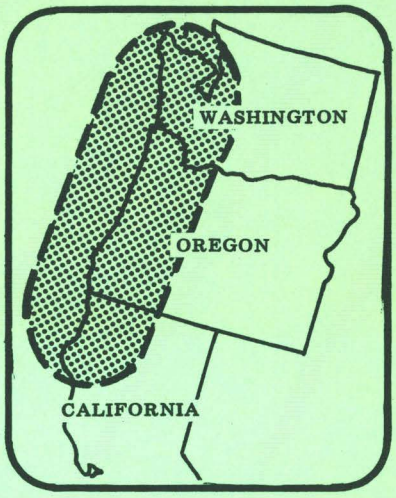
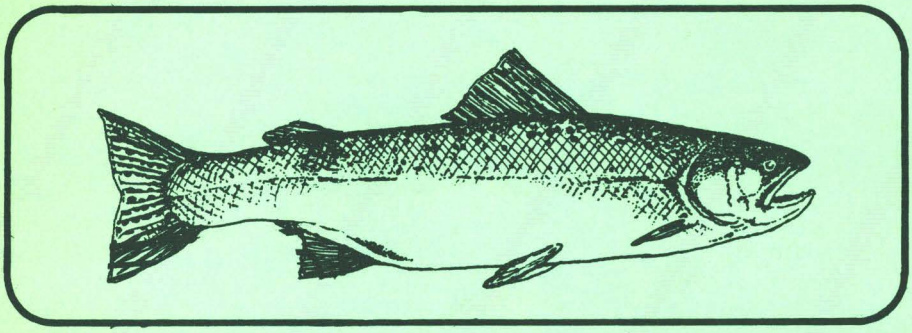
Biological Services Program

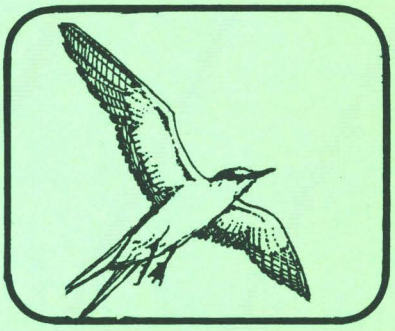
FWS/OBS-79/15
July 1980

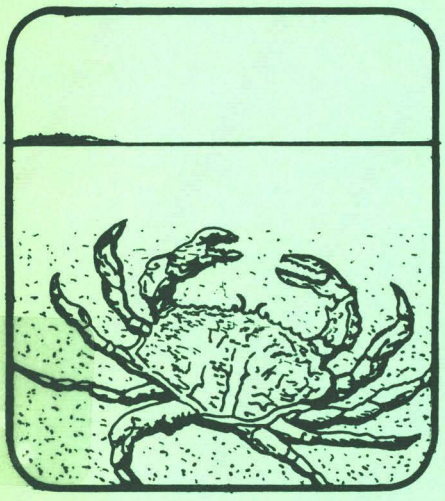
An Ecological Characterization of the Pacific Northwest Coastal Region

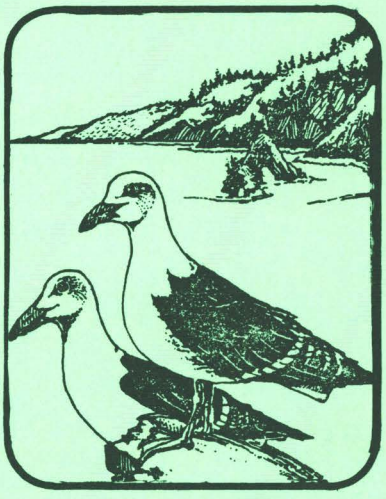
VOLUME 5
DATA SOURCE APPENDIX











Interagency Energy-Environment Research and Development Program

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
AND
Fish and Wildlife Service
U.S. Department of the Interior

The Biological Services Program was established within the U.S. Fish and Wildlife Service to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems. The mission of the program is as follows:

- To strengthen the Fish and Wildlife Service in its role as a primary source of information on national fish and wildlife resources, particularly in respect to environmental impact assessment.
- To gather, analyze, and present information that will aid decisionmakers in the identification and resolution of problems associated with major changes in land and water use.
- To provide better ecological information and evaluation for Department of the Interior development programs, such as those relating to energy development.

Information developed by the Biological Services Program is intended for use in the planning and decisionmaking process to prevent or minimize the impact of development on fish and wildlife. Research activities and technical assistance services are based on an analysis of the issues a determination of the decisionmakers involved and their information needs, and an evaluation of the state of the art to identify information gaps and to determine priorities. This is a strategy that will ensure that the products produced and disseminated are timely and useful.

Projects have been initiated in the following areas: coal extraction and conversion; power plants; geothermal, mineral and oil shale development; water resource analysis, including stream alterations and western water allocation; coastal ecosystems and Outer Continental Shelf development; and systems inventory, including National Wetland Inventory, habitat classification and analysis, and information transfer.

The Biological Services Program consists of the Office of Biological Services in Washington, D.C., which is responsible for overall planning and management; National Teams, which provide the Program's central scientific and technical expertise and arrange for contracting biological services studies with states, universities, consulting firms, and others; Regional Staff, who provide a link to problems at the operating level; and staff at certain Fish and Wildlife Service research facilities, who conduct inhouse research studies.

FWS/OBS-79/15
JULY 1980

AN ECOLOGICAL CHARACTERIZATION

OF THE PACIFIC NORTHWEST COASTAL REGION

VOLUME FIVE

DATA SOURCE APPENDIX

Prepared by
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Performed for
National Coastal Ecosystems Team
Office of Biological Services
Fish and Wildlife Service
U.S. Department of the Interior

DISCLAIMER

The opinions, findings, conclusions, or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of the Office of Biological Services, Fish and Wildlife Service, U.S. Department of the Interior.

PREFACE

Reference Data for the Characterization fall into three groups: 1) those which are incorporated in the first four volumes, 2) those which are printed in this volume, and 3) those which are physically separate from the printed volumes. The latter two groups, designated Parts 1 through 8 of Volume 5, constitute the Data Source Appendix, a deliverable item under the contract for this study.

Computer data processing for the project also fell into three groups which are in order of increasing complexity: 1) data storage, simple alphabetical sorting, and print-out for the Glossary of Terms; 2) storage, multiple sorting selective print-outs, and indexing for the Annotated Bibliography and Lists of References; and 3) storage, more complex sorting, combining, and printing for the Annotated Species List (ASL) and Community Compositions. Procedures for the latter two are discussed in Parts 1 and 2, respectively.

Aside from sorting, selection, and other time-saving manipulation that the computer can do, a major advantage is that it prints without introducing typing errors. While this was a great help in preparing the glossary, it was virtually indispensable in handling the bibliographic files and particularly the species lists.

It is our hope that we have produced a useful product. The Annotated Bibliography and, more particularly, the Species List can be parts of a growing data bank for the Pacific Northwest Coastal Region. This bibliography uses the FAMULUS system (see Part 1) and, while we have made innovations for easier entry, editing, and print-out, it is compatible with other reference files using this system. If kept updated, it will remain a very useful guide to the extensive literature on the Pacific Northwest coast.

The Annotated Species List is nearly complete for trees, shrubs, and vertebrates, and a good start has been made for other biota, as described in Part 2. We have only begun to utilize its potential in preparing the list of critical species in Volume 2 and the Community Composition lists in Volume 3. We recommend that this list receive further review and refinement and that it be expanded to include more species and possibly more habitats.

Questions or requests for this publication should be addressed to:

Information Transfer Specialist
National Coastal Ecosystems Team
U.S. Fish and Wildlife Service
NASA-Slidell Computer Complex
1010 Gause Blvd.
Slidell, Louisiana 70458

This report should be cited:

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LIST OF CONTRIBUTORS

Contributors are listed by name, affiliation, and contribution to this volume. RETA/Envirodyne Engineering, Inc. personnel are identified by RETA. Faculty consultants are identified by institution and department - HSU, Humboldt State University, CA; OSU, Oregon State University; UO, University of Oregon; UW, University of Washington. Graduate students are identified by institution only. Independent consultants are identified by the word Consultant. The act of contributing does not necessarily constitute endorsement. The responsibility for this document rests with RETA, Bellevue.

Baergen, Arlene, RETA: Secretary; document makeup and typing coordination

Bailey, Mark B., UW Computer Center: Annotated Species List program design and data management

Brown, Dr. George W., Jr., UW Fisheries: data sources, editing and bibliographic system design

Brown, Suzan: bibliography editing

Chew, Dr. Kenneth K., UW Fisheries: review estuarine and marine algae and invertebrates

Galvin, David V., RETA: Technical Editor; terrestrial non-vascular and vascular plants, rare, threatened, or endangered plants, bibliography editing, document management

Garcia, John C., RETA: Technical Director; Annotated Species List design and management, herpetofauna, coastal and marine mammals, ASL review

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Hanley, Kathleen, UW: list of terrestrial mammals

Koplin, Dr. James R., HSU Biology: additions to inland lists for Watershed Units 8 and 9

Lattin, Dr. John, OSU Entomology: list of insects

Lewis, Gary B., RETA: coastal algae and invertebrates, oceanic algae, invertebrates, and fish

Loney, Fred, UW: list of terrestrial vascular plants

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Paulson, Dr. Dennis R., UW Burke Museum: review bird and terrestrial vertebrate lists

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Roye, Cynthia L., UO: estuarine plants and animals, coastal algae and fish

Sloan, Carol L., RETA: species list editing

Taber, Dr. Richard D., UW Forestry: terrestrial wildlife

Warner, Molly, UW: list of terrestrial and oceanic birds

The following people provided technical/editorial assistance. FWS indicates Fish and Wildlife Service and BLM stands for Bureau of Land Management, both of the U.S. Department of the Interior.

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Jensen, William: Consultant
Johnston, James: FWS
Keene, Don: BLM
Kline, Gary: FWS
Kroger, Richard: FWS
Watson, Jay: FWS
Willet, Charlotte: Consultant
Yoshinaka, Marvin: FWS
Young, Martha: FWS

Barbara Carney and Daisy Singleton, FWS, provided clerical assistance in preparing the camera-ready document

INTRODUCTION

i. Purpose of the Study

The Ecological Characterization of the Pacific Northwest Coastal Region, Figure 1, is one of four similar projects of the Fish and Wildlife Service to characterize key coastal areas of the United States which is designed to provide a means of assessing and minimizing impacts of human activities in important fish and wildlife habitats.

When decisions must be made in land use planning and resource development matters, administrators and planners need an integrated overview of the ecosystems in the locale which may be affected, including the influences of man's activities. This overview must identify the important components of the ecosystem, the interrelationships of these components, how the ecosystem functions and changes, both seasonally and over the long term, and information that is missing. The scientist also needs to know the status of present ecological knowledge in the area.

The ecological characterization is intended to serve the needs of both these groups: to aid by supplying an integrated body of information in such form as to enable impact assessment and analyses, and to make apparent research needs to complete the data base.

The ecological characterization compiles and integrates information currently available concerning ecosystems of the study area, but does not claim to include all the data needed for detailed assessments of impacts. The characterization should enable decision-makers to ask the right questions.

