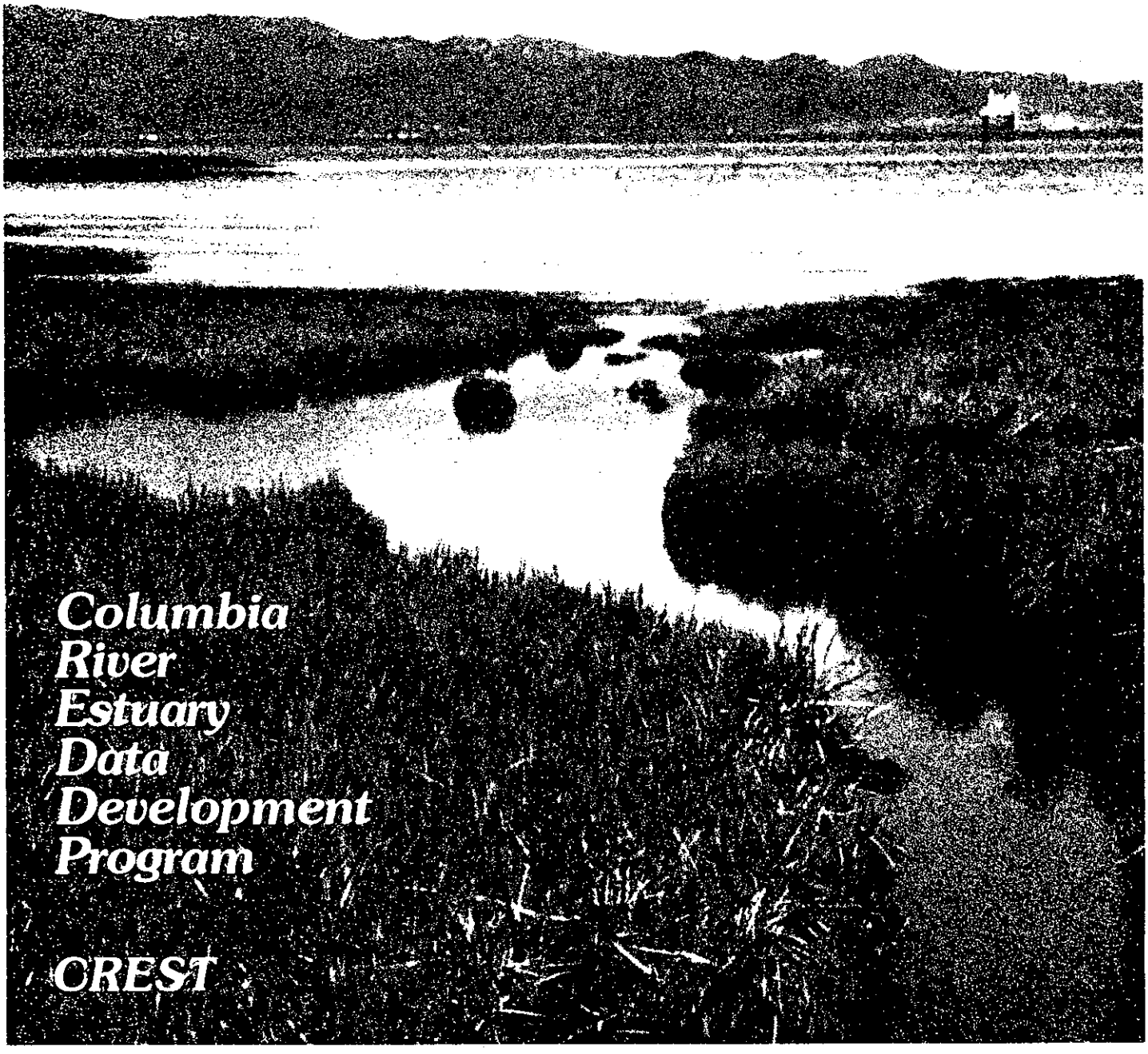
INDEX TO C.R.E.D.D.P. DATA



Columbia River Estuary

Data Development Program

(CREDDP)

INDEX

TO

CREDDP DATA

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FOREWORD

This index is the result of a cooperative effort on the part of most of the research contractors of the Columbia River Estuary Data Development Program (CREDDP). The structure of the document and the introductory material are the work of Howard Mercier, CREDDP Data Management contractor. Much of the material in the main body of the index was provided by the respective work unit investigators.

The outstanding cooperation of the U.S. Army Corps of Engineers Portland District in agreeing to maintain the CREDDP magnetic tape data archive and in providing office space and support for the CREDDP data manager is gratefully acknowledged. The staff of the Corps' North Pacific Division Data Processing Center provided the data manager with a great deal of valuable assistance which is much appreciated.

Credit is due Isabel Turner, Elizabeth Rummell, Julie Guerrero, and Linda Sanzo, who did the word processing for this index and performed all the revisions. The editor wishes to thank David Fox, CREDDP Technical Coordinator, who graciously, quickly, and knowledgeably answered innumerable questions. Jack Damron and Paul Benoit provided helpful review comments.

Substantial assistance with all aspects of this index was provided by Dick Morse and Sid Stillwaugh of the National Oceanic and Atmospheric Administration (NOAA). The index, data formats, and data codes fully meet standards of NOAA's National Oceanographic Data Center (NODC) wherever possible.

Every element of this index has been processed into NOAA's National Environmental Data Referral System (NEDRES), an on-line system available in a fully-searchable mode through the Bibliographic Retrieval System network in both the U.S.A. and Canada.

PREFACE

The Columbia River Estuary Data Development Program

This document is one of a set of publications and other materials produced by the Columbia River Estuary Data Development Program (CREDDP). CREDDP has two purposes: to increase understanding of the ecology of the Columbia River Estuary and to provide information useful in making land and water use decisions. The program was initiated by local governments and citizens who saw a need for a better information base for use in managing natural resources and in planning for development. In response to these concerns, the Governors of the states of Oregon and Washington requested in 1974 that the Pacific Northwest River Basins Commission (PNRBC) undertake an interdisciplinary ecological study of the estuary. At approximately the same time, local governments and port districts formed the Columbia River Estuary Study Taskforce (CREST) to develop a regional management plan for the estuary.

PNRBC produced a Plan of Study for a six-year, $6.2 million program which was authorized by the U.S. Congress in October 1978. For the next three years PNRBC administered CREDDP and $3.3 million was appropriated for the program. However, PNRBC was abolished as of October 1981, leaving CREDDP in abeyance. At that point, much of the field work had been carried out, but most of the data were not yet analyzed and few of the planned publications had been completed. To avoid wasting the effort that had already been expended, in December 1981 Congress included $1.5 million in the U.S. Water Resources Council (WRC) budget for the orderly completion of CREDDP. The WRC contracted with CREST to evaluate the status of the program and prepare a revised Plan of Study, which was submitted to the WRC in July 1982. In September, after a hiatus of almost one year, CREDDP work was resumed when a cooperative agreement was signed by CREST and the WRC to administer the restructured program and oversee its completion by June 1984. With the dissolution of the WRC in October 1982, the National Oceanic and Atmospheric Administration (NOAA) assumed the role of the WRC as the federal representative in this cooperative agreement.

CREDDP was designed to meet the needs of those groups who were expected to be the principal users of the information being developed. One such group consists of local government officials, planning commissions, CREST, state and federal agencies, permit applicants, and others involved in planning and permitting activities. The other major anticipated user group includes research scientists and educational institutions. For planning purposes, an understanding of the ecology of the estuary is particularly important, and CREDDP has been designed with this in mind. Ecological research focuses on the linkages among different elements in the food web and the influence on the food web of such physical processes as currents, sediment transport and salinity intrusion. Such an ecosystem view of the estuary is necessary to

predict the effects of estuarine alterations on natural resources.

Research was divided into thirteen projects, called work units. Three work units, Emergent Plant Primary Production, Benthic Primary Production, and Water Column Primary Production, dealt with the plant life which, through photosynthesis and uptake of chemical nutrients, forms the base of the estuarine food web. The goals of these work units were to describe and map the productivity and biomass patterns of the estuary's primary producers and to describe the relationship of physical factors to primary producers and their productivity levels.

The higher trophic levels in the estuarine food web were the focus of seven CREDDP work units: Zooplankton and Larval Fish, Benthic Infauna, Epibenthic Organisms, Fish, Avifauna, Wildlife, and Marine Mammals. The goals of these work units were to describe and map the abundance patterns of the invertebrate and vertebrate species and to describe these species' relationships to relevant physical factors.

The other three work units, Sedimentation and Shoaling, Currents, and Simulation, dealt with physical processes. The work unit goals were to characterize and map bottom sediment distribution, to characterize sediment transport, to determine the causes of bathymetric change, and to determine and model circulation patterns, vertical mixing and salinity patterns.

Final reports on all of these thirteen work units have been published. In addition, these results are integrated in a comprehensive synthesis entitled The Dynamics of the Columbia River Estuarine Ecosystem, the purpose of which is to develop a description of the estuary at the ecosystem level of organization. In this document, the physical setting and processes of the estuary are described first. Next, a conceptual model of biological processes is presented, with particular attention to the connections among the components represented by the work unit categories. This model provides the basis for a discussion of relationships between physical and biological processes and among the functional groups of organisms in the estuary. Finally, the estuary is divided into regions according to physical criteria, and selected biological and physical characteristics of the habitat types within each region are described. Historical changes in physical processes are also discussed, as are the ecological consequences of such changes.

Much of the raw data developed by the work unit researchers is collected in a magnetic tape archive established by CREDDP at the U.S. Army Corps of Engineers North Pacific Division Data Processing Center in Portland, Oregon. These data files, which are structured for convenient user access, are described in this Index to CREDDP Data. This index also describes and locates several data sets which were not adaptable to computer storage.

The work unit reports, the synthesis, and the data archive are intended primarily for scientists and for resource managers with a scientific background. However, to fulfill its purposes, CREDDP has developed a set of related materials designed to be useful to a wide

range of people.

Guide to the Use of CREDDP Information for Environmental Assessments demonstrates how CREDDP information can be used to assess the consequences of alterations in the estuary. It is intended for citizens, local government officials, and those planners and other professionals whose training is in fields other than the estuary-related sciences. Its purpose is to help nonspecialists use CREDDP information in the planning and permitting processes.

A detailed portrait of the estuary, but one still oriented toward a general readership, is presented in The Columbia River Estuary: Atlas of Physical and Biological Characteristics, about half of which consists of text and illustrations. The other half contains color maps of the estuary interpreting the results of the work units and the ecological synthesis. A separate Bathymetric Atlas of the Columbia River Estuary contains color bathymetric contour maps of three surveys dating from 1935 to 1982 and includes differencing maps illustrating the changes between surveys. CREDDP has also produced unbound maps of the estuary designed to be useful to resource managers, planners and citizens. These black-and-white maps illustrate the most recent (1982) bathymetric data as contours and show intertidal vegetation types as well as important cultural features. They are available in two segments at a scale of 1:50,000 and in nine segments at 1:12,000.

Two historical analyses have been produced. Changes in Columbia River Estuary Habitat Types over the Past Century compares information on the extent and distribution of swamps, marshes, flats, and various water depth regimes a hundred years ago with corresponding recent information and discusses the causes and significance of the changes measured. Columbia's Gateway is a two-volume set of which the first volume is a cultural history of the estuary to 1920 in narrative form with accompanying photographs. The second volume is an unbound, boxed set of maps including 39 reproductions of maps originally published between 1792 and 1915 and six original maps illustrating aspects of the estuary's cultural history.

A two-volume Literature Survey of the Columbia River Estuary (1980) is also available. Organized according to the same categories as the work units, Volume I provides a summary overview of the literature available before CREDDP while Volume II is a complete annotated bibliography.

All of these materials are described more completely in Abstracts of Major CREDDP Publications. This document serves as a quick reference for determining whether and where any particular kind of information can be located among the program's publications and archives. In addition to the abstracts, it includes an annotated bibliography of all annual and interim CREDDP reports, certain CREST documents and maps, and other related materials.

