commander	
US Army Foreign Science & Technology Center	
Attn: DRXST-IS1	2
220 Seventh St., NE	
Charlottesville, VA 22901	
Project Manager for Chemical Demilitarization and Installation Restoration	
Attn: DRCPM-DR, Bldg E4585	1
APG-Edgewood Area	
Redstone Scientific Information Center	
Attn: Chief, Documents	1
US Army Missile Command	
Redstone Arsenal, AL 35809	
Commander	
US Army Science & Technology Center-Far East Office	1
APO San Francisco 96328	

DISTRIBUTION LIST FOR ARCSL-SP-78002 (Contd)

Names	Copies
US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND	
Commander	
US Army Armament Research and Development Command	
Attn: DRDAR-AC	1
Attn: DRDAR-LCE-M	1
Attn: DRDAR-LCH	1
Attn: DRDAR-LCN	1
Attn: DRDAR-SER	1
Attn: DRDAR-TSS	2
Attn: DRCPM-CAWS-WP	1
Dover, NJ 07801	
Director	
Ballistic Research Laboratory	
Attn: DRDAR-TSB-S	1
Building 328	
Aberdeen Proving Ground, MD 21005	
US ARMY ARMAMENT MATERIEL READINESS COMMAND	
Commander	
Pine Bluff Arsenal	
Attn: SARPB-ETA	5
Pine Bluff, AR 71611	
Commander	
Rocky Mountain Arsenal	
Attn: SARRM-MD	1
Commerce City, CO 80022	
Commander	
Frankford Arsenal	
Attn: SARFA-T-4200	1
Attn: Library Branch, TSP-L	2
Bldg 51-2	
Philadelphia, PA 19137	
US ARMY TEST & EVALUATION COMMAND	
Commander	
US Army Tropic Test Center	
Attn: STETC-MO-A (Tech Library)	1
APO New York 09827	
Commander	
Dugway Proving Ground	
Attn: STEDP-PO	1
Dugway, UT 84022	
Commander	
US Army Test & Evaluation Command	
Attn: DRSTE-ME	1
Attn: DRSTE-FA	2
Aberdeen Proving Ground, MD 21005	

Names	Copies
DEPARTMENT OF THE NAVY	
Chief of Naval Research	
Attn: Code 443	1
800 N. Quincy Street	
Arlington, VA 22217	
Commander	
Naval Facilities Engineering Command	
Attn: Code 03	1
200 Stovall Street	
Alexandria, VA 22332	
Commander	
Naval Ordnance Systems Command	
Attn: ORD-03D	1
Washington, DC 20360	
Chief, Bureau of Medicine & Surgery	
Department of the Navy	
Attn: CODE 5	1
Washington, DC 20372	
Commander	
Naval Air Systems Command	
Attn: Code AIR-350E	1
Attn: Code AIR-53231B	1
Washington, DC 20361	
DEPARTMENT OF THE AIR FORCE	
HQ Foreign Technology Division (AFSC)	
Attn: PDRR	1
Wright-Patterson AFB, OH 45433	
HQ, USAF/SGPR	1
Forrestal Bldg	
WASH DC 20314	
HQ AFISC/SEV	1
Norton AFB, CA 92409	
Commander	
Armament Development & Test Center	
Attn: DLOSL (Technical Library)	1
Eglin AFB, FL 32542	
ADDITIONAL ADDRESSEES	
Commander	
USDRC Installations & Services Agency	
Attn: DRCIS-RI-IU	1
Rock Island, IL 61201	
Commander	
US Army Materiel Development & Readiness Command	
Munition Production Base, Modernization & Expansion	
Attn: DRCPM-PBM-EC/Project Manager	1
Attn: DRCPM-PBM-EB/Mr. A. Selman	1
Dover, NJ 07801	

DISTRIBUTION LIST FOR ARCSL- SP-78002 (Contd)

Names	Copies
Commander DA-DCSLOG Attn: DALO-AMP Washington, DC 20310	1
Department of the Army Attn: DAEN-ZCE Washington, DC 20310	1
Commander US Army Construction Engineering Research Laboratory Attn: CERL-ER Champaign, IL 61820	1
Office of Chief of Engineers Attn: DAEN-MCZ-E Washington, DC 20314	2
District Engineer US Army Corps of Engineers 6014 US PO & Courthouse 215 N 17th Street Omaha, NB 68102	1
District Engineer US Army Corps of Engineers Attn: HNDED-M Attn: HNDED-FC PO Box 1600 West Station Huntsville, AL 35807	1 1
Commander Holston Army Ammunition Plant Attn: SARHO-E Kingsport, TN 47662	5
Commander Milan Army Ammunition Plant Attn: SARMI-S Milan, TN 38358	1
Commander Newport Army Ammunition Plant Attn: SARNE-S Newport, IN 47966	1
Commander Radford Army Ammunition Plant Attn: SARRA-IE Radford, VA 24141	1
Commander Sunflower Army Ammunition Plant Attn: SARSU-O Lawrence, KS 66044	1
Commander Volunteer Army Ammunition Plant Attn: SARVO-T Chattanooga, TN 37401	1
Army Logistics Management Center Environment Management Attn: LCDR/J.C. Bolander Fort Lee, VA 23801	1
US Army Engineer Waterways Exe Experimental Station Environmental Systems Division PO Box 631 Vicksburg, MI 39180	1
Commander US Army Armament Materiel Readiness Command	
Attn: DRSAR-ASN	1
Attn: DRSAR-IMB-C	1
Attn: DRSAR-ISE	2
Attn: DRSAR-LC	1
Attn: DRSAR-PDM	1
Attn: DRSAR-SA	1
Attn: DRSAR-SF	1
Attn: DRSAR-SR	1
Rock Island, IL 61201	


78