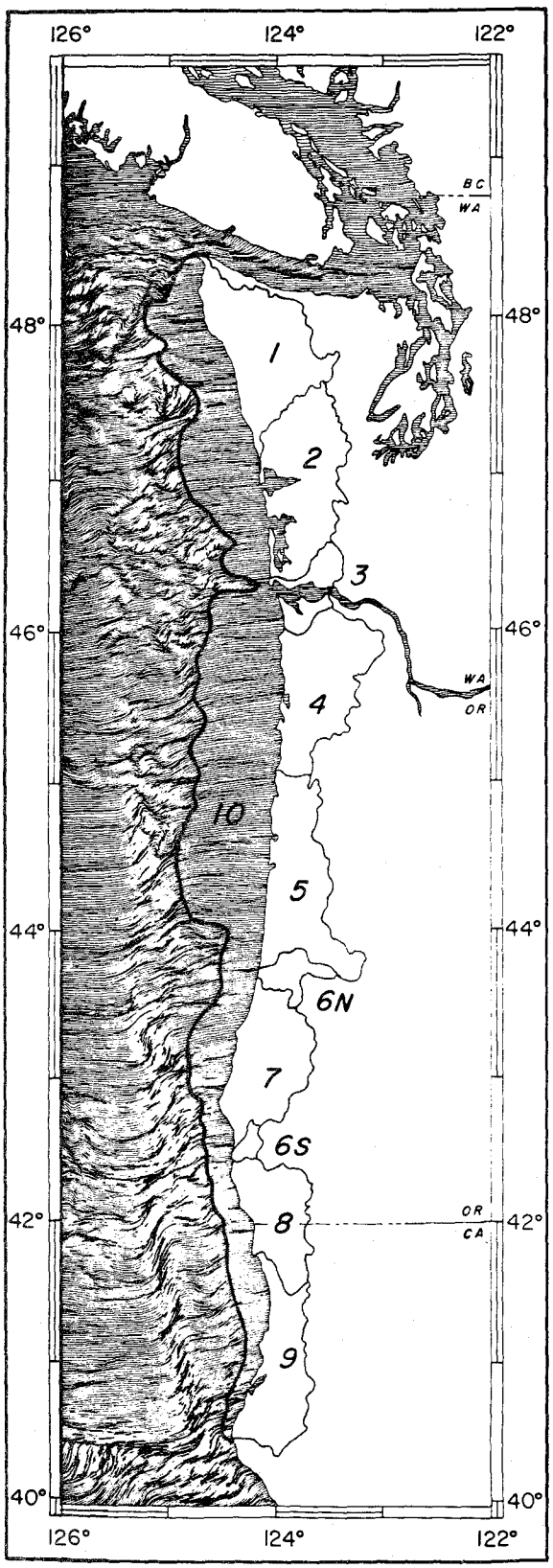
ii. Approach to the Study and Organization of Documents

To organize the collection, synthesis, and presentation of the data to be used for the ecological characterization of the study area, a Conceptual Model of the Pacific Northwest Coastal ecosystems was developed. The Model was tested in the Pilot Study (Test Characterization of Coos-Coquille Watershed Unit 7) and was then extensively revised and reorganized. It now forms a comprehensive framework on which this Characterization Atlas is based.

The organization of documents for this study is illustrated in Figure 2. The Conceptual Model is Volume 1 of the Ecological Characterization of the Pacific Northwest Coastal Region. It is followed by Volume 2, Characterization Atlas - Regional Synopsis, which embraces the entire study area and, using the same outline and the models of Volume 1, includes information which is characteristic of the region as a whole and is not specific to the Watershed Units. The Regional Synopsis also includes detailed descriptions of species which are important to the Pacific Northwest for economic, ecological, and esthetic reasons. The modeling is continued and expanded in Volume 3, Characterization Atlas - Zone and Habitat Descriptions, which includes food web, community composition, succession, and ecosystem models for habitats in the biological zones of the region.

In Volume 4, Characterization Atlas - Watershed Unit Descriptions, specific data and/or references are given for each of the Watershed Units. This information is organized and presented primarily in the form of a summary and references, corresponding to sections of Volumes 1 and 2, rather than as an expanded independent document for each unit. Volume 5, Data Source Appendix, contains the Data Gap Report and an explanation of the Annotated Bibliography and Species Lists, computer tapes, programs, and print-outs of which will be on file with Region 1, USFWS in Portland, Oregon.

The same general chapter outline is used for the Model, the Regional Synopsis, and each of the Watershed Unit descriptions in the Characterization Atlas. The Introduction and Users Guide of the other four volumes and their Tables of Contents may be consulted for more information on how to locate material in these reports.



PACIFIC NORTHWEST COASTAL REGION WATERSHED UNITS

1 Olympic Rainforest

2 Willapa – Grays Harbor

3 Columbia Estuary

4 Oregon North Coast

5 Oregon Mid Coast

6 Lower Umpqua and Lower Rogue

7 Coos - Coquille

8 Oregon - California Border

9 Redwood Coast

10 Continental Shelf

FIGURE 1. THE STUDY AREA AND ITS BOUNDARIES.

x

Data

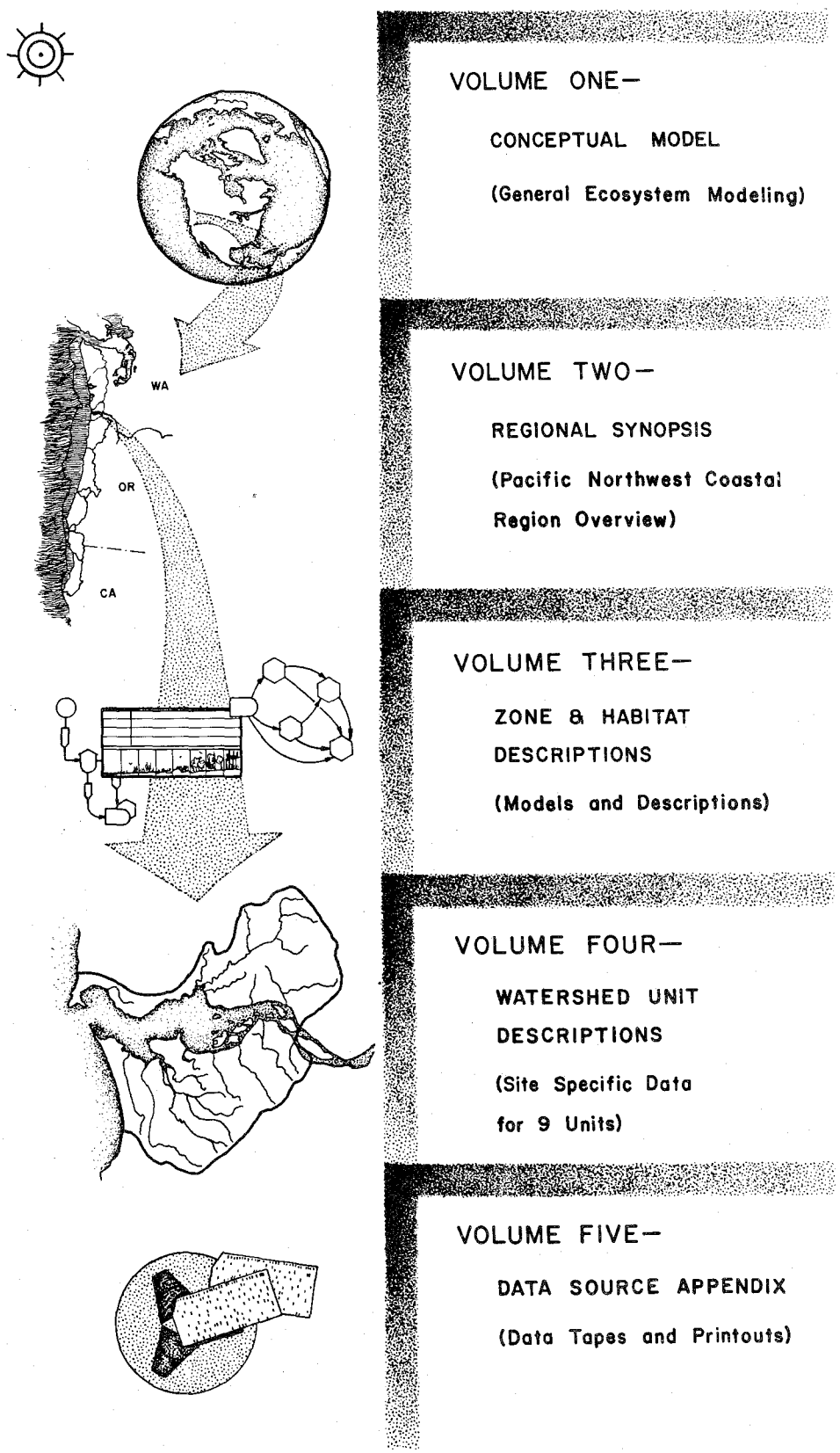


FIGURE 2. ORGANIZATION OF THE ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION. See the Introduction and User's Guide of Volume 1 for more information.

iii. Organization of the Data Source Appendix

This volume consists of eight parts, four of which are printed here. The other four are computer tapes, print-outs, and program notes which were delivered to Region 1, U.S. Fish and Wildlife Service, 500 N.E. Multnomah Street, Portland, Oregon 97232. The volume is divided as follows:

Part 1 Annotated Bibliography
description and general discussion

Part 2 Annotated Species List (ASL)
description, general discussion, and list of references for the ASL

Part 3 Data Gaps Report

Part 4 List of References
cited in the text of Volume 5

Part 5 Computer Print-out of Annotated Bibliography

A Index by Key Words

B Master Bibliographic File

Part 6 Computer Print-out of ASL

A Community Composition Print-out
by habitat and trophic level

B Master ASL File

Part 7 Data Tape
containing Parts 5B and 6B, and the Glossary of Terms (glossary print-outs are in Volumes 1 through 4)

Part 8 Program Notes

A FAMULUS document (see Part 1, Section 2.3)

B ASL Program Notes
print-outs, in binder with Part 6

This Introduction follows the general plan used in the preceeding volumes except that regional description and the Users' Guide are omitted. Parts 1, 2, and 3 are not divided into chapters, as in earlier volumes, so division pages also are omitted.

iv. Numbering of Pages, Figures, and Tables

Consecutive small roman numerals are used for the opening pages and the Introduction and single arabic numerals for the figures. Two-part, hyphenated arabic numerals are used elsewhere. The number for each page, figure, or table begins with a numeral 1, 2, or 3 (for the respective Part of the volume) followed by a hyphen and a second numeral which is the serial number for that page, figure, or table. Thus 2-1 is the number for the first such unit (page, figure, table) in Part 2. Page numbers for the List of References at the back of this volume begin with R (e.g., R-3). Page Designators are Data, Refs, Species, Gaps, and Data for the Introduction and Parts 1, 2, 3, and 4, respectively.

Page designation and numbering follow the same system used in Volumes 1 and 2 except that Parts in this volume have essentially the status of Chapters in Volumes 1 and 2.

Part One – ANNOTATED BIBLIOGRAPHY

1.0 PROSPECTUS - A COMPUTER-BASED BIBLIOGRAPHIC SYSTEM

1.1 An Automated Bibliography Approach

Most scientific report writing requires accompanying literature citations for documentation. For short articles and reports, the handling and manipulation of the bibliographic entries may be done conveniently by hand. However, for long reports with extensive bibliographic citations, the preparation, maintenance, and manipulation become cumbersome and error-prone when done manually. When bibliographic citations are used for cross-reference purposes on subject matter, and when searches on subject matter are to be performed, computerization materially reduces the time and cost of operations and contributes substantially to their accuracy.