To order any of the above documents or to obtain further information about CREDDP, its publications or its archives, write to CREST, P.O. Box 175, Astoria, Oregon 97103, or call (503) 325-0435.

LIST OF VARIABLES

Listed alphabetically below are the principal variables of interest from each of the data sets indexed herein. Most data sets include additional sampling and environmental data as well as the variables listed below.

Variable	Data Set
Avifauna activity	H.1
Avifauna activity	H.4
Avifauna activity distribution	H.2
Avifauna activity distribution	H.3
Avifauna age distribution	H.2
Avifauna age distribution	H.3
Avifauna count	H.1
Avifauna count	H.2
Avifauna count	H.3
Avifauna count	H.4
Avifauna sex distribution	H.2
Avifauna sex distribution	H.3
Benthic carbon fixation rate	B.2
Benthic chlorophyll a	B.1
Benthic chlorophyll a	B.2
Benthic diatom species composition	B.3
Benthic oxygen consumption rate	B.2
Benthic phaeopigment	B.1
Benthic phaeopigment	B.2
Benthic primary ash-free dry weight	B.2
Conductivity	L.2
Conductivity	L.5
Current direction	L.2
Current direction	L.5
Current speed	L.2
Current speed	L.5
Current velocity	L.2
Current velocity	L.5
Emergent plant aboveground ash-free DW	A.2
Emergent plant aboveground dry weight	A.1
Emergent plant belowground dry weight	A.3
Emergent plant litterbag dry weight	A.4
Epibenthic invertebrate count	F.1
Epibenthic invertebrate weight (wet)	F.1
Epibenthic macroinvert. (EM) length	F.1
EM stomach contents	F.1
Fish count	G.1
Fish density	G.1
Fish length	G.1
Fish length - demersal	F.1
Fish standing crop	G.1
Fish stomach contents	G.1
Fish weight	G.1
Fish weight - demersal	F.1
Ichthyoplankton count	D.1
Infauna count	E.1
Infauna weight	E.1
Light attenuation coefficient	C.1
Light intensity - benthic	B.2
Light intensity - surface	B.2
Light intensity - surface	C.1
Marine mammal count	J.1
Marine mammal morphometry	J.2
Marine mammal scat analysis	J.3
Marine mammal stomach contents	J.3
Nephelometry	K.4
Pressure - atmospheric	L.3
Pressure - water	L.5
Phytoplankton carbon fixation rate	C.1
Riverflow	L.4
Salinity	B.2
Salinity	C.2
Salinity	D.1
Salinity	F.1
Salinity	G.1
Salinity	K.4
Salinity	L.2
Salinity	L.5
Secchi depth	D.1
Secchi depth	F.1
Sediment bedform surface area	M.1
Sediment bedform topography	K.3
Sediment class - Shepard	K.2
Sediment grain size - mean	B.2
Sediment grain-size distribution	E.2
Sediment grain-size distribution	K.1
Sediment grain-size distribution	K.2
Sediment organic content	E.2
Sed. statistics - 1st thru 4th moments	K.2
Sed. statistics - Folk and Ward	K.2
Sed. statistics - Inman	B.2
Sed. statistics - Inman	K.2
Sed. statistics - Trask	K.2
Sediment volume displaced	M.1
Sigma-t	L.2
Sigma-t	L.5
Suspended sediment concentration	K.4
Suspended sediment size-distribution	K.4
Temperature - water	C.2
Temperature - water	D.1
Temperature - water	F.1
Temperature - water	G.1
Temperature - water	L.1
Temperature - water	L.2
Temperature - water	L.3
Temperature - water	L.5
Tidal height	L.1
Water column chlorophyll a	C.2
Water column in vivo fluorescence	C.2
Water column nitrate + nitrite	C.2
Water column phaeophytin	C.2
Water column (WC) phosphate	C.2
WC seston - organic and inorganic	C.2
Water column silicic acid	C.2
Water depth	M.1
Wildlife distribution	I.1
Wildlife food habits	I.1
Wildlife habitat use	I.1
Wildlife period of birth	I.1
Wind direction	L.3
Wind speed	L.3
Wind velocity	L.3
Zooplankton count - epibenthic	F.1
Zooplankton count - water column	D.1
Zooplankton weight (wet) - epibenthic	F.1

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CONTENTS OF THE MAGNETIC TAPE ARCHIVE

(All of the data sets described in this index are contained in the magnetic tape archive except those from the Wildlife and Marine Mammals work units and two data sets from the Sedimentation and Shoaling work unit.)

TAPE	FILES	CONTENTS	RECORDS*	BYTES*/ RECORD	SUBSECTION NUMBER
1	1-123	VCTD Profiles	215,000	132	L.5
2	1-147	VCTD Profiles	210,000	132	L.5
3	1-101	VCTD Profiles	195,000	132	L.5
4	1- 87	VCTD Profiles	125,000	132	L.5
5	1- 52	Tidal Height	65,000	132	L.1
5	53-313	Currents	135,000	132	L.2
5	314-327	Wind	15,000	132	L.3
5	328-332	Flow	9,000	132	L.4
6	1	Benthic Primary Productivity	155	132	B.2
6	2	Benthic Chlorophyll	3,798	80	B.1
6	3	Benthic Diatom	1,771	132	B.3
6	4	Benthic Diatom Codes/Names	149	80	-
6	5	Benthic Sediment	772	132	E.2
6	6	Benthic Infauna	3,750	132	E.1
6	7	Benthic Infauna Codes/Names	241	80	-
6	8	Water Column Productivity	408	80	C.1
6	9	Water Column Physical	521	132	C.2
6	10	Zooplankton	3,941	80	D.1
6	11-41	Sediment Statistics	15,000	80	K.2
6	42-72	Sediment Grain Size	13,000	80	K.1
6	73	Avifauna Circular Plot	7,028	80	H.1
6	74	Avifauna Transects	8,015	80	H.2
6	75	Avifauna Point Census	886	80	H.3
6	76	Avifauna Incidental Sightings	796	80	H.4
6	77	Avifauna Species Codes/Names	172	80	-
6	78	Emergent Plant Ash-free DWGT	327	80	A.2
6	79	Emergent Plant Dry Weight	6,049	80	A.1
6	80	Emergent Plant Subsurface DWGT	198	80	A.3
6	81	Emergent Plant Litter	492	80	A.4
6	82	Emergent Plant Codes/Names	58	80	-
6	83	Fish	20,165	80	G.1
6	84	Fish Predator Codes/Names	121	80	-
6	85	Fish Prey Codes/Names	171	80	-
6	86	Bathymetry	31,168	80	M.1
6	87	Epibenthic Organisms	26,790	80	F.1

*Record: a line of print. Byte: the smallest printable unit of information; a letter, digit, or symbol.

INTRODUCTION

Extensive data on Columbia River Estuary physical and biological characteristics were collected between 1979 and 1981 by scientific investigators working under contract to the Columbia River Estuary Data Development Program (CREDDP). CREDDP was a federally funded, $4.8 million program that began in October 1978 and terminated in June 1984. Its origin, purposes, structure, and products are described in the Preface starting on page v.

Although each of the investigative teams that contracted to perform a CREDDP work unit produced a report detailing the methods and results of its study and presenting various summaries and interpretations of its data, an effort was made to collect and preserve the field data on which these reports were based in such a way that they would be available to any interested scientist, government agency, or private citizen after the termination of CREDDP. A total of 32 data sets were assembled from 13 work unit contractors. The purpose of this index is to describe these data sets and to indicate how they may be obtained. The descriptions are detailed and are intended to provide all the documentation that would be necessary to potential users of the data.

All but six of the data sets had been put in machine-readable form by the work unit contractors. These machine-readable data sets are now stored on six reels of magnetic tape maintained at the U.S. Army Corps of Engineers North Pacific Division Data Processing Center in Portland, Oregon. Printed or magnetic tape copies of these data sets are available as explained below. The remaining data sets are housed in various locations; each description of such a data set includes information on how and where to request it.

The data sets that reside in the magnetic tape archive vary in length from 155 to 745,000 records (lines) and comprise between one and 458 files apiece. Also archived are a few taxonomic code tables too lengthy to be reproduced in this index. Data sets were archived in approximately the order they were received by CREDDP's data manager. A list of the contents of the magnetic tape archive is shown on the opposite page.

While the Corps of Engineers will provide copies of these data sets, there is no mechanism for copying a portion of a file or mixing data from different files. Only complete files will be copied.

Origins of the Data

Most of the data described in this index were generated through field sampling and measuring conducted from 1979 through 1981 by CREDDP work unit contractors. A number of data sets, especially in the Currents work unit, were generated by federal agencies and were obtained to supplement CREDDP data. Some of the data sets were generated by CREDDP investigators for other studies.

Organization of This Index

The CREDDP effort was divided into work units, each focusing on a different physical or biological characteristic of the estuary. This structure is preserved in both the magnetic tape archive and this index.

Each subdivision in this index deals with an individual work unit and its associated data set(s). There are from one to five data sets per work unit. Each work unit section begins with an overview of the work unit goals and the methods used to achieve those goals. Since it is anticipated that users of CREDDP data sets will want to refer to the associated work unit report(s), the appropriate references are included in each introductory work unit overview.

Subsections on each of the data sets associated with the work unit follow the introductory overview. Each data set subsection begins with a statement describing the data collection effort represented. After this statement comes the following information on the data set:

a. Variables - the principal variables of interest. Most data sets contain other descriptive or subsidiary data.
b. Data Set Description - the extent and form of the data set and, if the data set resides in the magnetic tape archive, a complete column-by-column description of the format and contents of the various types of records, referencing code tables where necessary. See below for more on computer file formats.
c. Sampling - information concerning the sampling program represented by the data set.
d. Processing - information concerning any processing of the data by either the work unit contractor or the CREDDP data manager which may have occurred prior to archiving.
e. Quality Control - steps that were taken to ensure the quality of the data.
f. Data Set Request Information - tape and file numbers if the data set resides in the magnetic tape archive; see below. For data sets not adaptable to magnetic-tape storage, names and addresses of contacts are given.
g. Alternate Sources - a few data sets are available from alternate sources.

Code tables referenced in the data set descriptions are grouped at the end of each work unit section following the last data set subsection. These code tables are often referenced in more than one of the data set descriptions in a given work unit section.

It is anticipated that most users of this index will turn directly to the work unit section(s) of particular interest to them. As an additional convenience, a composite list of the principal variables of interest is shown on page viii opposite the Table of Contents. This composite List of Variables is arranged alphabetically to provide a cross-reference for variables that appear in more than one data set. Data sets are identified by subsection number. Readers who find a variable of interest in the List of Variables can use the data set

subsection number to find the name and page number of the data set in the Table of Contents.

Processing and Quality Assurance During Archiving

CREDDP investigators formatted their data in a variety of ways. While no standard format was adopted during archiving, some processing did occur. Data sets were organized by work unit and in some cases multiple data sets from a single work unit were combined. Data sets in which measurements were not accompanied by latitude, longitude, and date were processed to include this information. During processing, as many of the coded data as feasible were replaced with uncoded data to reduce the need for auxiliary code tables. In many instances the data were reformatted during archiving so that the printouts would be easier to read.

Steps were taken to assure that there was no decrease in the quality of the data after they were received from the work unit contractors. In the course of these quality assurance procedures, many errors in the files supplied by the contractors were discovered and corrected. A discussion of the steps taken by CREDDP's data manager to assure the quality of the data can be found in the appendix to this index.

Computer File Formats

The computer files are formatted in three styles. The Currents work unit files all begin with header records (either nine or ten) giving locations, sampling duration, and other information. These are followed by records containing the observations. Other investigators opted for a hierarchical structure similar to the NODC formats. These files have records occurring in groups with a record-type field (column) indicating the contents and format of the record. In each group the first few records contain sampling or environmental information; these are followed by data records. Zooplankton, Epibenthic Organisms, Avifauna, and Sedimentation data sets use this structure. Bathymetry can be included in this group since its records contain a record-type field which is the key to decoding the record. Each of the remaining data files contains records that do not vary in format. Each record in these sets begins with date, latitude, and longitude and then goes on to present the information gathered by the researchers.