Recently, federal agencies and others have been requesting that reports contain citations that include keywords (descriptors) or annotations, or both, and that the bibliography be computerized. Because we anticipate a growing need for performing searches on specialized bibliographies, we describe here a computerized bibliographic system serving such needs. In addition to meeting the demands for keywords and annotations, this system also serves the needs of research teams organizing information in special areas. In the ecological field, an area heavily supported by state and federal contracts, much of the information useful in various studies is contained in in-house reports and other reports of limited circulation. Consulting firms dealing with such contracts have the opportunity of building a master bibliographic file for use on a large number and variety of projects. For individual projects, pertinent references can be retrieved through search routines. These computer-stored references contain key words (descriptors) and short annotations of great value in providing documentation for subject areas to be covered in the report.

A computerized bibliography not only serves the final need at the time of publication or termination of a project, but also provides an organized structure aiding in the preparation of further reports.

There are other advantages of the computerized bibliography over the manual method:

1) Selected print-out. In reports that are written in sections, it may be necessary to provide appropriate references for individual citations from a master list. This need is readily filled by a computerized bibliography, with much less effort and expense than would be required if selected references had to be located and retyped from the citations appearing in the master list.

2) Camera-ready print-out. A variety of print-out formats are available so that the final bibliography can be printed out with dimensions suitable for immediate copying or photographing for photo-offset printing.

3) Reduction of typographical errors. Experience has shown that bibliographies are very prone to introduction of typographical errors because of peculiarities of format, punctuation, and multiple human handling. Once proofed, computerized citations remain virtually error-free through any and all manipulations. Much time and expense can be saved through elimination of continued proofreading of new versions of bibliographies.

4) Searches. The entire citation, or parts thereof, may be searched for particular terms and words. Searches can aid in organizing specific citations in relation to subject matter, species, geographical areas, authors, location of publication, and other data included with a given citation.

1.2 Description of the Computerized Bibliographic System

1.2.1 Source Program. The computer-based bibliography is organized from the FAMULUS system developed in its original form by the U.S. Forest Service at the University of California. This system is a packaged program now established at the Academic Computer Center of the University of Washington for use with the CDC6400 computer.

1.2.2 Format. As many as ten fields may be established for elements of a bibliographic citation. These can receive any designation, but the following are considered useful:

(1) Author
(2) Year (of publication)
(3) Title
(4) Publication (journal, book, thesis, newspaper, etc.)
(5) Key words - or Descriptors. These are words or phrases dealing with subject matter, and constitute the field(s) most often searched.
(6) Annotations
(7) to (10) These categories are available for other fields or means of classification as necessary or desired. For example:
Name of reviewer, location of article (library, agency, private), accession number, species of organisms with possible variations of spelling or classification, or other information desired. One of these fields may be reserved for in-house purposes, with comments on the status or value of the reference.
Each citation can comprise a total field length of about 400 words, sufficient for an extensive list of key words and annotated remarks.

1.2.3 Entry of Citations. Citations are entered into the computer by punched cards or through an interactive remote terminal. Entry is made from Bibliographic Data Sheets (Figure 1-1) as easily as making out cards for filing, as most researchers have done in the past. By the inclusion of an accession number on the data sheet, each citation is uniquely defined.

1.2.4 Manipulations. Original and additional entries are placed on the computer file as accumulated in random order. A number of manipulations on this file are possible:

1) Sort. This manipulation permits alphabetizing the citation by author of publication as with standard bibliographies.

2) Corrections. These may be made via appropriately punched cards or through an edit routine with an interactive terminal.

3) Print-out. These may be made at any time in a variety of formats. Field labels may be retained or suppressed.

4) Index. An index of terms appearing in the descriptor field may be provided at any time. Under each term appears the number of the citation(s) containing the term referred to. Reference to the last print-out of the master file will yield the exact citations listed.

BIBLIOGRAPHIC DATA SHEET

ECOLOGICAL CHARACTERIZATION OF THE PACIFIC NORTHWEST COASTAL REGION

* PRINT OR TYPE ALL CAPS IF POSSIBLE *

* Zero = Ø *
* Letter O = O *

AUTHOR(S)
1234 6(Agencies, corporations may appear as author, e.g., U. S. Bureau of ...)

YEAR
1234 6(Of publication; if no year given, print ND)

TITLE
1234 6(Do not abbreviate title, except for U.S.)

PUBLICATION
1234 6(Follow CBE Style Manual. For journal articles give standard abbreviations or give name of publication in full; cite first and last pages. For books and reports, give publisher, city, state, total pages. Reports prepared by consulting firms should end with (firm name, city, state)).

DESCRIPTORS
1234 6( ), 6(WATERSHED UNIT CODE(S)) OCEANIC, INLAND, COASTAL as applicable, , , HEADLAND, BEACH, DUNES, ESTUARY as applicable. Set off descriptors by commas; See updated list

ANNOTATIONS
1234 6(BE BRIEF. Avoid use of same words as in DESCRIPTORS when possible. Use telegraphic style--phrases instead of sentences.)

LOCATION
1234 6(Libraries, organizations, individuals, etc. where material may be found)

CODE
1234 ( ) 6(See instructions) 17(Acquis. No.)

REVIEWER
1234 6(Last name, initials)

* Reviewer: make any comments to editor on reverse side. YES ☐ NO ☐ *

(do not write below this line)

STATUS
1234 6(In-house code)

Date recvd: Date edited: Editor:

Initial and date: Keypunched: Proofed list: Added to PF

FINAL PROOF (initial box)

PFN

☐ PF ☐ CAMERA READY

FIGURE 1-1. BIBLIOGRAPHIC DATA SHEET ENTRY FORM.

5) Ossify. At any time, an updated or corrected file can be preserved as a back-up in the form of newly-punched cards. Should permanent files or magnetic tape of the master list be destroyed, these cards can be used to reestablish any file in its last updated configuration.

6) Search. Descriptor terms may be searched for retrieval, and citations satisfying the search formula will be printed out. Searches can be made readily from remote terminals away from the computer location through acoustic connection to any telephone. The degree of access to the file can be limited by the file manager.

7) Deletions. Citations may readily be deleted from the file with closing of space between adjacent citations, doing away with the usual cut-and-paste routine or the retyping of citations with the possibility of introducing typographical errors.

1.3 Costs

Costs for actual computer time are low as relatively little data processing is needed. A major cost area is that associated with preparation of the bibliographic data sheets with selection of key words (descriptors), preparing the annotation, and having the whole edited. Entry of citations on the computer file should not materially exceed the cost of typing the bibliography on sheets of paper. A real saving comes from obviating the need to retype any references once a citation is entered into the computer file.

Under current rates, computer costs for establishing the file are of the order of one cent per citation. Various manipulations which can be performed are each in this range. Recently (fall, 1978), a bibliography of about 350 entries with about 10 keywords as descriptors for each entry was searched simultaneously for several terms. Output was obtained for less than two dollars.

1.4 Competence Required of Personnel to Manage the Computer-Based Bibliographic File

Some competence with the handling of packaged computer programs is desirable. Extensive testing of the system over the last six months indicated that with suitable brief instruction, upper division of B.S. science students can establish and maintain a file under limited direction of one knowledgeable in the FAMULUS system or one familiar with computer systems. However, supervision of the entire operation should be under the direction of an individual familiar with the preparation of bibliographies and having scientific editing experience.

2.0 PREPARATION OF THE BIBLIOGRAPHY

2.1 Format Programs, and Retrieval

The bibliography was prepared through use of the FAMULUS program mentioned below (U.S.D.A., 1969). The bibliographic format employed in this work includes ten fields which are provided here in the following order: author, year, title, publication, descriptors, annotation, code, location(s) of publication, reviewer, and status. The code field contains two entries: a condensed bibliographic identifier and an accession number. The condensed bibliographic identifier is of the form, MORA50, which would be a publication by, for example, A.R. Morgan and A.R. Gerlack in 1950. The first three letters of the last name of the first author and his first initial are used with last two digits of the year. An accession number, e.g., P20210, uniquely defines a publication in condensed format. The condensed bibliographic identifier or accession number can be of use for rapid citation retrieval and for long-distance teletype terminal access to reduce connect time and long-distance charges. The status field is for in-house management of the file and will be suppressed from final bibliographies.

The FAMULUS program was run on the CDC6400 computer at the Academic Computer Center at the University of Washington where the program is librariied. Input was made via punched cards. Randomly-entered bibliographic entries are first arranged alphabetically by author, then chronologically by year of publication, by a SORT routine. These citations are consecutively numbered during print-out and will be updated as more citations are included. The FAMULUS system permits print-out of separate fields, identified by the first four letters of field names, e.g. AUTH, YEAR, PUBL, etc. It also provides print-out in standard format (termed GALLEY) following the rules of the Council of Biology Editors (1972) Style Manual. Changes can be made to the computer-stored bibliographic entries for editing and updating purposes. A SEARCH routine can be employed for retrieval of terms in the descriptor field, and a VOCABULARY routine can be used for retrieval of words or numbers in any field. An INDEX routine yields an alphabetical print-out of all descriptors along with numbers corresponding to individual citations in the current alphabetical print-out. A SEARCH routine uses the rules of Boolean algebra (with and $\wedge$, or $\vee$, not $\neg$ operators) for inclusion or exclusion of terms in citation retrievals.

2.2 Machine Files

A master file of all citations is maintained on magnetic disk or tape, and additions to it are made as reviewers provide new citations. The initial bibliographic file was maintained on disk file and then transferred to magnetic tape (7 track) as the file size increased beyond allowable disk storage space. Updating of the file is accomplished by copying the most current tape file to disk, making additions and corrections to the disk file, and transferring the latter back to the tape as an updated master file.

2.3 Back-up Files, Editing, and Entries

Ultimate back-up of the master tape file was the file of original punched cards. At any time, however, a punched deck in the original punched format could be provided from the current master file through an OSSIFY routine. An ossified card deck provided a current back-up of the master tape file.

As the number of references increased - there are 1488 entries in the final file - the use of punched cards became unwieldly and was abandoned. During the latter part of the project, card image files on tape were used instead of the actual cards. The file was also on the tape in "galley format," the same form as the print-outs provided to FWS. Corrections and new entries could now be made by keyboard (tele-typewriter) terminal, either local or remote, and using either a printer or a cathode ray tube (CRT) display.

Punch cards could still be used, of course, and proved advantageous when there were extensive corrections or new entries to be made. Cards could always be prepared from the tape if desired. This was not done, however, because the tape was more convenient and less expensive.

A duplicate, back-up tape was always kept, away from the computer, whenever the working tape was mounted on the machine. In case of any computer accident, the back-up tape was still in reserve, unspoiled. This procedure would involve three tapes. The back-up tape, the working tape, and a third tape to copy the revised working tape when the manipulations were complete.

For further information on the FAMULUS system, see University of Washington, Academic Computer Center, CDC6400 Program Library, FAMULUS (A PERSONAL DOCUMENTATION SYSTEM), W00056, February, 1976, 24 pages, copy on file with U.S. Fish and Wildlife Service, Region 1, Portland, Oregon 97232, and in computer centers at Oregon State University, the University of Washington, and others.

2.4 Reference List Printouts

The Lists of References for the Watershed Units in Volume 4 contain all of the fields listed in Section 1.2.2 including descriptors and annotations. This was done so the Lists could be used as information resources. In the first three volumes, however, the Lists of References were computer-printed in regular book or journal form with author(s), year, title, and publication only.

Preparation of these reduced lists was accomplished in the following manner. The complete master file was used to prepare a tape via the LOCATE procedure. This tape contained three reference lists which had been sorted, one for each of the first three volumes. "Garbage" characters were added to the DESC (descriptor) and REVI (reviewer) fields in card-image format to insure an entry in these fields for all references, whether or not the initial reviewers had made entries in all fields on the Bibliographic Data Sheets. This tape was attached as a local file to a CRT (cathode ray tube) terminal. A UEDIT routine was then used to delete from each reference entry in the file all lines after PUBLICATION (refer to Figure 1-1). From this a new FAMULUS file was created which contained only the author, year, title, and publication for each entry. A List of References for Volumes 1, 2, and 3 was printed in galley format from this tape. These three Lists were photo-copied (reduced to 64%) and printed directly in the Conceptual Model, Regional Synopsis, and Zone and Habitat Description volumes.

Preparation of the Watershed Unit printouts for Volume 4 was easier, as all the fields were included. In a SEARCH routine, the descriptor field was simply searched for the Unit number (e.g. 7. for Watershed Unit 7). This will produce all entries with descriptors 7.0, 7.1, 7.2, etc. In the Volume 4 lists, however, those references which were common to all the Units were separated to reduce the number of pages in the volume by searching for 7. ∧ ¬ ALL (which reads "7. and not ALL"). The list of references cited in all the Watershed Units was obtained simply by searching the descriptor field for the key word "ALL." These lists were then photo-reduced and printed in Volume 4.

2.5 Descriptors

2.5.1 Rationale. Descriptor terms were selected on the basis of information content, subjective probability of "hits" through machine searching in the FAMULUS system, searching by other routines with remote terminals, and for terms to appear in an Index of all terms.

The FAMULUS system permits descriptor terms containing up to forty (40) characters and spaces. FAMULUS machine searching operates on strings of characters and spaces. Descriptor terms are contained within commas, searching proceeding with characters appearing after a comma. Search does not proceed following a comma appearing after a descriptor term. Any character string used for searching will recognize this string even if followed by other characters. For example, a search for SALMON will yield all citations containing SALMON, SALMONID, SALMONIDAE, and SALMONBERRY. Judicious use of searching descriptors will maximize relative hits. A search for SALMONID will yield SALMONID and SALMONIDAE, but not SALMON or SALMONBERRY.

2.5.2 Universal Descriptors. Universal descriptors are here defined as being descriptors, one of which at least must appear in the descriptor field. The universal descriptors used are those for the Watershed Units:

1.0,2.0,3.0,4.0,5.0,6.0,7.0,8.0,9.0,

for oceanic Unit: 10.0,
for general (non-regional) references: GENERAL,
and for general topographical location: INLAND, COASTAL, OCEANIC.

Thus every reference should begin with, or have in the descriptor field, either GENERAL or one or more Watershed Unit code(s), and a INLAND, COASTAL, or OCEANIC locator.

Citations that cover all nine Watershed Units will also have the descriptor ALL to facilitate searching. Decimalized watersheds also appear, for example, 7.1 for Coos Bay (see Volume 4).

The descriptor 10.0 has been used mainly for references dealing specifically with the Pacific Northwest Continental Shelf. When used alone it indicates a general reference for the oceanic region or one covering the entire area; when used in conjunction with state names and/or Watershed Unit code numbers it indicates regions or portions of the shelf. CONTINENTAL SHELF often appears as a separate descriptor, adding redundancy to the field.

2.5.3 Geographic Locations. State names (CALIFORNIA, OREGON, WASHINGTON) and localities (e.g. GRAYS HARBOR, COOS BAY) are included where they are applicable. This adds redundancy and aggregation of descriptor elements or terms with respect to Watershed Unit codes (e.g. 2.1, 7.1); it facilitates searching and aids in compilation of the Index.

2.5.4 Organisms. As a rule, common names, especially official common names (e.g. COLUMBIAN WHITE-TAILED DEER), and binomial scientific names (e.g. ODOCOILEUS HEMIONAS COLUMBIANUS) are given. Common names for recognized groups of organisms may be given also, e.g. OWL, SPOTTED OWL, STRIX OCCIDENTALIS. An effort was made by the editor to also include a general classification in the descriptors, e.g. ANIMAL, VERTEBRATE, MAMMAL, along with the species name to aid in searching for various levels and aggregating them for the Index. This was generally not done for plants, except for terms such as TREE, DIATOM, ALGAE where appropriate.

Intermediate taxa appear with scientific designations, hence:

NEMATODA not NEMATODE
CRUSTACEA not CRUSTACEAN.

Major taxa are referred to by common names. Decision on this matter rested upon the use of such common names in other computerized bibliographic systems, e.g. Medline, Chemical Abstracts. Hence:

BIRD not AVES
MAMMAL not MAMMALIA
INSECT not INSECTA
FISH not PISCES or OSTEICHTHYES or CHONDRICHTHYES

Note use also of:

PLANT not FLORA
ANIMAL not FAUNA.

Lower plant taxa are in the plural, since they are generally referred to that way. Hence:

ALGAE not ALGA
FUNGI not FUNGUS

Variations of the above general rules may occur, especially in compound descriptors, e.g.

DISTRIBUTION -- FOREST TREES.

2.5.5 Use of the Singular. Most descriptor terms appear in the singular, hence:
BIRD, INDUSTRY, FIRE, TREE, SEDIMENT, REDD, IMPACT.

However, numerous disciplines or fields appear as a plural, e.g.
SOCIOECONOMICS, ENERGETICS, POLITICS.

FISHERY/FISHERIES presented a difficult problem, since FISHERIES is a discipline as well as being a plural term for where fish are caught as well as describing an operation with certain specific fishes. We have gone mostly with the singular FISHERY. This does not offer much problem in searching; searching with FISHER will retrieve all citations having either FISHERY FISHERIES, or both. (It would also retrieve FISHERMAN, but not KINGFISHER, should these occur as descriptors.)

References relating to forestry may be found either under FORESTRY or SILVICS. Although FORESTRY is the more general term, references with SILVICS often were entered without it as an additional descriptor.

2.5.6 Compound Descriptors. Advantage was taken of the forty character maximum length of descriptor terms to include additional information in the terms. These will be valuable for the Index of Key Words. Variations in usage will often be found in compound descriptors, e.g.

CLEARCUT	and	IMPACT--CLEARCUTTING ON BIOTA
TREE	and	DISTRIBUTION--FOREST TREES
SEA BIRD	and	SPECIES LIST--WASHINGTON SEA BIRDS.

The longer a descriptor term, the less likely an un-informed searcher would be able to provide a complete descriptor term to look for. Their major use is for the index. However, a search for IMPACT--CLEARCUT would retrieve the citation containing IMPACT--CLEARCUTTING ON BIOTA.

Other common compound descriptors include the following first words:
SPECIES ACCOUNT--
TAXONOMY--
BOOK--
INVENTORY--

2.5.7 Synonyms. Multiple words referring to the same subject can increase the difficulty of retrieving most of the citations for a given topic. An attempt has been made to eliminate as many of these as possible. Thus all references dealing with birds in the oceanic environment include the descriptor SEA BIRD and not the synonyms MARINE BIRD, OCEANIC BIRD, SEABIRD, SEABIRDS, etc. The Index of Key Words is invaluable for determining what descriptors were selected.

2.5.8 Cross References. In order to assist the user in finding which similar or synonymous terms to search for a given topic, numerous cross-references appear in the descriptor field, e.g.,

THERMODYNAMICS--SEE ENERGY...ENERGETICS
INVENTORY--SEE ALSO...RESOURCE INVENTORY
MARINE BIRD--SEE...SEA BIRD
DOUGLAS-FIR--SEE...DOUGLAS FIR
VEGETATION--SEE ALSO...PLANT.

Cross-references will suggest to the user other terms useful for a given search. They also will provide more information for those using the Index.

2.5.9 Additional Comments. It has been recognized that there is no correct way of selecting descriptor terms. Selection must be based on the user, and it is difficult to anticipate actual users and their biases in approaching searches. The use of redundancy, cross-references, and compound descriptors widens the scope of usage. An attempt has been made in the bibliography to use, when possible, different terms in the Annotation field. This will aid in searches of the complete file by search routines other than that of the FAMULUS system. For example, the UEDIT routine of the U. W. Academic Computer Center could be used to search effectively an entire galley output file with ease and at moderate expense from locations remote from the Center by use of a teletype or CRT terminal over existing phone lines.

Part Two – ANNOTATED SPECIES LIST

1.0 ASL DESCRIPTION AND DISCUSSION

1.1 General Description

The Annotated Species List (ASL) is a computerized information system which relates the species of the study area, in this case the Pacific Northwest Coastal Region, to the biological zones and particular habitats within the area. The system includes information on seasonality, relative abundance, trophic level, status (endangered, commercial, etc.), as well as additional notes and a selected bibliography for many of the vertebrate groups. The ASL, although general in its structure, is specific to this region in respect to the zones and habitats included and to the ranges (by Watershed Units), abundances, seasonalities, and other species data entered.

The data system is divided into four major groups - inland, estuarine, shoreline, and oceanic - which roughly correspond to the first level of zonation described in Sections 1.3.1 and 3.1 of Volumes 1 and 2: inland, coastal, and oceanic. (Estuarine corresponds to 2.1 Estuaries of the biological zonation Coastal group, and shoreline corresponds to both 2.2 Beaches and Dunes and 2.3 Headlands and Rocky Islands.) Data for the human activity zones were not assembled at this time. The zones and the habitats within the zones are described in detail in Volume 3. For each one of these major sets (species lists), a number of subsets have been developed corresponding to major taxonomic delineations: vascular plants, non-vascular plants, invertebrates, fish, herpetofauna, birds, and mammals.

The system is designed for ease of update and flexible analytical capability at moderate costs. Any combination of and/or searches for any specific entries under the headings indicated in the figures in the following section is possible. As an example, the ASL files were searched in order to compile the Community Composition Lists presented in Volume 3; that is, they were searched on a zone and habitat specific basis by trophic level. The search listed the producers of a given habitat, their range (Watershed Units), and their abundance, as well as any special status (endangered, commercial, etc.). It then listed herbivores with the same categories, then carnivores, etc. Additional analytical procedures are discussed in Sections 1.3 and 2.0 which follow.

The advantages of computerization include ease of update, editing, reviewing, and republication, as well as the machine searching and sorting capabilities. Modification of particular species entries can be accomplished without complete tables being retyped or reworked. This is of particular importance since scientific names are often misspelled when retyping is necessary. Also status changes and expansion of the list with additional entries are facilitated.

Only the most common, characteristic, or significant plants (vascular and non-vascular) have been entered in the inland, estuarine, shoreline, and oceanic fields due to the large numbers present. All the tree species, however, and most major shrubs are included. Likewise, only a sampling of the major invertebrates was entered for these areas, again because of large numbers of species found in the region in this diverse animal category. (Insect species alone are estimated at over 5,000 in the region.) For the other major groups (fish, herpetofauna, birds, and mammals), an effort was made to include all the species found in the coastal region. The major functional group of organisms not included in the ASL at this time are the decomposers, because of the numbers involved (among the fungi, for example, more than 2,500 species of mushrooms alone are estimated to occur in the Pacific Northwest), the taxonomic problems encountered, the lack of regional-specific and species-specific data, and the "black box" treatment of the group in most environments by researchers.

1.2 Methods and Format

1.2.1 Organization. The system was originally conceptualized to have two supra files - an annotated file and a taxonomic file. The annotated file portion of the system has been compiled. The taxonomic file, which was to be a taxonomic listing of all species entered in the annotated file, has not been completed.

The annotated supra-file is segregated into four major files which correspond to major biological "super-zone" divisions as described in Volume 3. These are inland, estuary, shoreline, and oceanic. Format for entry of information in each one of the files differs slightly. As indicated in the figures in the next section, however, there is a consistant generalized format among files.