Each description of a computer archive file contains a column-by-column listing of contents. These are given as FORTRAN specifications. When a field always contains the same value, that value appears in quotes in place of format specification. Three of the data sets (F.1, K.1, and K.2) assume a feature of FORTRAN and some other languages, namely, an explicit decimal point will override a format specification.

Printouts of each single-file data set and of one representative file from each multiple-file data set are available for review at the Corps' Portland library. Copies of the first page from each of the above files are in the CREST library at Astoria, Oregon (see Preface).

Computer Capabilities and Costs

The data in the magnetic tape archive are accessed via the Corps of Engineers' AMDAHL 470 mainframe. The Corps will make these data available upon request and will recover the cost of reproduction. The Corps will charge requesters for computer resources consumed, personnel time for processing the request, and postage.

The services provided will normally be limited to the following:

- Copies of the data will be provided as they have been archived.
- Only complete files will be copied. There is no mechanism for copying a portion of a file or mixing data from different files.
- Only printouts or half-inch magnetic tape copies of the files will be provided.
- Magnetic tapes must be supplied by the requester.
- Tapes will be written according to the following specifications: 9 track, 1600 BPI, EBCDIC. Tapes will be blocked at 5280 characters per block.
- Non-labeled or IBM standard labeled tapes may be requested.

Although the above is a complete listing of the Corps' obligations under its Memorandum of Understanding with CREDDP, users wishing extended services may contact the Corps' Planning Division (see CREDDP Data Request Form) to investigate available options.

The Corps periodically reviews the cost of providing its services and adjusts its prices accordingly. As of June 1984 the computer cost was 3¢ for each 1000 records copied. The additional personnel costs will vary with the complexity of the request; as an estimate, $20 per reel of tape has the correct order of magnitude. Allowing for labels, one can plan on approximately 100 records per foot; a standard 2400-foot tape would therefore accommodate about 240,000 records. Thus to copy a number of files with a total of 240,000 records onto a 2400-foot tape, the Corps would charge approximately $7 computer time (3¢ per 1000, times 240,000) plus $20 personnel time, plus postage. These costs apply to both printouts and magnetic tape copies.

Requesting Computer Data

A form is provided at the back of this index that solicits the information necessary to process a request. The Corps personnel who will process the request may not be familiar with scientific terminology. To avoid confusion, therefore, files must be requested by tape and file number. Fill in the form or a copy thereof and mail it as indicated. If a magnetic-tape copy is requested, remember to include the tape. Do not prepay; the Corps will send a bill after its services have been performed and its costs computed.

A. EMERGENT PLANT PRIMARY PRODUCTION

The study objectives for the Emergent Plant Primary Production work unit were to:

- o describe and map emergent plant biomass and primary productivity patterns;
- o relate marsh vegetation types and productivity to elevation, salinity, and other pertinent physical and chemical factors;
- o estimate the export of detritus from marshes; and
- o determine the emergent plant carbon budget.

Data were collected using well-tested standard methods which are described in the work unit final report (see below). Briefly, these methods involve the use of:

- o clip quadrats for measuring net aboveground biomass;
- o core samples for measuring belowground biomass; and
- o litterbag studies for measuring decomposition of selected species of emergent vegetation.

These were processed to produce four data sets: Aboveground Dry Weight, Aboveground Ash-free Dry Weight, Belowground Dry Weight, and Litterbag Dry Weight. The aboveground and belowground biomass measurements were used to make estimates of net annual production throughout the estuary for major emergent marsh plant associations, for different intertidal elevations, and for individual species common in the estuary. Ash-free dry weight data are an alternative method of recording biomass which represents an estimate of the organic matter content of the vegetation. Decomposition rate data from selected plant materials were used to estimate the potential export of (particulate) detritus from the marshes of the estuary.

Principal investigator for this work unit was Keith B. Macdonald of Woodward-Clyde Consultants. For further information see:

Macdonald, K.B.; Winfield, T.P. 1984. Tidal marsh plant production in the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

A.1 DATA SET: Emergent Plant Aboveground Dry Weight

Aboveground biomass was used in conjunction with belowground (root) biomass to estimate overall primary production values for emergent vegetation. Production values were used as a basis for estimating potential organic carbon contribution to the estuary from various regions and intertidal elevations.

a. Variables

Aboveground dry weight

b. Data Set Description

This data set is one of the files in the computer archive. The file contains 6,049 records, 80 bytes each. The data are sorted first by date, then by station. All records are identical in format as follows:

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
31-36	I6	Station number
38	I1	Replicate number
40	I1	Living/dead (Table A1)
42-43	I2	Plant code*
45-71	A27	Plant name
72-80	F9.1	Dry weight (g/m^2)

c. Sampling

The data were collected roughly monthly from 15 April 1980 to 11 October 1980 and again on 17 August 1981. In all, 22 sites were sampled.

d. Processing

Data were recorded on data entry forms and keypunched. Data were reformatted via a computer program and date, longitude, latitude and plant name were inserted into the record.

e. Quality Control

Data listings were checked against data entry forms. Selected computer input and output records were compared.

f. Data Set Request Information: Tape 6 File 79*

g. Alternate Sources: None

*Tape 6 File 82 contains species codes.

A.2 DATA SET: Emergent Plant Aboveground Ash-free Dry Weight

Ash-free dry weight values were determined from dry weight samples. These measurements were important due to the presence of volcanic dust on plants which inflated actual dry weight values, especially for May and June 1980 samples.

a. Variables

Aboveground ash-free dry weight

b. Data Set Description

This data set is one of the files in the computer archive. The file comprises 327 records, each 80 bytes long. The records are sorted first by date, then by station. All records have the following format:

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
31-36	I6	Station number
38	I1	Replicate number
40	I1	Living/dead (Table A1)
42-43	I2	Plant code*
45-71	A27	Plant name
72-80	F9.2	Ash-free dry weight (% of dry weight)

c. Sampling: Same as A.1.c

d. Processing: Same as A.1.d

e. Quality Control: Same as A.1.e

f. Data Set Request Information: Tape 6 File 78*

g. Alternate sources: None

*Tape 6 File 82 contains species codes.

A.3 DATA SET: Emergent Plant Belowground Dry Weight

Belowground (root) biomass data were used in combination with aboveground biomass data to develop estimates of overall primary production values for emergent vegetation. Production estimates served as a basis for estimating potential organic carbon (particulate) contribution to the estuary by region and by intertidal elevation.

a. Variables

Belowground dry weight

b. Data Set Description

This data set resides in the computer archive. It consists of 198 records, 80 bytes each. The records are sorted first by date, then by location. All records are formatted as follows:

Columns	Format	Contents
2-7	3I2	Date: YYMMDD

9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
31-36	I6	Station number
38	I1	Replicate number
72-80	F9.1	Dry weight (g/m^2)

c. Sampling: Same as A.1.c

d. Processing

Processing was the same as for Data Set A.1 except that no plant names were inserted.

e. Quality Control: Same as A.1.e

f. Data Set Request Information: Tape 6 File 80

g. Alternate Sources: None

A.4 DATA SET: Emergent Plant Litterbag Dry Weight

Litterbags were used to measure decomposition rates of selected species of plants at various locations throughout the estuary and at low and high intertidal elevations. Decomposition rate estimates were used to approximate the potential export of detritus from the various marsh types found in the estuary. Results for Carex lyngbyei and Potentilla pacifica suggest that plants decompose at a higher rate upstream than downstream (near the mouth) and that at the same location plants decompose faster in the low intertidal zone than in the high intertidal.

a. Variables

Litterbag dry weight

b. Data Set Description

This data set is one of the files in the computer archive. The file comprises 492 records, each 80 bytes long. The data are sorted first by date, then by location. All records are identical in format as follows:

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SS N(orth)
20-29	3I3'W'	Longitude: DDD MM SS W(est)
31-36	I6	Station number
38	I1	Replicate number
42-43	I2	Plant code*
45-71	A27	Plant name
72-80	F9.2	Dry weight (g/bag)

c. Sampling

Samples were collected at eight sites.

d. Processing: Same as A.1.d

e. Quality control: Same as A.1.e

f. Data Set Request Information: Tape 6 File 81*

g. Alternate Sources: None

*Tape 6 File 82 contains species codes.

Table A1. Living/dead Codes

Code	Usage
0	Mixture
1	Living
2	Dead

B. BENTHIC PRIMARY PRODUCTION

The general objective of the Benthic Primary Production work unit was to determine mechanisms that control the production dynamics of benthic plants relative to physical and biological processes in the Columbia River Estuary. In particular, the research was concerned with effects of chemical and physical gradients on the structural and functional attributes of micro- and macro-vegetation and on the productivity and biomass of the benthic primary food supply.

The data set called Benthic Primary Production and Environment was collected to directly monitor rates of primary production in the field and to study this process relative to physical and biological variables. Analysis of these data revealed that rates of benthic primary production were (1) uncorrelated with salinity, water temperature, and ambient light intensity; (2) weakly correlated with sediment characteristics; and (3) strongly correlated with the concentration of chlorophyll a in the top centimeter of sediment.

The establishment of a relationship between observed rates of primary production and chlorophyll a concentration at five intensive study sites permitted the estimation of rates of primary production from chlorophyll a samples collected at additional estuarine sites. These additional data are contained in the data set entitled Benthic Primary Production Chlorophyll and Phaeopigments.

The data set called Diatom Species Distribution contains the relative abundances of benthic and planktonic diatom taxa in samples from the Columbia River Estuary. Analysis of these data revealed that the estuarine microflora is dominated by freshwater taxa. Brackishwater taxa were abundant in Baker Bay and were found frequently in the sediments from Youngs Bay. Diatoms are the dominant autotrophic organisms in the benthic flora of the estuary.

Principal investigator for this work unit was C. David McIntire of Oregon State University. For further information see:

McIntire, C.D.; Amspoker, M.C. 1984. Benthic primary production in the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

B.1 DATA SET: Benthic Primary Production Chlorophyll and Phaeopigments

Chlorophyll a and phaeopigment concentration were monitored on estuarine tidal flats to estimate autotrophic biomass and to be evaluated as a predictor of rates of gross primary production. At each sampling location, four or fewer 25-meter transects were established side-by-side at different tidal levels. Samples were collected at six positions along each transect. For each sample, variables were measured at three depths into the sediment.

a. Variables

Chlorophyll a concentration
Phaeopigment concentration

b. Data Set Description

This data set is one of the files in the computer archive. The file contains 3,798 records, 80 bytes each. All records are in the format shown below. The data are sorted first by station, then by date.

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
32-33	I2	Station number
36	I1	Tidal level (Table B1)
39	I1	Depth into sediment (Table B2)
42	I1	Replicate number
45-50	F6.2	Chlorophyll a concentration (micro-g/cm^3)
53-58	F6.2	Phaeopigment concentration (micro-g/cm^3)

c. Sampling

The data were collected at roughly monthly intervals between April 16, 1980, and August 30, 1981. Thirty-six sites were sampled. For a complete description of sampling see McIntire and Amspoker (1984).

d. Processing

Field notes were transcribed to laboratory work sheets, then to coding sheets and keypunched. Data were reformatted via a computer program and latitude, longitude, and date were inserted into the record.

e. Quality Control

All transcriptions were checked against field notes and laboratory sheets. Selected computer input and output records were checked.

f. Data Set Request Information: Tape 6 File 2

g. Alternate Sources: None

B.2 DATA SET: Benthic Primary Production and Environment

These data were collected to directly monitor rates of benthic primary production and related physical and biological variables at intensive study and validation sites. From these results

relationships between rates of primary production and the other variables were established. These relationships were used to estimate the rates of primary production at the other estuarine sites. Chlorophyll a concentration in the upper centimeter of sediment was the best predictor of rates of primary production.

a. Variables

Carbon fixation rate	Light intensity - surface
Oxygen consumption rate	Light intensity - benthic
Chlorophyll a concentration	Median sediment grain size
Phaeopigment concentration	Mean sediment grain size
Ash-free dry weight	Sediment statistics - Inman
	Salinity

b. Data Set Description

This data set is one of the files in the computer archive. The file contains 155 records, 132 bytes each. The records are all of the format shown below. The file is sorted first by station, then by date. The letter M is used to designate missing data.