Each one of the major files is further separated into files by major floral or faunal groups. For example, the inland file has a listing for non-vascular plants, vascular plants, invertebrates, fish, herpetofauna, birds, and mammals. These same lists are repeated for the other three major files (estuary, shorelines, oceanic) with a slight modification of combining the vascular and nonvascular plant files in the oceanic list, as there are only two vascular plants which occur there.

As indicated in the figures of Sections 1.2.2-1.2.5, each list presents certain information including distribution (by Watershed Unit), seasonality, habitat use, relative abundance, trophic level, status, and notes. Additional information specific to the zones is given as is deemed appropriate. For example, in the case of the inlands, there is a canopy/floor/epiphyte designation (see Figure 2-1) and in the shorelines, intertidal zonation information has been added (Figure 2-2).

A selected bibliography has been developed for many of the vertebrate species of the region. These are identified in the species-specific Notes column in the ASL printout by author and date. A complete ASL bibliography (separate from the master Annotated Bibliography of this study) is given in Section 4.0.

As mentioned previously, each of the four major divisions has a slightly different format for data entry and retrieval. Format and keying for each of these is discussed below.

1.2.2 Inland Species Lists. The entry format and key for the inland file is shown in Figure 2-1. Discussion of entries by column follows:

Species. Species are entered with scientific name first followed by common name. Bacteria, phytoplankton, and invertebrates may be entered at higher taxonomic levels. Occasionally, other entries are made at the genus level, with spp. implied. Alphabetization is by the scientific name.

Watershed Unit. The range (N to S) of the organism is entered according to the list in the Watershed Unit column of Figure 2-1. These are keyed to the standard Watershed Unit numbers (1-9) used in the study (see Figure 1 of the Introduction to this volume).

Zone. The zones listed correspond to the inland zones described in Volume 3. Seasonal use is entered as indicated in the key in these columns of Figure 2-1.

ANNOTATED SPECIES LIST FOR 1.1 & 1.2 INLANDS

SPECIES Scientific and Common Name*	ZONES: WATERSHED UNIT	ARCTIC ALPINE ZONE	TRUE FIR ZONE	WESTERN HEM-LOCK ZONE	SITKA SPRUCE ZONE	REDWOOD ZONE	MIXED EVER-GREEN ZONE	HABITAT TYPES: RIVERINE	LACUSTRINE	PALUSTRINE	ALPINE/ MEADOW	ROCKLANDS	GRSLD/ERLY SR WD ST/PSTR.	ERLY. SR SHRB; SHRUB	2ND GROWTH BROADLEAF	2ND GROWTH CONIFER	OLD GROWTH	SERPENTINE	RIPARIAN	PARKS & GRDN.	AGRICULTURE	TROPHIC LEVEL	STATUS	CANOPY	NOTES
*List using scientific and common names. Write in large legible letters.	1 Olympic Rainforest 2 Willapa-Grays Harbor 3 Columbia Estuary 4 Oregon North Coast 5 Oregon Mid Coast 6 Lower Umpqua and Rogue 7 Coos-Coquille 8 Oregon California Border 9 Redwood Coast Q Distribution in Question		Indicates Seasonal Use SP - Spring S - Summer W - Winter F - Fall R - Resident Q - Unknown					A - Abundant C - Common U - Uncommon Q - Present, abundance unknown													1 Producer 2 Herbivore 3 Carnivore 4 Detritivore 5 Omnivore 6 Parasite 7 Undifferentiating Small Item Eater 8 Scavenger 9 Invertebrate Feeder Q Unknown	R - Rare E - Endangered T - Threatened P - Peripheral I - Endemic G - Game C - Commercial & Potentially Commercial x - Pest	F - Forest Floor C - Canopy E - Epiphyte	

FIGURE 2-1. ENTRY FORM AND KEY FOR THE INLAND SPECIES LIST FILE.

Habitat Types. The habitat types listed (with the exception of Parks and Gardens and the mixed broadleaf/conifer second growth forest) correspond to the habitats described in Volume 3. The definition of the Parks and Gardens habitat is taken from U.S. ACOE (1975F) and is paraphrased as follows: "An urban habitat that includes patches of native vegetation and exotic vegetation usually strongly modified by man." Mixed second growth forest is not entered. Species for this community can be developed by combining second growth hardwood and second growth conifer.

Trophic Level. Trophic level of the organism is keyed as indicated in Figure 2-1. This entry and column is consistent for all of the lists.

Status. Status of rare, endangered, and threatened species is based on USDI's most recent Federal Register listing or on state designation. In the case of the plants, unofficial listings by the respective state organizations were entered as "R" (or "I" where appropriate) and documented in the notes. Other entries (commercial, game, pest, etc.) are based on the professional opinions of the compilers and reviewers.

Canopy/Floor/Epiphyte. This column was used for vascular plants and indicated whether they were a forest floor species, a canopy species, or an epiphyte.

Notes. This is an open-ended entry where special information on this species, e.g. other common names, change in scientific name, major works, can be added. It is the same for all lists.

1.2.3 Estuarine Species Lists. Figure 2-2 shows the format and key for the estuarine file. Discussion of entries by column follows:

Species. Same as Inland List. Juvenile stages of selected organisms receive separate entries, however, due to changed trophic level or seasonality.

Watershed Unit. Same as Inland List.

Salinity. The estuary is subdivided into lower, middle, and upper zones. Seasonal use will be indicated as shown in Figure 2-2.

Tidal Range. Preferred tidal range of organisms is noted as indicated in Figure 2-2. These correspond to the three biological zones in the estuary.

Habitat Types. The habitat designations correspond to the habitat types identified in the Estuarine "Super-Zone" of Volume 3. Abundance designations are entered in these columns. See Figure 2-2.

Trophic Level. Same as Inland.

Status. Same as Inland.

1.2.4 Shoreline Species Lists. The shoreline file includes both beaches and dunes (2.2) and headlands and rocky islands (2.3) of the biological zonation scheme presented in Volume 3. The entry format and key for the shoreline file is shown in Figure 2-3. Discussion of entries by column follows:

Species. Same as Inland.

Watershed Units. Same as Inland.

Zone. Same as Inland.

Tidal Range. Tidal range is entered as indicated in Figure 2-3. Intertidal corresponds to the Surf Zones of the biological zonation.

Habitat Types. These correspond to the habitats described in the Surf Zones and the Above Tide Beach and Dune and Headlands and Rocky Islands Zones in Volume 3.

Trophic Level. Same as Inland.

Status. Same as Inland.

Notes. Same as Inland.

ANNOTATED SPECIES LIST FOR 2.1 ESTUARINE

SCIENTIFIC AND COMMON NAME SPECIES*	WATERSHED UNIT	Estuary: Upper	Estuary: Middle	Estuary: Lower	WATER COLUMN	SUBTIDAL	INTERTIDAL	ABOVE TIDE	FORESTED	SHRUB	MARSH	EELGRASS	MUDFLAT	SANDFLAT	ROCKY SUBSTRATE	PILING	CHANNEL	TROPHIC LEVEL	STATUS	NOTES
*List using scientific names and common names.		Seasonal Use Entry			Key Tidal Range							Key for Habitat Types						Key for Trophic Level		
		*																1. Producer		
		SP - Spring																2 Herbivore		
		S - Summer																3 Carnivore		
		F - Fall																4 Detritivore		
		W - Winter																5 Omnivore		
		R - Resident																6 Parasite		
		Q - Unknown			*X indicates occurrence													7 Undifferentiated Small Item Feeder		
	1 Olympic Rainforest																	8 Scavenger		
	2 Willapa-Grays Harbor																	9 Invertebrate Feeder		
	3 Columbia Estuary																	Q Trophic Level Unknown		
	4 Oregon North Coast											Put in Abundance Data								
	5 Oregon Mid Coast											*A - Abundant								
	6 Lower Umpqua and Rogue											C - Common								
	7 Coos-Coquille											U - Uncommon								
	8 Oregon California Border											Q - Present abundance Unknown								
	9 Redwood Coast																			
	Q Distribution in Question																			
																			Key for Status	
																			E - Endangered	
																			R - Rare	
																			T - Threatened	
																			P - Peripheral	
																			I - Endemic	
																			G - Game	
																			C - Commercial and Potentially Commercial	
																			X - Pest	

FIGURE 2-2. ENTRY FORM AND KEY FOR THE ESTUARINE SPECIES LIST FILE.

ANNOTATED SPECIES LIST FOR 2.2 SHORELINES (BEACH, DUNE, & HEADLAND/ISLAND)

Scientific and Common Name

Species*

List using scientific and common name. Please put / between the two. Write in large legible letters.

WATERSHED UNIT	ZONE: BEACHES & DUNES	ZONE: HEADLANDS & ISLANDS	TIDAL RANGE: WATER COLUMN	TIDAL RANGE: INTERTIDAL	TIDAL RANGE: ABOVE TIDE	HABITAT TYPES: UNPROTECTED BEACH	PROTECTED BEACH	FOREDUNE	COASTAL LAGOON	DEFLATION PLAIN	DUNE MARSH	ACTIVE DUNE	DUNE LAKE	STABILIZED DUNE	UNPROTECTED RKY. SHORE	PROTECTED RKY. SHORE	ABOVE TIDE HEADLANDS	TROPHIC LEVEL	STATUS	NOTES
1 Olympic Rainforest 2 Willapa-Grays Harbor 3 Columbia Estuary 4 Oregon North Coast 5 Oregon Mid Coast 6 Lower Umpqua and Rogue 7 Coos-Coquille 8 Oregon California Border 9 Redwood Coast Q Distribution in Question	Enter seasonal Use* Sp-Spring S -Summer F - Fall W -Winter R-Resident		Enter X-Occurrence 1-Zone 1 (Rky Shr. Intdl. After Ricketts & Calvin, 1968) 2-Zone 2 3-Zone 3 4-Zone 4 A-All Zones U-Upr. Zones 1 and 2 M-Mdl. Zones 2 and 3 L-Lwr. Zones 3 and 4						Put in Abundance* A - Abundant C - Common U - Uncommon Q - Present abundance unknown									* 1 Producer 2 Herbivore 3 Carnivore 4 Detritivore 5 Omnivore 6 Parasite 7 Undifferentiating Small Item Eater 8 Scavenger 9 Invertebrate Eater Q Trophic Level Unknown	R - Rare E - Endangered T - Threatened P - Peripheral I - Endemic G - Game C - Commercial Potentially commercial x - Pest	Key works, Name Changes, Habitat Requirements, etc.

FIGURE 2-3. ENTRY FORM AND KEY FOR THE SHORELINE SPECIES LIST FILE.

1.2.5 Oceanic Species Lists. Figure 2-4 shows the entry format and key for the oceanic file. Discussions of entries by column follow:

Species. Same as Inland.

Watershed Unit. Same as Inland, only indicates range in the waters offshore of the designated Watershed Units.

Season. As indicated in Figure 2-4, entries designate seasonal use.

Water Column. The water column is separated into three zones: Euphotic - surface to compensation depth; Mid water column - between compensation depth and bottom of water column (i.e. Disphotic Zone); Bottom - within one meter of bottom and within bottom substrate (i.e. Benthic Zones).

Habitat. Columns correspond to benthic habitat types identified in Volume 3. Entries designate abundance. Euphotic and Disphotic Zones have only one habitat each.

Trophic Level. Same as Inland.

Status. Same as Inland.

Notes. Same as Inland.

1.3 Discussion of Data Limitations

Any analysis completed on the entered data is no better than the data entered. The quality of the data entered is generally inversely related to the taxonomic level of the group entered. Birds and mammals are the best known and are in low enough species numbers that comprehensive coverage is possible. Distribution, abundance, and trophic level of invertebrates is often poorly known, and the number of species is so large that representative ones must be selected or the number of entries expands into tens of thousands, and the system becomes impractical.