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
32	I1	Station number
34	I1	Tidal level (Table B1)
36-39	F4	Surface light (micro-E/m^2/s)
42-45	F4	Underwater light (micro-E/m^2/s)
47-51	F5.1	Production temperature (°C)
53-57	F5.1	O_2 consumption temperature (°C)
58-62	F5.2	Median grain size (phi)
64-68	F5.2	Mean grain size (phi)
70-74	F5.2	Grain size sorting coefficient
76-80	F5.2	Grain size skewness coefficient
82-86	F5.2	Grain size kurtosis coefficient
88-92	F5.2	Ratio (CHLa-surface/CHLa-5cm)
94-97	F4.1	Salinity (ppt)
99-104	F6.2	Carbon fixation rate (mgC/m^2/h)
106-111	F6.2	Oxygen consumption (mgO_2/m^2/h)
113-118	F6.2	Chlorophyll a concentration (mg/m^2)
120-125	F6.2	Phaeopigment concentration (mg/m^2)
127-132	F6.2	Ash-free dry weight (g/m^2)

c. Sampling: Same as B.1.c

d. Processing: Same as B.1.d

e. Quality Control: Same as B.1.e

f. Data Set Request Information: Tape 6 File 1

g. Alternate Sources: None

B.3 DATA SET: Diatom Species Distribution

Distributional patterns of benthic and planktonic diatoms were studied as indicators of salinity change and water movement. The data are reported as number of valves for each diatom taxon in a sample of 300 valves. The benthic diatom flora was composed primarily of freshwater taxa. A brackishwater assemblage was found in Baker Bay. Large numbers of planktonic taxa were found on the sediments.

a. Variables

Diatom species composition

b. Data Set Description

This data set is one of the files in the computer archive. The file contains 1,771 records, 132 bytes each. The data are sorted first by station, then by month. The format is as follows:

Columns	Format	Contents
2-3	I2	Month
5-14	3I3'N'	Latitude: DD MM SSN(orth)
16-25	3I3'W'	Longitude: DDD MM SSW(est)
28-29	I2	Station number
31-32	I2	Region (Table B3)
35	I1	Season (Table B4)
37-38	I2	Block number
41-43	I3	Species code*
46-85	A40	Species name*
88-90	I3	Count

c. Sampling

The data were collected between April 1980 and October 1981. The data were pooled by month; that is, May 1980 and May 1981 are reported as month 5. Twenty-seven sites were sampled.

d. Processing

The data were first recorded on laboratory work sheets, then were transcribed to coding sheets and keypunched. Data were reformatted via a computer program; latitude, longitude, and organism name were inserted into the record.

e. Quality Control: Same as B.1.e

f. Data Set Request Information: Tape 6 File 3*

g. Alternate Sources: None

*Tape 6 File 4 contains benthic diatom species codes and names.

Table B1. Tidal Level Codes

Code	Usage
1	Marsh: approximately 0.9m above MLLW
2	High intertidal: approximately 0.7m above MLLW
3	Mid intertidal: approximately 0.5m above MLLW
4	Low intertidal: approximately 0.3m above MLLW

Table B2. Depth into Sediment Codes

Code	Usage
1	0-1cm
2	4.5-5.5cm
3	9-10cm

Table B3. Region Codes

Code	Usage
1	Station 1
2	Station 2
3	Stations 5-10
4	Stations 3 and 12-16
5	Stations 4, 11, and 17-20
6	Station 21
7	Station 22
8	Station 23
9	Station 24
10	Station 25
11	Station 26
12	Station 27

Table B4. Season Codes

Code	Usage
1	Month 1
2	Months 3 and 4
3	Months 5-8
4	Months 9-11

C. WATER COLUMN PRIMARY PRODUCTION

The goal of the Water Column Primary Production work unit was to characterize the abundance and rates of photosynthesis of phytoplankton in the Columbia River Estuary and to identify the important environmental factors controlling the distribution and production of the phytoplankton. Light was found to be the main factor limiting phytoplankton production, with both incident solar radiation and light attenuation in the water column strongly affecting growth. Of the major nutrients (N, P, Si), only nitrogen was depleted to levels which may, at times in the summer, have been limiting.

There was little vertical structure in the water column properties measured except in the region of the salt wedge. There was a notable decrease in chlorophyll a concentration from freshwater to the mixing zone, and it was concluded that this was due to the loss of phytoplankton species intolerant of saline water. There was a clear seasonal pattern, with low chlorophyll concentrations and productivity in winter and high chlorophyll and productivity in summer. Inorganic nutrient (N, P, Si) concentrations varied inversely with productivity and chlorophyll concentrations (high in winter, low in summer), with only nitrogen approaching limiting values.

The data for this study are contained in two data sets: Water Column Primary Production and Water Column Biomass and Environment. The former contains carbon fixation rates and light data while the latter contains chlorophyll, nutrient, and other environmental measurements.

Principal investigator for this work unit was Lawrence F. Small of Oregon State University. For further information see:

Frey, B.E.; Small, L.F.; Lara-Lara, R. 1984. Water column primary production in the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

C.1 DATA SET: Water Column Primary Production

Data were collected to characterize the abundance and photosynthetic rates of phytoplankton and to identify the important environmental factors controlling distribution and production. This data set includes carbon uptake rates and solar radiation data. Light was found to be the main factor limiting phytoplankton production.

a. Variables

Light attenuation coefficient
Light intensity - surface
Phytoplankton carbon fixation rate

b. Data Set Description

This data set is one of the files in the computer archive. The

file contains 408 records, 80 bytes each. The data are sorted first by date, then by location. The records are formatted as follows:

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
32-34	F3	Nominal depth (ft)
36-37	I2	Cruise number
39-42	I4	Station number
45-47	I3	Percent light transmittance
49-52	F4.2	Light-attenuation-per-meter coefficent
55-58	F4	Incident light (micro-E/cm^2/s)
60-62	A1,F2	Size fraction (less than 10, greater than 33 micrometers)
64-69	F6.2	Carbon uptake (mg/m^3/h)
71-75	F5.2	Standard deviation of two replicates

c. Sampling

Ten cruises were conducted on a roughly monthly schedule between April 8, 1980, and July 31, 1981. Samples were collected at 18 locations. For more information about the sampling scheme see Frey et al. (1984).

d. Processing

Data were reformatted via a computer program; latitude, longitude, and depth were inserted into the records.

e. Quality Control

Data were key-verified upon entry. Selected computer input and output records were checked. Manual calculations were performed to check computer processing routines.

f. Data Set Request Information: Tape 6 File 8

g. Alternate Sources: None

C.2 DATA SET: Water Column Phytoplankton Biomass and Environment

Data were collected to characterize phytoplankton biomass. This data set includes measures of biomass and suspended particulate matter, and physical and chemical environmental variables which may affect growth and distribution.

a. Variables

Water temperature	Phaeophytin
Salinity	In vivo fluorescence

Nitrate + nitrite	DCMU-enhanced fluorescence
Phosphate	Organic seston
Silicic acid	Inorganic seston
Chlorophyll a	Total seston

b. Data Set Description

This data set is one of the files in the computer archive. The data file contains 521 records, 132 bytes each. It is sorted first by date, then by station. The data records are formatted as follows:

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
33-35	F3	Nominal depth (ft)
37-41	F5.2	Depth (m)
43-44	I2	Cruise number
46-49	I4	Station number
52-55	F4.1	Water temperature (°C)
57-60	F4.1	Salinity (ppt)
63-66	F4.1	Nitrate + nitrite (micro-mol/l)
68-71	F4.1	Phosphate (micro-mol/l)
73-77	F5.1	Silicic acid (micro-mol/l)
81-84	F4.1	Chlorophyll a (micro-g/l)
87-91	F4.1	Phaeophytin (micro-g/l)
93-96	F4.1	In vivo fluorescence (relative units)
98-101	F4.1	DCMU-enhanced fluor. (relative units)
104-107	F4.1	Fluoresence ratio (DCMU/In vivo)
109-111	F3.1	Organic seston (mg/l)
116-119	F4.1	Inorganic seston (mg/l)
124-127	F4.1	Total seston (mg/l)

c. Sampling

Ten cruises were conducted on a roughly monthly schedule between April 8, 1980, and July 31, 1981. Samples were collected at 53 locations. For more information about the sampling scheme see Frey et al. (1984).

d. Processing: Same as C.1.d

e. Quality Control: Same as C.1.e

f. Data Set Request Information: Tape 6 File 9

g. Alternate Sources: None

D. ZOOPLANKTON AND LARVAL FISH

A CREDDP field sampling program for zooplankton and larval fishes in the Columbia River Estuary was carried out from April 1980 to April 1981. The objectives of the study were to:

- describe and map the distribution and abundance of the zooplankton and of larval fishes by taxonomic categories and assemblages over time;

- examine relationships between the distributions and abundance of animals and salinity; and

- describe the population and life history of Eurytemora affinis, a relatively small calanoid copepod.

Distributions and abundance were studied at ten fixed sampling locations two miles apart along the axis of the main navigation channel. Seasonal observations were made on thirteen sampling cruises distributed aperiodically through one year; most observations were in spring and summer. The planktonic animals were identified in 50 taxonomic categories: 11 fishes, 5 mysids, and 34 zooplankters. The division of some taxonomic categories into life history stages provided a data array of 120 animal categories.

The distribution and abundance of the plankton animals was found to be clearly related to salinity and to season. Seasonal changes in abundance were striking. Assemblages of animals corresponded to marine, estuarine, and freshwater salinities. The most abundant species sampled was Eurytemora affinis. Populations of E. affinis were repeatedly and consistently greatest at the locations between seawater and fresh water. Egg-carrying females occurred in significant numbers at one or more locations during every cruise. The fluctuating abundance of life history stages over time suggested a pattern of at least several generations during the spring and summer.