The problem with flora is similar to that experienced with invertebrates, i.e. the number of species is very large. Hitchcock and Cronquist (1973) list an estimated minimum of 7,000 vascular plants for the Pacific Northwest. The number of species within our study area is probably not much less. Consequently the listing of flora in the ASL is not comprehensive, although all native trees and most shrubs are included. Representative grasses and herbs are also listed. The listing includes a complete list of plants which are of concern (i.e. proposed for rare, endangered, or threatened designation) according to the Smithsonian Institution (1975) and various state entities (Siddall, 1977A and 1977B; Denton et al., 1977; and California Native Plant Society, 1974).

All officially classified endangered or threatened animal species of the region under either state or federal classification as of January, 1978, are included in the list.

"Q" entries are scattered throughout the list and identify areas where information on particular species was not available or non-existent. Compilers and reviewers were encouraged to enter "Q"s when information was doubtful or ambiguous.

In an attempt at quality control of the data entry, two different review procedures were utilized. The first consisted of a technical review of the first printout of the listings by a person with specialized knowledge of the taxa listed. Changes were incorporated into the list and the list was reprinted. A second review was then accomplished which checked for keypunching errors and errors of omission. Whenever possible, compilation and review functions were kept separate, but shortages in expertise and funds made some overlap necessary.

The quality of data entered varied with the particular compiler and with availability of data for the group and zone under consideration. Likewise the intensity of the review varied considerably with the person or persons reviewing the data. We recommend additional review of the list by experts not affiliated with the project as an additional measure for guaranteeing quality control.

The compilers of the list are indicated in Table 2-1 along with an indication of portions of the list for which they were responsible. Likewise the reviewers are listed with an indication of which portions of the list they reviewed. Additional information on compilers and reviewing is given in the Contributors List in the front of this volume. Major and minor sources for the compilation are given also in Table 2-1. Nomenclature followed Hitchcock and Cronquist (1973) for vascular plants, although names of flora of the Siskiyous and south follow Munz and Keck (1959). The AOU Checklist (American Ornithologists Union, 1973) was the standard for birds, American Fisheries Society (1970) for fishes, and Ingles (1965) and Paulson (pers. comm.) for mammals. Stebbins (1966) was used for herpetofauna, G.C. Anderson (1972) and Scagel (1967) were used for marine algae, and OSU (1971) was used for marine invertebrates and phytoplankton.

ANNOTATED SPECIES LIST FOR 3.0 OCEANIC

Species *	WATERSHED UNIT	SEASON	PELAGIC		BENTHIC						TROPHIC LEVEL	STATUS	NOTES
			EUPHOTIC	DISPHOTIC	ROCKY	MUD	MUDDY SAND	SAND	KELP	SURFGRASS			
*List alphabetically using scientific names by order with the exception of algae and bacteria	1 Olympic Rainforest 2 Willapa-Grays Harbor 3 Columbia Estuary 4 Oregon North Coast 5 Oregon Mid Coast 6 Lower Umpqua and Rogue 7 Coos-Coquille 8 Oregon California Border 9 Redwood Coast Q Distribution in Question	Key * Sp-Spring S -Summer F -Fall W -Winter R -Resident Q -Seasonality Unknown					Key * A-Abundant C-Common U-Uncommon Q-Present, Abundance Unknown				Key * 1 Producer 2 Herbivore 3 Carnivore 4 Detritivore 5 Omnivore 6 Parasitic 7 Undifferentiated Small Item Eater 8 Scavenger 9 Invertebrate Feeder Q Trophic Level Unknown	Key R-Rare E-Endangered T-Threatened P-Peripheral I-Endemic G-Game C-Commercial and Potentially Commercial x-Pest	

FIGURE 2-4. ENTRY FORM AND KEY FOR THE OCEANIC SPECIES LIST FILE.

TABLE 2-1. DATA SOURCES AND DOCUMENTATION. The species lists were compiled by several people from numerous sources and subsequently reviewed by experts. Initial list of compilers, major and minor sources, and reviewers are given in the following table.

LIST	COMPILERS	PRIMARY SOURCE(S)	SECONDARY SOURCE(S)	FINAL REVIEWER(S)
INLAND				
Non-vascular Plants	Galvin (Terrestrial) Noble (Aquatic)	Kozloff, 1976; Foris (undated); Hansmann, 1969.	Needham and Needham, 1962.	In-house review of terrestrial non-vascular plants.
Vascular Plants	Loney	Hitchcock and Cronquist, 1973; Fowells, 1965; Franklin and Dyrness, 1973; Whittaker, 1960; Denton et al., 1977; Siddall, 1977A and 1977B; CNPS, 1974.	Becking, 1956; Dyrness, 1973; Franklin, 1964; Krajina, 1963; Muenscher, 1944; Preston, 1961; Ruth, 1958; Scott, 1962; Stone, et al. 1972; Trappe, et al., 1967.	Gessel Galvin
Invertebrates	Lattin (Terrestrial Insects) Noble (Aquatic) Garcia (Molluscs)	Anderson, 1976, Edmunds et al., 1976; Demory, 1971; Jewett, 1959.	Moring and Lantz, 1975; Noble, 1969, Pennak, 1953; Usinger, 1971; Kozloff, 1976; Cummins, 1973.	Lattin
Fish	Noble	Scott and Crossman, 1973; Moyle, 1976; Wydowski and Whitney, in press.	Bond, 1973; American Fisheries Society, 1970; California Dept. of Fish and Game, 1969; Kimsey and Fisk, 1969; McPhail, J.D., 1967; Reimers and Baxter, 1976.	Garcia
Herpetofauna	Garcia	Stebbins, 1966.	Loy et al., 1976; Slater, 1963; Slater, 1964; U.S. ACOE, 1975C.	Garcia
Birds	Warner	Gabrielson and Jewett, 1970; Robbins et al., 1966; Wahl and Paulson, 1971.	Alcorn, 1971; U.S. ACOE, 1975C; Garcia et al., 1977; Larrison and Sonnenberg, 1968.	Paulson
Mammals	Hanley	Maser et al., 1977; Garcia et al., 1977; Pinto et al., 1972.	Ingles, 1965; Maser and Franklin, 1974; Larrison, 1976.	Paulson
ESTUARY				
Non-vascular Plants	Roye	Kilburn, 1961; McGowan and Lyons, 1973; Abbot and Hollenberg, 1976; OIMB, 1970.	Kozloff, 1973; Ricketts and Calvin, 1968; Scagel, 1967; Cupp, 1943; Sanborn and Doby, 1944.	Chew
Vascular Plants	Roye/Garcia	Hoffnagle, 1976; Eilers, 1975; Jefferson, 1974; Hitchcock and Cronquist, 1973.	Smith et al., 1976; Cheatham and Haller, 1975; Siddall, 1977A; Siddall, 1977B; Seaman, 1977.	Galvin

TABLE 2-1 . DATA SOURCES AND DOCUMENTATION, continued.

LIST	COMPILERS	PRIMARY SOURCE(S)	SECONDARY SOURCE(S)	FINAL REVIEWER(S)
ESTUARY, continued				
Invertebrates	Roye	Smith and Carlton, 1975; Oregon Institute of Marine Biology, 1970; Slotta et al., 1973.	Ricketts and Calvin, 1968; Albright and Rammer, 1976; Hartman and Reish, 1950; Queen, 1930; Yocum and Edge, 1931, Benson, 1977; U.S. ACOE, 1975A,B. Porch, 1970.	Chew
Fish	Roye	Hart, 1973; Miller and Lea, 1972.	Seaman, 1977; Forsberg et al., 1976	DeLacy and Harris[1]
Herpetofauna N/A				
Birds	Roye	Magwire, 1976A, Garcia et al., 1977; College of Forest Resources, 1974.	Pinto et al., 1972; Gabrielson and Jewett, 1970; Robbins et al., 1966.	Paulson
Mammals	Roye	Magwire, 1976B; College of Forest Resources, 1974.	Seaman, 1977; Maser et al., 1977; Pinto et al., 1972; Ingles, 1965.	Garcia
COASTAL-SHORELINES (BEACHES AND DUNES HEADLANDS AND ISLANDS)				
Non-vascular Plants	Roye, Lewis/Garcia	Scagel, 1967; Guberlet, 1956.	Kozloff, 1973; Ricketts and Calvin, 1968; Sandborn and Doby, 1944; Lewin et al., 1975.	In House
Vascular Plants	Loney	Hitchcock and Cronquist, 1973; Wiedeman et al., 1974; Hekner and Foin, 1977; Breckon and Barbour, 1974; MacDonald and Barbour, 1974; Grams et al., 1977.	Siddall, 1977A; Siddall, 1977B; California Native Plant Society, 1974; Barbour et al., 1975; Chapman, 1964; Kumler, 1969, Purer, 1942; Denton et al.,1977.	Galvin/Garcia
Invertebrates	Lattin (Insects) Garcia/Lewis	Ricketts and Calvin, 1968; Kozloff, 1973; Caldwell, 1970.	Oregon State University, 1971.	Lattin (Insects)
Fish	Roye/Garcia	Hart, 1973.	Ricketts and Calvin, 1968; Kozloff, 1973; Pinto et al., 1972.	Harris and DeLacy
Herpetofauna	Garcia	Stebbins, 1966; Pinto et al., 1972.	Slater, 1963; Slater, 1964; Garcia et al., 1977.	Garcia

[1]Only reviewed scientific names.

TABLE 2-1. DATA SOURCES AND DOCUMENTATION, continued.

LIST	COMPILERS	PRIMARY SOURCE(S)	SECONDARY SOURCE(S)	FINAL REVIEWER(S)
COASTAL-SHORELINES, (Continued)				
Birds	Garcia/Warner	Pinto et al., 1972; Frazer et al., 1973; Osborne, 1972.	Garcia et al., 1977; Campbell, 1976; College of Forest Resources, 1974.	Paulson
Mammals	Garcia	Pinto et al., 1972; Maser et al., 1977.	Ingles, 1965; Garcia et al., 1977; Maser and Franklin, 1974.	Garcia
OCEANIC				
Non-vascular Plants	Lewis	Anderson, 1972.		Chew
Vascular Plants - N/A				
Invertebrates	Lewis	Alton, 1972A; Carey, 1972; Pereyra and Alton, 1972; McCauley, 1972; Pearcy, 1972.	Alton, 1972B; Peterson, 1972; Pruter, 1972; Oregon State University, 1971.	Chew
Fish	Lewis	Pruter, 1972; Pearcy, 1972; Barss et al., 1977.	Hart, 1973; American Fisheries Society, 1970.	DeLacy and Harris
Birds	Warner	U.S. ACOE, 1975C; Salo, 1975; Sanger, 1970; Wahl, 1975.	Robbins et al., 1966; Frazer et al., 1973, Osborne, 1972.	Paulson
Mammals	Garcia	Garcia et al., 1977; Eaton, 1975.	Ingles, 1965; Larrison, 1976; Mate, 1975.	Mate

Note: Most of the source references in this table are included in the Annotated Species List Bibliography in Section 4.0 of Part 2 (pp. 2-13 through 2-39). Those references that are not included in the ASL list are found in the Volume 5 List of References in Part 4.

2.0 DATA PROCESSING

2.1 Data Base and Programs

The data base consists of two major parts. The first is the card image file which contains the raw data, and the other is the data base itself. The data base is designed using SYSTEM 2000 (S2K), a data base management system developed by MRI Systems Incorporated[1]. To use the data base requires learning to use a few simple programs and S2K itself.

The first program, LISTER, provides a listing of the raw data. The raw data is stored in four separate files (ESTUARY, INLANDS, OCEANIC, and SHORELINE) each consisting of seven separate sub-files (non-vascular plants, vascular plants, invertebrates, fishes, herpetofauna, birds, and mammals). To obtain a complete listing of the Annotated Species List requires running LISTER on each of the twenty-eight sub-files.

The raw data are stored in card image format. Each data entry for a species consists of the following cards:

	card column
1	11
SCIEN	scientific name - free field
COMMON	common name - free field
DATA1	data entries - fixed format
DATA2	data entries - fixed format
NOTES	notes - free field, multiple cards possible followed by a blank card.

If there are no entries for a given card, the card is omitted. Each group must be terminated by a blank card.

To load the raw data requires that the data be put into a form which S2K can interpret. This requires the use of program VALSTR. Next the output from VALSTR needs to be loaded into the data base. Once the data are loaded, access to the data base may begin.

To use S2K requires knowledge of the S2K commands. These can be found in the System 2000 Reference Manual[2]. Knowledge of these commands allows for simple accesses to the data base. More complicated accesses can be gained by using the Procedure Language Interface of $2K. An example of this can be seen from the program ESTUAR (on file at USFWS, Portland, OR) which produced the community composition list for the estuarine habitats.

2.2 Extending System Capacity

Several modifications and extensions can be made to the data base to increase its data handling capabilities. The twenty-eight separate sub-files might be combined into fewer files. This will require a study of the size versus access time to see if the consolidation of the files is practical. Space also needs to be allowed for multiple field entries in, but not limited to, such fields as the status and trophic levels. The data management routines (LISTER, VALSTR, and ESTUAR) should also be more fully documented to provide easier usage and faster execution.

3.0 HINDSIGHT

3.1 Problem Areas

The Annotated Species List data base produced satisfactory results but, when looking back, as in any project several improvements could have been made. Below is a discussion of these improvements from the time of collection of the data until the output of the community compositions.

Several improvements are needed in the method of data collection. The forms for data entry should be less crowded, both horizontally and vertically, to provide for better alignment. This would make it much easier to see which column the data are in especially when the data are sparse. Also, more care needs to be taken in collecting and proofreading the data to see that they are in correct form with a minimum number of errors before they are keypunched. Although final proofing can best be done on the computer print-outs, it is usually much more efficient to make the major corrections in format and spelling before the data are put in the machine.

[1] P.O. Box 9968, Austin, Texas 78766

[2] MRI Systems Inc., 1976.

3.2 System Improvements

More generality should have been provided for in the data base for information. Several fields (TROPHIC LEVEL, and STATUS for example) were originally designed to accept only one entry when several values were possible at once. Several times large entries were required in the NOTES field. Standardization of abbreviations and formats should be developed to provide for maximum clarity and minimum size of notes.

Originally, the data base was divided into four files, each consisting of seven sub-files. These seven sub-files provided most of the problems when data retrieval was attempted. Having the separate sub-files caused much cutting and pasting to be done for the community compositions and many computer jobs run to produce the list. Combining the sub-files into a new file (another field on the data sheet) would have made retrieval easier and would have provided the Community Composition print-outs in a format closely matching the format used in Volume 3. The actual print-outs contained simple lists of organisms by major category (e.g., non-vascular plants) and trophic level, printed in a continuous string and in no particular order. These print-outs were cut and reassembled by hand (a very time-consuming job) to produce the Community Composition Lists in Volume 3.

Reformatting so the Community Composition Lists can be printed directly by the computer is a straight-forward process which should be done at the first opportunity and before any further Lists are assembled. This can readily be done by modifying the program VALSTR so that it adds a field designating the sub-file from which the raw data was read to the valve-string output. Since the raw data are stored in card image format on a disk file the reformatting can be done by the computer and no human interaction is necessary except to modify the program VALSTR. This output can then be loaded into the data base using SYSTEM 2000.

Accessing this new field provides for the separation originally maintained by the sub-files. Combining the sub-files, however, could prove cumbersome due to the size and access time introduced, but the fewest number of sub-files practical should be used. To do this now would require adding only one field which designates the appropriate sub-file.

Most of the improvements suggested should be made to provide for better collection and retrieval of data, while consolidation of sub-files should be studied to determine its cost effectiveness. The support routines (on file with Region 1, U.S. Fish and Wildlife Service, Portland, Oregon) need to be further developed to provide for smoother processing. The data base provides reasonable access to the Annotated Species List but the improvements listed above should be made to enhance retrieval capabilities.

4.0 ASL BIBLIOGRAPHY.

References pertaining to a number of the vertebrate species entered in the ASL, as well as status authorities for the rare, endangered, or threatened plants, have been included in the Notes column in the respective lists. These references, most of which are species-specific and do not pertain otherwise to the Ecological Characterization of the Pacific Northwest Coastal Region, are included in a separate bibliography which follows on the next 26 pages. Most of these references are not included in the master Annotated Bibliography.

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Part Three – DATA GAPS REPORT

1.0 DATA GAP SUMMARY

1.1 Kinds of Data Gaps

There are two kinds of data gaps that must be dealt with in any study of this sort. The first exist because data have not been collected nor experiments performed. The second kind exist because data reports are inaccessible for any of several reasons such as: unpublished, data not yet analyzed for reporting, published in an obscure or generally unavailable form out-of-print and loan copy not located, report poorly indexed (or omitted) by the abstracting services, or reports that are missed through lack of time or sheer oversight. It is the first kind of data gap with which this report will be generally concerned.

1.2 References Acquired

More than twenty-one hundred (2100) references have been used in preparation of these reports. A total of about 1500 are included in the Annotated Bibliography file and another 640 or so are in the list of references for the Annotated Species List.

1.3 Limits to Data Search

The acquisition and perusal of all information concerning the coastal ecosystem and related socioeconomic systems could not be done within the realistic constraints of manpower and budget. Even if this had been possible, doing so would have been impractical. At some point the effort and time expended in locating an additional piece of information exceeds the value of the information acquired. The situation is analagous to a sampling program which gives 90 percent of the species on a given site with 10 samples and 95 percent of the species with 100 samples. It is doubtful that the additional 5 percent of species is worth ten times more effort except in some very rare instances.

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[1] Some of the sections, which are numbered out of sequence here, correspond directly to similarly numbered sections in Volume 2.

1.4 Availability of Data

In many cases, the degree to which biological systems or physical events are interrelated to organisms and/or physical processes is not clearly understood. A recent trend in research has been to look at total systems to determine these interrelationships, but this work is only beginning.

The holistic view of the ecosystem has not yet resulted in any significant body of data derived from regular, periodic, simultaneous, and synoptic observations of all the parameters needed to determine the values of the interactive components and processes of the ecosystems that have been modeled. There are a few exceptions, but this type of data acquisition, whether completed, ongoing, or planned, is seldom guided by ecosystem models.

As a rule, the reported data collections are limited in the parameters observed, scattered in time and space, and variable in method. Not that the investigators have no model - any study plan is based on some working model, either implicit or expressly stated. At times, however, this working model is described only vaguely or incompletely and its content is not readily apparent from the study report. Even when the model is clearly described, it may be different from that of the user, so that the latter finds "gaps" in the reported data.

During the test characterization, a general lack of the site-specific information needed to distinctively characterize the separate Watershed Units became apparent. On the other hand, considerable amounts of data are applicable across several or all Watershed Units and form the general data base for the Regional Synopsis and the Zone and Habitat Descriptions.

Some examples of major data gaps of a fundamental nature that became apparent in this study are as follows:

1. Decomposers. Next to nothing is known about these essential organisms and their functions. No data appear to exist on rates of decomposition, regulating factors, etc. in the study area.

2. Terrestrial invertebrates. Little is known concerning the role and influence of terrestrial invertebrates on consumers and producers, although the majority of energy flow through the terrestrial grazing food web flows through these numerous but obscure organisms.

3. Long term effects of intensive forest management in this region are relatively unknown, but are considered potentially damaging by some groups and benign by others.

1.5 Effects of Data Gaps on Models

Biases which occur in the generation of models, reflecting the particular expertise, assumptions, and beliefs of the originators and reviewers, are enhanced when wide gaps exist in the knowledge about the groups of organisms involved. Hopefully, the computer-based Annotated Species List will help to identify large gaps in particular food webs or other models.

For a number of the models, many components will have to remain hypothetical without hard data to confirm them. For example, as Joel Hedgpeth (personal communication) says, food webs must be recognized as "idealized dreams."

It was initially thought that lines and arrows in the food web and ecosystem models could be weighted or broadened to indicate relative importance of the different flows. This has proved impractical because of variability with seasonal and other factors, and because the relative importances are not known, even on orders of magnitude levels, in the great majority of cases.

1.6 Criteria for Defining Coastal Zones and Regions

Criteria for delineation of the "coastal zone" are still being debated. Similar problems arise in definition of the "coastal region." The criteria adopted for this study established the inland boundary as the "crest of the coastal range." This was interpreted to mean that the crest

of the range would be projected across major river valleys which penetrate the range and drain inland zones. This criterion is straightforward in the Pacific Northwest.

Boundaries were drawn from the topographic markings on 1:500,000 scale USGS maps of the states. Until we got to preparation of biological zonation maps (Figure 3-1 of Volume 2 and a map with each Watershed Unit in Volume 4), we were not aware that the upper part of the Siuslaw River Basin, in Watershed Unit 5, and an adjacent portion of Unit 6N (shown in white on our zonation maps) belonged to an inland biological zone. This area should perhaps have been excluded from our study area boundaries.

Definition of the coastal zone and coastal region become much more difficult where there are no prominent geographical features to use as guides. Some of the problems, including interpretation of Federal Law, are discussed in a recent article by Woodruff et al. (1978) in the Coastal Zone Management Journal.

2.0 PHYSICAL-CHEMICAL DATA GAPS

2.1 General and Specific Reviews

Several recent studies and reports have identified gaps in geological, hydrological, and meteorological data for the region and for general processes within those environments. Inland, coastal, and oceanic area data gaps were identified in a recent study by the Oceanographic Institute of Washington (1977) for the coastal zones of Oregon and Washington, and in proceedings of a December, 1976 Conference/Workshop conducted for the Bureau of Land Management (Massoglia, 1977).

THE NUMBERS OF MOST OF THE FOLLOWING SECTIONS ARE KEYED TO CORRESPONDING SECTIONS IN VOLUME 2, THE REGIONAL SYNOPSIS.

2.6 Estuarine Conditions

Estuarine Processes was the subject of a conference in Galveston, Texas in October, 1975 and is the title of a two-volume report of proceedings (Wiley, 1976). Adams, the reviewer for Science (Vol. 198, 18 November 1977, pp 724-5), says that the major value of the proceedings may be in helping to identify topics that require further study. Since this is one of the important functions of such conferences, information about data needs can usually be found in their reports.

Although a great deal is known - both qualitatively and quantitatively - about estuarine processes, we still cannot predict with certainty what the environmental effects of certain changes will be and we do not know the physical processes that are involved in other changes (Officer, 1976).

2.7.3 Mixing Processes, Oceanic. Much remains to be learned about mixing processes in the shelf region. Mixing dynamics are currently being studied by Drs. Gregg and Halpern of the University of Washington, Niiler of Oregon State University, and Davis of Scripps Institution of Oceanography. Their reports may be consulted for further information.

2.7.4 Sediment Transport, Coastal and Oceanic. The same processes that are responsible for mixing are involved in sediment transport. An immediate practical concern is the need for more information on sediment transport so that prediction can be made of the dispersal and environmental effects of dredge spoils that are dumped on the shelf.