Principal investigator during the data collection phase of this work unit was T. Saunders English of the University of Washington. Principal investigators for the preparation of the interpretive report on this work unit were James A. Lichatowich, Kim K. Jones, and Daniel L. Bottom of the Oregon Department of Fish and Wildlife. For further information see:

Jones, K.K.; Bottom, D. 1984. Zooplankton and larval fishes of the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

D.1 DATA SET: Zooplankton

Ten sampling station locations along the main navigation channel were sampled on thirteen cruises. Temperature and salinity were observed at one-meter intervals from the surface as deep as 13m; Secchi disc depths were observed. Plankton samples were taken with

two half-meter diameter nets, with flowmeters, mounted side-by-side in a plankton sled. Double oblique hauls were made by allowing the sled to touch bottom. The species of the zooplankton were identified when possible, and sex and life history stages were determined; ichthyoplankton were identified and the life history stage determined.

a. Variables

Water temperature
Salinity
Secchi depth
Zooplankton and ichthyoplankton count

b. Data Set Description

This data set is one of the files in the computer archive. The file structure is hierarchical, with each record being part of a set. The sets are of variable length. Records are of two types (2 and 3). Record type 2 requires four records to complete. These present information on the sampling date, location, environment, and method. Each set begins with four such records of type 2. Following this information are a variable number of records of type 3, which contain data on the zooplankters captured. The file contains 3,941 records, each 80 bytes in length. The first 14 columns of all records are as follows:

Columns	Format	Contents
1-3	'A25'	File type
5	I1	Record type (2 or 3)
7-8	I2	Cruise number
10-11	I2	Station number
13-14	I2	Haul number

Record type 2 continues as follows:

(record 2-1)		
16-21	3I2	Date: DDMMYY
23-26	2I2	Time: HHMM
28-29	F2	Water depth (m)
34-43	3I3'N'	Latitude: DD MM SSN(orth)
45-54	3I3'W'	Longitude: DDD MM SSW(est)
80	'1'	Sequence number for type 2
(record 2-2)		
16-18	F3.2	Secchi depth (m)
19-74	14F4.2	Salinities at 0-13 meters (ppt)
80	'2'	Sequence number for type 2
(record 2-3)		
19-74	14F4.2	Temperatures at 0-13 meters (°C)
80	'3'	Sequence number for type 2

(record 2-4)

16	'1'	Haul type - always double oblique tow
17-19	F3	Maximum net depth (m)
20-22	F3	Minimum net depth (m)
24-29	3I2	Duration of tow: HHMMSS
30-31	F2	Wire angle (degrees)
32-34	F3	Wire length (m)
37	I1	Starboard gear type (Table D1)
38-41	I4	Starboard flowmeter number (Table D2)
42-47	F6	Initial starboard flowmeter reading
48-53	F6	Final starboard flowmeter reading
54-56	F3	Settled volume of starboard sample (ml)
59	I1	Port gear type (Table D1)
60-63	I4	Port flowmeter number (Table D2)
64-69	F6	Initial port flowmeter reading
70-75	F6	Final port flowmeter reading
76-78	F3	Settled volume of port sample (ml)
80	'4'	Sequence number for type 2

Record type 3 continues as follows:

16	I1	Gear type (Table D1)
17-18	I2	Subsample number
19-24	F6.5	Fraction of sample examined
25-30	A6	Species mnemonic
31	I1	Sex (Table D3)
32-33	I2	Life history stage (Table D4)
34-36	I3	Count
38-67	A30	Species name
68-79	I12	NODC taxonomic code

c. Sampling

Thirteen cruises are recorded. Eleven were made roughly semi-monthly between April 29 and September 30, 1980; the last two were made in January and April, 1981. Samples were taken at ten locations between RM-5 and RM-23 in the main navigation channel. Details of the sampling scheme can be found in Jones (1984).

d. Processing

Latitude, longitude, species name, and NODC taxonomic codes were inserted into the record via a computer program.

e. Quality Control

Data were key-verified upon entry. Data deck listings were checked against field and lab data sheets. Each type of calculation done via computer programs was checked by hand and selected input and output records were checked.

f. Data Set Request Information: Tape 6 File 10

g. Alternate Sources: None

Table D1. Gear Type Codes

Code	Usage
1	1m Tucker trawl
2	0.5m diameter, 253 micro-m mesh, in PGE sled
3	0.5m diameter, 335 micro-m mesh, in PGE sled

Table D2. Flowmeter Numbers and Factors

Number	Factor*
1083	0.0292
1097	0.0290
5287	0.0289
5288	0.0287
5473	0.0286
5482	0.0286
5486	0.0280

*Factor = meters/revolution. Final flowmeter reading minus initial reading yields number of revolutions; times factor equals meters traveled. Meters traveled times area of net ($0.2m^2$) equals volume filtered.

Table D3. Sex Codes

Code	Usage
Blank	No information
0	Indeterminable
1	Male
2	Female
3	Hermaphrodite
4	Transitional
5	Grouped, both sexes present

Table D4. Life History Stage Codes

Code	Usage
Blank	No information
00	Indeterminable
01	Larva
02	Juvenile
03	Adult
04	Combination juvenile/adult
05	Egg-carrying female

10	Copepodid stage not determined
11	Copepodid stage I
12	Copepodid stage II
13	Copepodid stage III
14	Copepodid stage IV
15	Copepodid stage V
16	Adult copepod
17	Egg-carrying copepod
20	Juvenile mysid
21	Immature adult mysid
22	Mature adult mysid
23	Brooding adult mysid
24	Spawned adult mysid
30	Fish egg
31	Fish larva
32	Fish juvenile
33	Fish adult
40	Zoea
41	Megalopa
50	Nauplius
51	Cypris
60	Pupa
61	Nymph
70	Medusa
80	Veliger

E. BENTHIC INFAUNA

The objectives of the CREDDP infauna studies were to determine and map density distributions, determine habitat relations, and provide information on food chain relations. These objectives were achieved through a combination of distributional, life history, and production ecology studies.

The infauna of a Baker Bay intertidal mudflat was intensively studied from August 1980 to September 1981. Abundances of individual taxa changed dramatically through the year, but species richness and the relative dominance of surface deposit feeders remained unchanged. Macoma balthica dominated biomass density.

Year-round studies of the benthic amphipod Corophium salmonis at Desdemona Sands and Grays Bay showed this species to have a two generation per year life cycle. Population fluctuations due to migration were pronounced, and differed markedly between the two sites. The difference in migration patterns may have been caused by the greater salinity range of the Desdemona Sands area. Community production at both sites was dominated by C. salmonis.

A distributional survey was conducted in September 1981 utilizing a stratified-random design. Dominant species were brackishwater species common to other west coast estuaries and included Macoma balthica, Neanthes limnicola, Hobsonia florida, Corophium salmonis, Eogammarus confervicolus, and Pseudopolydora kempi. Only four or five communities could be characterized. Because of habitat instability in the form of strong currents, active sediments, and high tidal and seasonal variability in salinity, a few euryhaline species with opportunistic life history patterns appear to dominate biomass and production rates over the estuary.

Following the May 18, 1980, eruption of Mt. St. Helens, a survey of the benthic infauna in the upper estuary, where up to 11.5cm of volcanic ash was deposited, indicated that most taxa were able to inhabit the ash. However, except for the oligochaetes, animal densities were reduced in areas where volcanic ash lay atop the sediment surface as compared to areas where the ash layer had been buried beneath or mixed with sands and/or muds.

Principal investigator for this work unit was Robert L. Holton of Oregon State University. For further information see:

Holton, R.L.; Higley, D.L.; Brzezinski, M.A.; Jones, K.K.; Wilson, S.L. 1984. Benthic infauna of the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

E.1 DATA SET: Benthic Infauna Distribution

Count and weight data are provided for several surveys of the estuary. The studies represented include but are not limited to the four studies described above.

a. Variables

Infauna count
Infauna weight

b. Data Set Description

This data set resides in the computer archive. It consists of 3,750 records, each 132 bytes. The data are sorted first by date, then by station. The records are formatted as shown below. For Sample Series "AS1", ignore Sample Number since only one sample was collected at each station and Sample Number simply repeats part of Station code. To convert Count or Weight to a per square meter basis, extrapolate to a whole-sample basis using Percentage of sample counted and then multiply by the conversion factor indicated in the table of gear type codes.

Columns	Format	Contents
2-7	3I2	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude DDD MM SSW(est)
31-36	F6.1	Depth relative to MLLW (ft)
38-40	A3	Sample series
42-46	A5	Station code
48-50	I3	Sample number (for Sample series AC2, see Table E1)
52-53	I2	Gear type (Table E2)
55-58	I4	Organism code*
60-61	I2	Life history stage (Table E3)
63-68	I6	Count
70-75	F6.2	Percentage of sample counted
77-85	F9.4	Weight of organisms counted (g)

c. Sampling

This file combines data from several surveys conducted between 1 September 1975 and 11 September 1981. Each has its own temporal/spatial pattern. In all, 323 sites were visited.

d. Processing

Data were transcribed to keypunch forms and entered. Data were reformatted via a computer program and latitude, longitude, and date were inserted into the record.

e. Quality Control

Keypunch cards were validated by using templates. Computer printouts were checked against data entry sheets. Selected computer input and output records were checked.

f. Data Set Request Information: Tape 6 File 6*

g. Alternate Sources: None

*The organism code table is available as Tape 6 File 7.

E.2 DATA SET: Benthic Infauna Sediment

Sediment subsamples were collected with some infauna samples. Sediment texture and organic content (by ignition) were analyzed to describe environmental conditions and to allow investigation of physical/biological relations.

a. Variables

Sediment grain-size distribution
Sediment organic content

b. Data Set Description

This data set is one of the files in the computer archive. It contains 772 records, each 132 bytes long. The records are sorted by date, then station. All records are of the format shown below. Only 23 records have the complete size class analysis. All records show Percent less than 63 microns. The later records all show Percent organic content. For Sample Series "AS1", ignore Sample Number since only one sample was collected at each station and Sample Number simply repeats part of Station code.

Columns	Format	Contents
2-7	I6	Date: YYMMDD
9-18	3I3'N'	Latitude: DD MM SSN(orth)
20-29	3I3'W'	Longitude: DDD MM SSW(est)
31-36	F6.1	Depth relative to MLLW (ft)
38-40	A3	Sample series
42-46	A5	Station code
48-50	I3	Sample number
52-55	F4.1	Percent exceeding 1000 microns
57-60	F4.1	Percent exceeding 700 microns
62-65	F4.1	Percent exceeding 500 microns
67-70	F4.1	Percent exceeding 350 microns
72-75	F4.1	Percent exceeding 250 microns
77-80	F4.1	Percent exceeding 175 microns
82-85	F4.1	Percent exceeding 125 microns
87-90	F4.1	Percent exceeding 88 microns
92-95	F4.1	Percent exceeding 63 microns
97-100	F4.1	Percent exceeding 3.9 microns
102-105	F4.1	Percent less than 63 microns
107-110	F4.2	Median particle size (phi)
117-120	F4.1	Organic content (percent)

c. Sampling

This file combines data from several surveys conducted between September 1, 1975, and September 11, 1981. In all, 273 sites were visited.

d. Processing: Same as E.1.d

e. Quality Control: Same as E.1.e

f. Data Set Request Information: Tape 6 File 5

g. Alternate Sources: None

Table E1. Sample Number Codes for Sample Series AC2

Column	Code	Usage
48	1	First core removed from grab sampler
	2	Second core removed from grab sampler
49	1	Top sediment stratum (visual determination)
	2	Middle sediment stratum
	3	Bottom sediment stratum (if present)
50	1	Natural sediment
	2	Ash
	3	Mixed natural sediment and ash
	4	Marbled natural sediment and ash

Table E2. Gear Type Codes

Code	Usage	Conversion Factor
01	3.5 cm diameter hand corer	1039.4
02	4 inch diameter hand corer	123.3
03	6 inch diameter hand corer	54.8
04	8 inch diameter hand corer	30.8
05	7 inch diameter hand corer	40.3
06	3 inch diameter hand corer	219.3
07	2 inch diameter hand corer	493.4
08	6.6 cm diameter hand corer (Sub-sampled from Smith-McIntyre Grab Sampler)	292.3
09	6 inch diameter hand corer	54.8
10	8 inch diameter hand corer	40.3
11	3.5 cm diameter hand corer (Sub-sampled from Smith-McIntyre Grab Sampler)	1039.4
20	Smith-McIntyre Grab Sampler	10.0
21	Smith-McIntyre Grab Sampler	10.0
22	Ponar Grab Sampler	20.0
23	4 inch diameter hand corer (Sub-sampled from Smith-McIntyre Grab Sampler)	123.3

Table E3. Life History Stage Codes

Code	Usage
01	Unspecified
02	Eggs
03	Zoea
04	Pupae
05	Nymphs
06	Larvae
07	Juveniles
08	Adults
09	Megalops
10	Adults and juveniles
11	Cocoon
12	Polyp
13	Medusae

F. EPIBENTHIC ORGANISMS

The overall hypothesis of the Epibenthic Organisms work unit was that the structure and standing stock of epibenthic organisms in the Columbia River Estuary can be characterized by physical (sediment structure, depth), chemical (salinity), and biological (primary production, predators) characteristics in definable regions (habitats). Objectives included: (1) describe and map key and selected other epibenthic species or assemblages in terms of density, standing crop, and production over time; (2) quantify relationships among epibenthic organisms and physical and biological factors; (3) describe the population structure, dynamics, life history, and trophic relationships of Dungeness crab, crangonid shrimp, and mysids; and (4) define functional relationships of epibenthic organisms in the ecosystem, including predator-prey linkages, emigration and immigration, and role in the estuarine food web. Habitat-stratified sampling of epibenthic organisms occurred between March 1980 and July 1981 using four types of sampling gear. Some laboratory processing of stomach contents of selected key species was also performed.