2.8 Water Quality

Specific gaps exist in the data base relating to general environmental factors in the region: climatic conditions, geology, specific hydrological characteristics, erodability, and surface-water resources, as well as for mineral content, particulates, and human, agricultural, and industrial pollutants in the waters.

Most aspects of water quality will deteriorate with increasing land use and development, which will increase both consumptive and non-consumptive water use and involve discharge of a great variety of wastes (OIW, 1977). An expanded data base is needed for both present and future water quality management.

3.0 BIOLOGICAL DATA GAPS

3.1 Biological Zonation and Habitat Mapping

Thompson and Snow (1974) have prepared a habitat map for the Oregon coastal area but it is not a vegetation map, and does not indicate seral stages. No similar habitat or community inventory is available for Washington State. The Washington State Department of Game, however, (Hirshi, pers: comm. 1977) is currently working on a detailed habitat inventory of coastal communities up to 200 meters altitude above the high tide line.

Unfortunately, little detailed information is available for upland habitat distribution in Washington and Oregon, nor are any such efforts proposed at this time. California has completed several such habitat surveys (California State Fish and Game Commission, 1965A) and are in the process of completing another.

In the test characterization (Pilot Study Report, 23 November 1977), inland habitat maps were generated by Photo Science, Inc. of Gaithersburg, Maryland, for the Coos-Coquille Watershed Unit (7) utilizing optical analysis of LANDSAT data. We found that within the size restrictions of graphic format ($8\frac{1}{2}$ x 11 page size) the large scale (small size) maps were not considered to be of any great value. When presented at a smaller scale (larger size), however, we believe that such habitat mapping, particularly when keyed to the zones and habitats described in Volume 3, would be of great utility.

The lack of such mapping comprises a major data gap within the region.

The latest comprehensive wetland survey for the study area was completed in 1954 (Shaw and Fredine, 1956). However, this information is dated and of questionable accuracy. The Office of Biological Services of the U.S. Fish and Wildlife Service, Department of the Interior (Cowardin et al., 1977), is currently producing a nationwide wetlands inventory. Some limited areas within this region have been inventoried to date (fall, 1978). The Oregon estuaries have been mapped as has Humboldt Bay, Grays Harbor, and Willapa Bay. Little mapping has occurred for the small estuaries of Watershed Unit 1. The dune areas of Oregon have been mapped in considerable detail by USDA (1975A) and Pinto et al. (1972) but have had limited treatment in Washington (U.W., College of Forest Resources, 1974; Richardson Associates, 1976) although the previously mentioned study by Washington Department of Game should cover the majority of these areas in Washington.

Mapping of oceanic benthic types is in progress by NOAA. The mapping is not of habitat types per se, but is of sediment types which translates into the benthic habitat types described in Volume 3. Maps have been published for Oregon and Washington (Barss et al, 1977, Byrne and Panshin, 1968), but have not yet been published for California, although raw data have been compiled.

3.2.1 Ecosystems. Studies of wet coniferous forests have been extensive within the Western Hemlock Zone in and near the region, and are summarized by Edmonds (1974, 1975) and other International Biome Program (IBP) publications. The Sitka Spruce Zone has not been studied in equal detail but much of the information gathered in the Western Hemlock Zone is also applicable to the Sitka Spruce Zone. Even within these relatively well known ecosystems, information is lacking on decomposer food webs and energetics of the decomposition processes on the forest floor. Interest in the subject, however, is increasing (Pacific Northwest Forest and Range Experiment Station, 1977).

Few ecological studies have been carried out within the Arctic Alpine or True Fir Zones of the region. The True Fir Zone has been studied, however, in the Cascade Mountains by the Coniferous Forest Biome Study (IBP - Edmonds, 1974, 1975; Efford and Hall, 1975) and ecosystem function seems applicable to the True Fir Zone of Watershed Unit 1, but less so to those areas within Units 8 and 9.

The Mixed Evergeen Zone has had considerable vegetational study, but otherwise little ecosystems analysis. Little is known about wildlife populations in the area.

The ecology of riverine systems within the study area is fairly well known, although information on distribution and abundances of producers (periphyton) is lacking. Also, detailed distribution of fish other than Salmonids for the region is not well known and there is a dearth of information on the ecology of the lakes within the region. Little published information exists on their chemistry, biology, or ecology.

The Above Tide Headland Communities have only been studied in a few locations and then principally in a vegetation context, with little information existing on wildlife use, other than the documentation of seabird rookeries and marine mammals haulout areas. Intertidal ecology is much better known and is reported in an extensive literature (Ricketts and Calvin, 1968; Connell, 1972; Kozloff, 1973; and others).

Little or no information is available on the estuaries north of Grays Harbor in Watershed Unit 1. They are small but may be of considerable importance as nursery and primary productivity areas. Secondary productivity data is lacking for the salt marsh and estuarine ecosystems of the study area. Nutrient and material transfers between communities and their significance are not well documented. Massoglia (1977) reports additional estuarine data gaps as does Hedgpeth (1976).

Ecological information for the Surf Zone is also lacking. The active surf on this coast makes data collection very difficult.

Data gaps for the Oceanic Zones have been presented in some detail by Massoglia (1977). Estimates of standing biomass and secondary production in the pelagic communities is a readily apparent data gap.

There is conflicting information on the long term effects of intensive forest management on flora, fauna, and nutrient cycling within the region. Many authorities feel the effects are always deleterious, while others say the forests can be managed with no harm to the natural cycles. See the forest ecosystem discussions in Volume 2.

3.2.4 Succession. Data for many terrestrial successional sequences are available although little information exists on succession within the Mixed Evergreen Zone (Franklin and Dyrness, 1973). Succession in dune communities and in estuarine intertidal communities has also been studied (Jefferson, 1974; Eilers, 1975; Wiedeman, 1966; Kumler, 1963; Kumler, 1969). Seasonal sequences of phytoplankton communities in the region's lakes, estuaries, and ocean areas, however, are not well known.

Rates of succession of wetlands in this region are not clearly documented. We are not at the point where we can look at a lake or wetland and project its life span, although we can predict the changes in community and have some concept of the controlling factors.

3.4 Species of Concern

An extensive literature has been developed on most species having commercial value in the region. The literature, however, is much better developed for inland species (trees) than for estuarine and marine species, e.g., Dungeness crab, demersal fish, shrimp. Similarly, considerable data are available on game species with information on non-game species, excluding rare and endangered species, being available but widespread. The biology of pest species likewise is typically well known. Thorough life history data on many terrestrial, estuarine, and marine invertebrates is spotty with considerable taxonomic work still required.

Rare, endangered, or threatened species have been treated in some detail for the region although data on some of the invertebrates and plants is limited.

Species specific data gaps on seasonality, relative abundance, distribution, and feeding habits are provided in the Annotated Species List (ASL). Use of the letter Q indicates that data were not available to determine that entry.

3.5 Areas of Ecological Concern

Several studies identifying ecologically critical areas have been completed recently within the region (Franklin et al., 1972; Battelle NWL, 1974; Isakson and Reichard, 1976B; Hood, 1977; OIW, 1977; The Nature Conservancy, 1977) and others are in progress (Hirschi, 1977; Matai, pers. comm. 1977; Rifer, pers. comm. 1977).

The California Native Plant Society, of Berkeley, has an Inventory of Rare and Endangered Vascular Plants of California (Special Publication No. 1, 1974, 56 pages, and 1976 addendum, cited too late to include in Bibliography). A number of plants from this inventory have been

placed on the rare and endangered list. Published information is not generally available, however, on occurrence, distribution, and specific location of proposed rare, endangered, and threatened plants in Washington and such information for Oregon is sparce.

4.0 SOCIOECONOMIC DATA GAPS

Socioeconomic data are generally not collected for the Pacific Northwest Coastal Region as such. In most cases the data reporting unit is the county and in most cases county boundaries do not coincide with the "crest of the coastal mountains range" nor with the boundaries between watersheds that are used to define the study region and Watershed Units within it. In the majority of cases, however, there is a rough correspondence between county boundaries and the coastal ridge. Major exceptions are Clallam and Jefferson Counties in Washington and Lane and Douglas Counties in Oregon. In each of these, the county seats and major centers of population and of socioeconomic activity are outside the study area. Most of Wahkiakum County's population of about 3700 (Washington DCED, 1977C) is in the study area (Watershed Unit 3) but Cathlamet, the county seat, is just outside to the east.

Consistent and comprehensive data are frequently lacking for parts of the region, even for those counties which are mainly coastal. It has thus been frequently necessary to use data for one or more counties in the Regional Synopsis as examples of patterns or trends. Where comprehensive data do exist, it is often necessary to interpret them with care. For example, County Business Patterns of the U.S. Department of Commerce (1977D) are more detailed than other sources of employment data. They seriously understate employment in seasonal industries, however, as the data are collected for only one day of the year, 12 March, in the low season.

Socioeconomic data are collected by many different groups for many different purposes at different times and intervals and for different population and geographic units. Comparisons among data from different sources can then be difficult if not misleading. For example, if the annual dollar value of fish landed in Coos County ports were divided by the number of employed fishermen reported in County Business Patterns, the productivity per fisherman would appear to be enormous. It would be false, as this procedure would credit the few fishermen employed in March with the entire year's catch. It would also ignore all those fishermen who are not on a reported payroll. Recent changes have been made in the reporting system but there has not been time to build a data base in the new system.

Forestry inventory data cover a variety of public and private holdings and are available for different years in the different counties or for different holdings. The data are badly out of date in many cases and much of it is considered proprietary, log flow data for example. In agriculture, the big problem is an abundance of data but a great diversity in the manner of reporting (e.g., bales, barrels, bushels, etc.) so that compiling data for an overview is laborious and frustrating. Many other examples could be mentioned but data gaps and deficiencies are cited throughout Chapter 4, Socioeconomic Environment, of the Regional Synopsis and need not be repeated here. The interested reader may consult that chapter in Volume 2.

Part Four - LIST OF REFERENCES

This list includes all references cited in the text of this volume and a few references for Table 2-1 of the Annotated Species List (ASL) description. These references are included in the Annotated Bibliography master file (ABM).

References for the ASL are specific to the species list and do not apply to the ecological characterization of the region generally, although many of them were also used in the other volumes. They were, therefore, kept as a separate list, appearing in Part 2 of this volume and were not entered in the ABM file. (The species list itself is a form of annotation and descriptor field for these references.) These are for the most part species-specific references cited in the "Notes" part of the ASL. See Part 2 for more details.

This list of references cited in Volume 5 has been prepared from the Annotated Bibliography discussed in detail in Part 1. The printout for this volume contains only the author, date, title, and publication fields for each reference. See the Master Bibliographic File (Part 5A of this volume) for the full annotations, descriptors, and other fields.

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The following parts of Volume 5 (computer tapes, printouts, and program notes) are enclosures with this document on file at Region 1, U.S. Fish and Wildlife Service, 500 N.E. Multnomah Street, Portland, Oregon 97232:

PART 5. COMPUTER PRINTOUT OF ANNOTATED BIBLIOGRAPHY

- A Index of Key Words
- B Master Bibliographic File

PART 6. COMPUTER PRINTOUT OF ANNOTATED SPECIES LIST

- A Community Composition Printout by Habitat and Trophic Level
- B Master Annotated Species List File

PART 7. DATA TAPE

Tape containing Parts 5B and 6B, and the Glossary of Terms

PART 8. PROGRAM NOTES

- A FAMULUS document (see Part 1, Section 2.3)
- B Annotated Species List Program Notes

DEPARTMENT OF THE INTERIOR
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