Due to sorting errors, missing data, or the natural lack of organisms in a sample, several record types will appear as missing in the existing chronological sequence. If further search does not disclose the record out of sequence, please contact the work unit investigator for clarification.

Principal investigator for this work unit was:

Charles A. Simenstad
Fisheries Research Institute, WH-10
University of Washington
Seattle, WA 98195

For further information see:

Simenstad, C.A. 1984. Epibenthic organisms of the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

F.1 DATA SET: Epibenthic Organisms

Habitat-stratified sampling occurred between March 1980 and July 1981 using four types of sampling gear (epibenthic suction pump and sled, sinking beach seine, bottom trawl). Variables measured included species, life history stage, maturity, sex, carapace length, abundance, and biomass; corresponding data on tidal stage and elevation, depth, sediment grain size, temperature, salinity, and sampling time and volume described the sampling conditions.

a. Variables

Temperature
Salinity

Secchi depth
Epibenthic invertebrate count
Epibenthic invertebrate wet weight
Epibenthic macroinvertebrate length
Epibenthic macroinvertebrate stomach contents
Demersal fish length
Demersal fish round weight

b. Data Set Description

This data set is a member of the computer archive. It contains 26,790 records, each 80 bytes in length. The data structure is hierarchical and is a modification of NODC File Type 100. The data are sorted by date, station, sequence number, and record type in that order. There are six record types formatted as follows:

Record type 1 (station header):

Columns	Format	Contents
4-9	A6	Subset identifier (identified by date)
10	'1'	Record type
11-15	I5	Station number (see Simenstad 1984)
16-19	I4	Sequence number
23-28	3I2	Date: YYMMDD
29-32	2I2	Time: HHMM (local time)
33-39	3I2'N'	Latitude: DDMMSSN(orth)
40-47	I3,2I2'W'	Longitude: DDDMMSSW(est)
48-54	I7	CREDDP coordinates
55-57	F3.1*	Water surface temperature (°C)
58-60	F3.1*	Salinity (ppt)
65-67	F3.1*	Secchi depth (m)

Record type 2 (sample description):

Columns	Format	Contents
4-9	A6	Subset identifier
10	'2'	Record type
11-15	I5	Station number
16-19	I4	Sequence number
20	A1	Gear type (Table F1)
22	I1	Replicate number
23-28	3I2	Date: YYMMDD
29-32	2I2	Time: HHMM
33-35	A3	Habitat (Table F2)
36-37	I2	Gear size (Table F3)
38-41	F4.1*	Sample elevation (m)
42-44	F3*	Depth to bottom (m)
45-52	F8.3*	Area sampled (m^2)
53-61	F9.3*	Volume sampled (m^3)
62-64	F3*	Distance fished (m)
65-68	F4.2*	Sampling duration (h)

69	I1	Tide stage (Table F4)
70-72	F3.1*	Tide height (m)
77	A1	Compass heading, start (N,S,E,W)
78	I1	Light intensity (Table F5)
79	A1	Current direction (N,S,E,W)

Record type 3 (total macroinvertebrate catch):

Columns	Format	Contents
4-9	A6	Subset identifier
10	'3'	Record type
11-15	I5	Station number
16-19	I4	Sequence number
20	A1	Gear type (Table F1)
22	I1	Replicate number
23-32	I10	NODC taxonomic code
33	A1	Life history stage (Table F6)
36-40	I5	Macroinvertebrate count
41-47	F7.2*	Wet weight (g)

Record type 4 (individual macroinvertebrate and fish lengths and weights):

Columns	Format	Contents
4-9	A6	Subset identifier
10	'4'	Record type
11-15	I5	Station number
16-19	I4	Sequence number
20	A1	Gear type (Table F1)
22	I1	Replicate number
25-34	I10	NODC taxonomic code
35	A1	Life history stage (Table F6)
37	I1	Preservation method (Table F7)
38	A1	Length type (Table F8)
39-42	I4	Length (mm)
43-49	F7.2*	Wet weight (g)
50	I1	Sex code (Table F9)

Record type 5 (macroinvertebrate stomach contents):

Columns	Format	Contents
4-9	A6	Subset identifier
10	'5'	Record type
11-15	I5	Station number
16-19	I4	Sequence number
20	A1	Gear type (Table F1)
22	I1	Replicate number
23-24	I2	Specimen number
25-34	I10	Predator NODC taxonomic code
35	A1	Predator life history stage (Table F6)
36	I1	Fullness (Table F10)

37	I1	Digestion (Table F11)
38-43	F6.2*	Stomach contents weight (g)
44-53	I10	Prey NODC taxonomic code
54	A1	Prey life history stage (Table F6)
55-58	I4	Prey count
59-65	F7.3*	Prey wet weight (g)
66	I1	Weight method (Table F12)
67	A1	Prey parts (Table F13)
68-70	I3	Predator length (mm)
71	I1	Predator length type (Table F8)
72-76	F5.1*	Predator weight (g)
77-80	2I2	Collection time: HHMM

Record type 7 (epibenthic zooplankton composition):

Columns	Format	Contents
4-9	A6	Subset identifier
10	'7'	Record type
11-15	I5	Station number
16-19	2I2	Time: HHMM
20	A1	Gear type (Table F1)
22	I1	Replicate number
23-24	I2	Gear size (Table F3)
25-29	F5.2*	Sample volume (m^3)
30-32	F3.1*	Tide height (m)
33	I1	Tide stage (Table F4)
34-38	F5.2*	Subsample percent of sample
39	I1	Subsample number
40-42	I3	Sequence number
43-52	I10	NODC taxonomic code
53	A1	Life history stage (Table F6)
55-59	I5	Zooplankton count
60-64	F5.3	Wet weight (g)
65	I1	Weight method (Table F12)
66	I1	Tentative identification (Table F14) (used only rarely)
70-75	F6.3*	Fraction wet weight (g)

*The FORTRAN format specification indicates the location of an implied decimal point. Whenever an explicit decimal point appears, it overrides.

c. Sampling

Samples were collected monthly between March and August 1980 and quarterly between September 1980 and July 1981. Sixteen sites were sampled.

d. Processing

Data were organized in file structure (according to record type) upon storage (disk and/or tape) and run through data analysis programs which flagged erroneous (i.e., invalid

codes) or missing data; data were then corrected using text editor; once all record types had been corrected, all files were merged and sorted by collection.

e. Quality Control

Data were key-verified and corrected as described in F.1.d above.

f. Data Set Request Information: Tape 6 File 87

g. Alternate Sources: None

Table F1. Gear Type Codes

Code	Usage
B	Beach seine
C	Trawl net
E	Epibenthic pump
G	Epibenthic sled

Table F2. Habitat Codes

Habitat codes are 3-character combinations, the first indicating wave energy, the second, sediment size, and the third, surface organics.

Column 33. Wave Energy

Code	Usage
1	Low wave energy, low beach gradient (slope less than 15%)
2	Low wave energy, moderate beach gradient (slope between 15% and 30%)
3	Low wave energy, high beach gradient (slope greater than 30%)
4	Moderate wave energy, low beach gradient
5	Moderate wave energy, moderate beach gradient
6	Moderate wave energy, high beach gradient
7	High wave energy, low beach gradient
8	High wave energy, moderate beach gradient
9	High wave energy, high beach gradient

Column 34. Sediment Size

Code	Usage
0	Rock, continuous strata
1	Boulder (greater than 256mm)
2	Cobble (64mm to 256mm)
3	Gravel (4mm to 64mm)
4	Coarse sand (0.5mm to 4mm)

5	Medium sand (0.25mm to 0.5mm)
6	Fine sand (0.06mm to 0.25mm)
7	Silt (0.004mm to 0.06mm)
8	Clay (less than 0.004mm)
A	Mixture of boulders and cobbles
B	Mixture of cobbles and gravel
C	Mixture of gravel and sand
D	Mixture of sand and silt
E	Mixture of silt and clay
F	Artificial substrate - vertical piling

Column 35. Surface Organics

Code	Usage
1	Chiefly shell fragments
2	Detritus - accumulated wood, sticks, and undecayed coarse organics
3	Fibrous peat
4	Pulpy peat
5	Muck - completely decomposed organic materials
6	Eelgrass
7	Kelp
8	Periphyton
9	No organic materials evident
A	Fouling organisms

Table F3. Gear Size Codes

Code	Usage
Blank	No information
01	4.9m (16 ft.) trawl net with 3.8 to 0.6cm (1½ to ¼ in.) mesh
04	36.6m (120 ft.) beach seine with 0.6cm mesh bag (sinking net)
54	Plankton pump (CREDDP) equipped with 0.5mm, 0.253mm, and 0.13mm mesh nets; sampling area = $0.1m^2$, sampling volume = $0.025m^3$
55	FRI-CREDDP epibenthic sled, $0.25m^2$, equipped with two $0.12m^2$ (0.13mm) nets
57	FRI-CREDDP epibenthic sled, $0.25m^2$, equipped with one $0.25m^2$ (0.253mm) net
61	$0.1m^2$ epibenthic plankton pump with 0.13mm net fraction of 3 nets
62	$0.1m^2$ epibenthic plankton pump with 0.253mm net fraction of 3 nets
63	$0.1m^2$ epibenthic plankton pump with 0.5mm net fraction of 3 nets
64	$0.1m^2$ epibenthic plankton pump with 0.13mm net only, unnested

Table F4. Tide Stage Codes

Code	Usage
Blank	No information
1	Ebb
2	Ebb slack
3	Flood
4	Flood slack

Table F5. Light Intensity Codes

Code	Usage
1	Day, direct sun
2	Day, bright overcast
3	Day, moderate overcast
4	Day, dark overcast
5	Twilight - dusk, dawn
6	Night, full moon
7	Night, moonlit overcast
8	Night, half moon or less
9	Night, black

Table F6. Life History Stage Codes

Code	Usage
Blank	No information
0	Indeterminable
1	Egg
2	Nauplius
3	Zoea
4	Megalop
5	Veliger
6	Larva
7	Juvenile
8	Adult
9	Combination of 6, 7, and 8
A	Combination of 7 and 8
B	Combination of 6 and 7
C	Juvenile/adult - sexual maturity unknown
D	Polyp
E	Cypris
F	Copepodid
G	Pupa
H	Nymph
I	Postlarva
J	Protozoea
K	Medusa
L	Egg-carrying female
M	Egg case

P	Parts
Q	Immature
R	Subadult
S	Trochophore larvae
T	Subadults and juveniles
U	Mating pairs
V	Mysis
W	Colony
X	Cyphonautes larvae
Y	Glaucothoe
Z	Yolk sac larvae

Table F7. Preservation Method Codes

Code	Usage
Blank	No information
1	Live, or just dead
2	Dead, but fresh
3	Frozen, then thawed
4	Preserved in formalin

Table F8. Length Type Codes

Code	Usage
Blank	No information
1	Tip of snout to fork of tail
2	Mideye to fork of tail
3	Tip of snout to hypural plate
4	Mideye to hypural plate
5	Total length (extremity to extremity)
6	Snout to second dorsal (ratfish...)
7	Estimated total length, part of caudal missing
8	Aperture length
9	Radius
A	Regular diameter
B	Length of carapace (base of eyestalk to mid-dorsal point for shrimp)
C	Width of carapace (widest point excluding spines)
D	Metasome length

Table F9. Sex Codes

Code	Usage
Blank	No information
0	Indeterminable
1	Male
2	Female
3	Hermaphrodite

4	Transitional
5	Grouped, both sexes present

Table F10. Fullness Codes

Code	Usage
Blank	No information
1	Empty
2	Trace of prey organisms
3	25% full
4	50% full
5	75% full
6	100% full
7	Distended

Table F11. Digestion Codes

Code	Usage
Blank	No information
1	All contents unidentifiable
2	Similar to 1, but traces of prey organisms identifiable
3	Less than 50% identifiable
4	50 to 75% identifiable
5	75 to 100% identifiable
6	No digestion - all contents identifiable

Table F12. Weight Method Codes

Code	Usage
Blank	No information
5	Whole sample: exact weight and count
6	Whole sample: exact weight and estimated count
9	Hybrid value: organisms greater than 1 cm in length are counted and weighted from entire sample area. These values are combined with exact weight and count values (X sample factor) for smaller organisms within a subsample area, to obtain the total count and weight values.

Table F13. Prey Parts Codes

Code	Usage
Blank	No information
0	Whole organism
1	Parts (unidentifiable)
2	Siphons

3	Inorganic parts
4	Legs
5	Setae
6	Chelae
7	Zooecia
8	Scales
9	Bones
A	Head
B	Eye
C	Jaws
D	Tail
E	Seeds
F	Leaves
G	Wings
H	Exuviae
J	Salps

Table F14. Tentative Identification Codes

Code	Usage
1	Species level probable
2	Genus level probable
3	Family level probable
4	Entire species code indefinite
5	Species undescribed
6	Genus undescribed
7	Specimen damaged beyond recognition
8	See written remarks on data sheet
9	Specimen lost

G. FISH

Fish populations in the estuary were sampled with bottom trawls, purse seines, and beach seines for 18 consecutive months to determine their spatial and temporal distributions and relative abundances. There were 22 trawl sites, 16 purse seine sites, and 11 beach seine sites. Final products from the fish catch summary data include: a tabulated printout of numbers of fishes captured, total weights, densities (number/m^2), and standing crops (g/m^2) by month, site, and gear for all fish species; a series of distributional maps for 10 key species; determinations of species assemblages in different habitats of the estuary; and determinations of relationships between selected physical factors (i.e., salinity, depth, and temperature) and species assemblages. Eight of the ten key species were separated into age classes. The density and standing crop information must be used with much caution because of such variables as gear sampling efficiency, the use of different gear types, and total area sampled (an average area for each gear type was used in computing densities and standing crops).

The food habits of fishes from the Columbia River Estuary were analyzed for 12 months (February 1980 through January 1981). The food habits of selected nonsalmonid fishes were determined for February through October 1980. Salmonid food habits were determined for February 1980 through January 1981. Food habits were determined by stomach analysis. Prey items were identified to the lowest possible taxon, counted, and weighed.

Principal investigator for data collection and preparation of the data report on this work unit was Robert McConnell of the National Marine Fisheries Service. Principal investigators for the preparation of the interpretive report on this work unit were James A. Lichatowich and Daniel L. Bottom of the Oregon Department of Fish and Wildlife. For further information see:

McConnell, R.; Blahm, T.; McCabe, G. Jr.; Clocksin, T.; Coley, T.; Durkin, J.; Emmett, R.; Muir, W. 1983. Draft report: Salmonid and non-salmonid fish. Astoria, OR: Columbia River Estuary Data Development Program.

Bottom, D.; Jones, K.K.; Herring, M.L. 1984. Fishes of the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

G.1 DATA SET: Fish

Fish populations were sampled with bottom trawls, purse seines, and beach seines to determine their spatial and temporal distributions and relative abundances. Fish feeding habits were determined by stomach analysis. Physical data were recorded to determine relationships between species assemblages and these factors.

a. Variables

Salinity	Fish density
Temperature	Fish standing crop
Fish count	Fish length
Fish weight	Fish stomach contents

b. Data Set Description

This data set resides in the computer archive. The file structure is hierarchical, with three record types in each set. Record type 1 presents sampling and physical data, record type 2, catch information, and record type 3, stomach analyses. Each sample has several catch records. Many catch records are followed by stomach records. This file contains 20,165 records of length 80 bytes. The format of each record is as follows (note that each change in data element is followed by a column that is left blank):

Record type 1:

Columns	Format	Contents
1-4	I4	Data subset number
6	'1'	Record type
12-17	3I2	Date: YYMMDD
19-22	2I2	Time: HHMM
24	I1	Gear type (Table G1)
25-26	I2	Station code
29-35	3I2'N'	Latitude: DDMMSSN(orth)
37-44	I3,2I2'W'	Longitude: DDDMMSSW(est)
46-48	I3	Water depth (ft)
50	I1	Tide stage (Table G2)
52-55	F4.1	Surface salinity (ppt)
57-60	F4.1	Surface temperature (°C)
62-65	F4.1	Bottom salinity (ppt)
67-70	F4.1	Bottom temperature (°C)

Record type 2:

Columns	Format	Contents
1-4	I4	Data subset number
6	'2'	Record type
8-10	I3	Fish species number*
12	I1	Age class (Table G3)
14-23	I10	NODC taxonomic code*
25-28	I4	Fish count
30-35	I6	Fish weight (g)
37-43	F7.4	Fish density (number/m^2)
45-51	F7.4	Fish standing crop (g/m^2)

Record type 3:

Columns	Format	Contents
1-4	I4	Data subset number
6	'3'	Record type
8-10	I3	Predator species number*
12	I1	Predator age class (Table G3)
14-23	I10	Predator NODC taxonomic code*
27-28	I2	Predator specimen number
30-35	I6	Predator weight (g)
37-40	I4	Predator length (mm)
42-45	I4	Prey species number*
47-56	I10	Prey NODC taxomonic code*
58-62	I5	Prey count
64-70	F7.4	Prey weight (g)

c. Sampling

Samples were obtained monthly between February 4, 1980, and July 15, 1981, from 49 stations. There were 16 purse seine sites, 22 trawl sites, and 11 beach seine sites.

d. Processing

The collecting organization edited the input records manually and via a computer program. Identification and description of food habits were completed by the use of a FORTRAN computer program. The processing organization reformatted the records, merged three files into one, and added latitude, longitude, and NODC taxonomic codes.

e. Quality Control

The data file was checked against the data entry sheets. The additions of total catches and weights (by species and sampling effort) on the data entry sheets were doubled-checked for only the ten key species. Input and output records for the processing routines were spot-checked.

f. Data Set Request Information: Tape 6 File 83*

g. Alternate Sources

Contact: Theodore Blahm
Coastal Zone and Estuarine Studies Division
Northwest and Alaska Fisheries Center, NMFS
2725 Montlake Blvd. East
Seattle, WA 98112

*Fish species numbers, corresponding NODC taxonomic codes, and common names are available on Tape 6 File 84; prey species numbers, corresponding NODC taxomonic codes, and common names are available on Tape 6 File 85.

Table G1. Gear Type Codes

Code	Usage
1	8-meter trawl, 22 stations, 1-22
3	200-meter purse seine, 16 staions, 1-16
7	50-meter beach seine, 11 stations, 1-11

Table G2. Tide Stage Codes

Code	Usage
1	Low slack
2	Early flood
3	Flood
4	Late flood
5	High slack
6	Early ebb
7	Ebb
8	Late ebb

Table G3. Age Class Codes

Code	Usage
0	Subyearling
1	Yearling (or yearling and above)
2	Two-year-old (or two years and above)
4	Chinook salmon yearling
5	Chinook salmon subyearling
7	Jack salmon
8	Adult salmon
9	No age-class separation; all age classes are combined

H. AVIFAUNA

The purpose of the CREDDP avifauna work unit was to determine the role of birds within the Columbia River Estuary. Study objectives included (1) identification of key avian species and habitats important to them and (2) identification of key avian habitats and description of the avian composition (bird density, species diversity, number of species, evenness, and consuming biomass).

Methodologies for defining use of the estuary by key species included use of boat transects, point censuses, and incidental bird sightings (IBSs). Variable circular plots (VCPs) were used to define the avian composition of seven key habitats: open water, mudflat, marsh, tree-shrub, marsh-shrub, shrub, and forest.

Boat transects were used to census distribution and relative abundance of the key avian species. Seventy-two transects were established and checked twice seasonally. Data were portrayed as birds/km and identified the location, seasonal use, and density of birds, primarily in open-water habitat.

Point censuses defined the number of birds/km and seasonal use at six sites: Clatsop Spit, Trestle Bay, Youngs Bay, Cape Disappointment, Cliff Point, and Knappton.

Incidental bird sightings (IBSs) were used primarily for observations of bald eagles and great blue herons throughout the estuary. Data were shown by number of individuals observed.

Variable Circular Plots (VCPs) were designed to identify bird composition and use in various habitats. Data allow comparisons among habitats, seasonal use, and subareas within the estuary.

Principal investigators for this work unit were Charles R. Hazel and Jonathan H. Ives of Jones and Stokes Associates, Inc. For further information see:

Hazel, C.R.; Ives, J.H.; Miller, K.J.; Edwards, D.K.; Tinling, J.S.; Dorsey, G.L.; Green, M.; Crawford, J.A. 1984. Avifauna of the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

H.1 DATA SET: Avifauna Variable Circular Plot Census

Seventeen variable circular plot sites were established in various habitat types in the estuary. Avian communities were censused to determine bird density, species present, evenness, and consuming biomass.

a. Variables

Avifauna count
Avifauna activity

b. Data Set Description

This data set resides in the computer archive. The file structure is hierarchical, with each record being part of a set. The records are of three types (1, 2, and 7 as described below). Each set comprises one each of types 1 and 2 (which contain sampling and environmental information) followed by a varying number of type 7 records - one for each species sighted. This file contains 7,028 records each 80 bytes in length. The first 17 columns of all records are identical except for the record type and are formatted as follows:

Columns	Format	Contents
1-3	'041'	File type
4-6	I3	Julian day
7-9	I3	Sequence number
10	I1	Record type (1, 2, or 7)
11-12	A2	Area (Table H1)
13-14	A2	Habitat (Table H2)
15-16	A2	Station
17	'C'	Data set identifier: C = Circular

Record type 1 continues as follows:

18	A1	Segment (Table H3)
19-20	A2	Platform (Table H4)
37-43	3I2'N'	Latitude: DDMMSSN(orth)
44-51	I3,2I2'W'	Longitude: DDDMMSSW(est)

Record type 2 continues as follows:

18	I1	Wind direction (Table H5)
19	I1	Cloud amount (Table H6)
20	I1	Wind force (Table H7)
21-22	A2	Weather (Table H8)
23	A1	Tide height (Table H9)
24	A1	Tide stage (Table H10)
25-28	2I2	Start time: HHMM
31-32	I2	Elapsed time (minutes)
35-40	3I2	Date: YYMMDD
41-44	A4	Observer 1
45-48	A4	Observer 2
49	A1	Glare intensity 1 (Table H11)
50	A1	Glare area 1 (Table H12)
51	A1	Glare intensity 2 (Table H11)
52	A1	Glare area 2 (Table H12)
60-62	I3	Barometric pressure (mm Hg)
63	A1	Barometric trend (+, -, 0)
64-65	I2	Air temperature (°C)

Record type 7 continues as follows:

19-28	I10	NODC taxonomic code*

34-37	A4	Species code*
39	A1	Sex (Table H13)
40-41	A2	Activity (Table H14)
42	A1	Age (Table H15)
43-45	I3	Distance (m)
46	I1	Detection method (Table H16)
47-50	I4	Number sighted

c. Sampling

Surveys were made bimonthly at five stations in four habitats between May 5, 1980, and February 28, 1981.

d. Processing

Latitude, longitude, and NODC taxonomic code were inserted into the record via a computer program.

e. Quality Control

All entries were manually checked. Frequency analyses of various data codes were performed and compared with code tables. Data entry errors were identifed and corrected.

f. Data Set Request Information: Tape 6 File 73*

g. Alternate sources: None

*Species codes, NODC taxonomic codes, and common names are available on Tape 6 File 77.

H.2 DATA SET: Avifauna Boat Transects

Seventy-two line transects were conducted to census distribution and relative abundance of key avian species in the estuary. Observers recorded species, count, age, activity, and various environmental data.

a. Variables

Avifauna count
Avifauna age distribution
Avifauna sex distribution
Avifauna activity distribution

b. Data Set Description

This data set resides in the computer archive. The format is similar to H.1. Record types 1 and 2 are nearly identical, but with some differences as noted below. Bird activity is described on Record types 3 and 6 as follows: For each type 3 record there is a corresponding type 6 record; the species codes allow the records to be linked. Columns 1 through 17

are identical to H.1 for all records except for record type (column 10) and data set identifier (column 17, which is 'B' for boat). This file contains 8,015 records, 80 bytes each.

Record type 1 is identical to H.1 with the addition of:

Columns	Format	Contents
52-54	I3	Length (km)
55-57	I3	Area (km^2)
73	'4'	Zone

Record type 2 is identical to H.1 with the addition of:

53-59	I7	CREDDP coordinates

Record type 3 continues:

19-30	I12	NODC taxonomic code*
33-37	I5	Total number observed
39-42	I4	Number of unknown sex
43-46	I4	Number of males
47-50	I4	Number of females
51-54	I4	Number of unknown age
55-58	I4	Number of adults
59-62	I4	Number of immature birds
73-76	A4	Species code*

Record type 6 continues:

32-35	A4	Species code*
36-41	I6	Total number observed
42-45	I4	Number swimming
46-49	I4	Number flying
50-53	I4	Number walking
54-57	I4	Number perched
58-61	I4	Number loafing
62-65	I4	Number feeding

c. Sampling

Seventy-two transects were made twice seasonally between March 6, 1980, and February 18, 1981.

d. Processing

NODC taxonomic codes were added by a computer program.

e. Quality Control: Same as H.1.e

f. Data Set Request Information: Tape 6 File 74*

g. Alternate Sources: None

*Species codes, NODC taxonomic codes, and common names are available on Tape 6 File 77.

H.3 DATA SET: Avifauna Point Census

Point censuses were conducted to collect information on the distribution and relative abundance of key avian species. Observers recorded species, count, age, activity, and various environmental data. The results indicated the frequency of use of various habitats.

a. Variables: Same as H.2.a

b. Data Set Description

This file resides in the computer archive with a format identical to H.2 except that the data set identifier is 'P' for point census. The file contains 886 records, each 80 bytes in length.

c. Sampling

Observations were made in 6 habitat types on a monthly basis from March 5, 1980, to February 19, 1981.

d. Processing: Same as H.2.d

e. Quality Control: Same as H.2.e

f. Data Set Request Information: Tape 6 File 75*

g. Alternate sources: None

*Species codes, NODC taxonomic codes, and common names are available on Tape 6 File 77.

H.4 DATA SET: Incidental Bird Sightings

Incidental bird sightings were recorded to monitor the use of the estuary primarily by bald eagles and great blue herons since these species were inadequately represented in boat transects and point censuses. The data are portrayed as numbers of individuals with activity, habitat, and other descriptors. The results show the distribution of species in various habitats.

a. Variables: Same as H.1.a

b. Data Set Description

This file contains 796 80-byte records and resides in the computer archive. All records are formatted as follows:

Columns	Format	Contents
1-3	'IBS'	Data set identifier
4-6	I3	Julian day
7-9	I3	Sequence number
10	'1'	Record type
11-16	3I2	Date: YYMMDD
17-20	2I2	Time: HHMM
22-28	3I2'N'	Latitude: DDMMSSN(orth)
29-36	I3,2I2'W'	Longitude: DDDMMSSW(est)
38-41	A4	Species code*
43-54	I12	NODC taxonomic code*
58	A1	Age (Table H15)
59	A1	Sex (Table H13)
60-63	I4	Number sighted
64-65	A2	Activity (Table H14)
66	A1	IBS habitat (Table H17)
67-68	A2	Weather (Table H8)
69-72	A4	Work unit of observer
73-76	A4	Observer

c. Sampling

Sampling took place sporadically between March 5, 1980, and March 3, 1981.

d. Processing: Same as H.2.d

e. Quality Control: Same as H.1.e

f. Data Set Request Information: Tape 6 File 76*

g. Alternate Sources: None

*Species codes, NODC taxonomic codes, and common names are available on Tape 6 File 77.

Table H1. Area Codes

Code	Usage
UE	Upper Estuary
LE	Lower Estuary
CS	Clatsop Spit
TB	Trestle Bay
YB	Youngs Bay
CD	Cape Disappointment
MP	Megler Point
KP	Knappton Point
HP	Harrington Point
BB	Baker Bay
IA	Island Area
GB	Grays Bay

Table H2. Habitat Codes

Code	Usage
MF	Mudflat
MA	Marsh
MS	Marsh-shrub
SS	Shrub (scrub-shrub)
TS	Tree-shrub
FO	Forest
OW	Open water

Table H3. Segment Codes

Code	Usage
C	Both sides of boat
J	Water surface (point census)
M	360° (C-plot)

Table H4. Platform Codes

Code	Usage
Blank	No information
JB	Jet boat
MO	16-foot monarch
VH	V-hull
OF	On foot
MM	Marine mammal 22-foot glasply

Table H5. Wind Direction Codes

Code	Usage
Blank	No information
0	Stationary, not applicable
1	N 337.5° - 22.5°
2	NE 22.5° - 67.5°
3	E 67.5° - 112.5°
4	SE 112.5° - 157.5°
5	S 157.5° - 202.5°
6	SW 202.5° - 247.5°
7	W 247.5° - 292.5°
8	NW 292.5° - 337.5°

Table H6. Cloud Amount Codes

Code	Usage
Blank	No information
0	0
1	1 okta (12.5%) or less, but not zero
2	2 oktas (25%)
3	3 oktas (37.5%)
4	4 oktas (50%)
5	5 oktas (62.5%)
6	6 oktas (75%)
7	7 oktas (87.5%) or more, but not 8 oktas
8	8 oktas (100%)
9	Sky obscured, or cloud amount cannot be estimated

Table H7. Wind Force Codes

This is an adaptation of the Beaufort scale, which has descriptors for estimating wind speed based on observed effects. Only mile-per-hour equivalents are listed here.

Code	Usage
0	Under 1 mph
1	1-3 mph
2	4-7 mph
3	8-12 mph
4	13-31 mph
5	32-46 mph
6	Over 46 mph

Table H8. Weather Codes

Code	Usage
Blank	No information
A1	Clear and calm
A2	Clear with light breeze
A3	Clear with moderate winds
A4	Clear with strong winds
A5	Clear with gale winds
A6	Partly cloudy and calm
A7	Partly cloudy with light breeze
A8	Partly cloudy with moderate winds
A9	Partly cloudy with strong winds
B0	Partly cloudy with gale winds
B1	Cloudy and calm
B2	Cloudy with light breeze
B3	Cloudy with moderate winds
B4	Cloudy with strong winds
B5	Cloudy with gale winds

B6	Light fog
B7	Dense fog
B8	Light drizzle
B9	Light drizzle with light breeze
C0	Light drizzle with moderate breeze
C1	Light drizzle with strong winds
C2	Light drizzle with gale winds
C3	Moderate rain
C4	Moderate rain with light breeze
C5	Moderate rain with moderate breeze
12	Shallow fog
41	Patchy fog
42	Thin fog
50	Intermittent slight drizzle
51	Continuous slight drizzle
63	Continuous moderate rain
81	Moderate to heavy showers

Table H9. Tide Height Codes

Code	Usage
Blank	No information
1	High
2	3/4
3	1/2
4	1/4
5	Low

Table H10. Tide Stage Codes

Code	Usage
Blank	No information
1	Ebb
2	Ebb slack
3	Flood
4	Flood slack

Table H11. Glare Intensity Codes

Code	Usage
Blank	No information/not applicable
0	Slight sun glare
1	Moderate sun glare
2	Intense sun glare
3	Slight cloud glare
4	Moderate cloud glare
9	No glare

Table H12. Glare Area Codes

Code	Usage
0	0 (None)
1	1-10%
2	10-25%
3	25-50%
4	50-75%
5	75-100%

Table H13. Sex Codes

Code	Usage
Blank	No information
0	Indeterminable
1	Male
2	Female
5	Grouped, both sexes present

Table H14. Activity Codes

Code	Usage
A2	Sitting/standing on land/ice
A6	Flying followed by landing on land/ice
A7	Flying followed by landing on water
01	Sitting on surface
10	Sitting on floating object
11	Sitting on floating object, flying off in response to observer
15	Sitting on ground
17	Walking
20	Flying (height and type not noted)
22	Flying, 0-3m above wave/swell crests (type of flight not noted)
23	Flying, 3-10m above crests (type of flight not noted)
24	Flying, 10-50m above crests (type of flight not noted)
28	Flying, gliding/soaring (ht. not noted)
30	Flying and calling
32	Flying, following ship
33	Flying, being pursued
34	Flying, being pirated
35	Flying in a milling or circling pattern
36	Flying, meandering (foraging)
37	Chasing
38	Took off
39	Landed
60	Feeding at surface
69	Feeding on ground

71	Feeding below surface, diving from air (plunge-dive), shallow (less than one body length)
73	Feeding below surface, diving from surface (pursuit diving)
83	Feeding above surface, pursuit
84	Flitting through vegetation
85	Hunting
86	Soaring
87	Aerial feeding
88	Local flying
89	Feeding
90	Courtship displays
92	Preening
93	Standing and sleeping
94	Copulating
95	Suspected nesting
96	Roosting
97	Swimming
99	Other
B1	Singing
B2	Calling
B3	Perched in vegetation
B4	Gleaning in canopy
B5	Resting on stationary object in water or out (stump, log, channel marker, buoy, piling, etc.)
B6	Vocalizing (calling or singing not distinguished)
B7	Being harassed by small birds (refers to raptors, crows)
B8	Hammering (refers to woodpeckers)
B9	Wind drying (cormorants)
C1	Loafing/resting
C2	Escaping observer

Table H15. Age Codes

Code	Usage
Blank	No information
0	Indeterminable
2	Hatching Year (HY), hatching date to December 31st
3	Immature
C	Gawky-downy; down color and patterns faded; neck and tail prominent; body long and oval
D	First feathers show on side
Q	Adult
S	Mixed ages

Table H16. Detection Method Codes

Code	Usage
1	Seen
2	Heard

3	Both

Table H17. IBS Habitat Codes

Code	Usage
Blank	No information
1	Deep open water
2	Shallow open water
3	Intertidal mudflat
4	Intertidal marsh
5	Intertidal shrub/marsh
6	Intertidal shrub
7	Intertidal shrub/forest
8	Intertidal rocky shore
9	Intertidal beach/bar
A	Intertidal forested
B	Residential
C	Commercial/industrial
D	Agricultural
E	Upland coniferous forest
F	Upland broadleaf forest
G	Upland mixed forest
H	Upland grass
J	Freshwater marsh
K	Pilings
M	Slough/tidal channel
N	Roadside ditch
O	Dredge deposition (sand)
P	Log raft
Q	Upland pasture with trees
R	Boat basin
S	Flooded pasture with trees
T	Marsh water edge
U	Upland grass/shrub
V	Marsh mudflat
W	Water edge
X	Clear-cut
Y	Jetty/dike

I. WILDLIFE

Ten key mammal species in or adjacent to the Columbia River Estuary were studied for CREDDP by investigators from the Washington Department of Game. The 5,700 hectare area, divided into low marsh, high marsh, and swamp habitats, was studied to determine mammal occurrence, density, distribution, food/prey consumption rate, factors limiting the use of the habitats by the key species, and reproductive cycles.

Principal investigator for this work unit was Jack C. Howerton of the Washington Department of Game. For further information see:

Dunn, J.; Hockman, G.; Howerton, J.; Tabor, J. 1984. Key mammals of the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

I.1 DATA SET: Wildlife

The field observations were never worked up into an organized data set, nor were they digitized or statistically processed. Observations were recorded on field log sheets for ten key species, namely muskrat, nutria, beaver, river otter, raccoon, black-tailed deer, Columbian white-tailed deer, deer mouse, Townsend's vole, and vagrant shrew.

a. Variables

Denning habits	Population index
Resting habits	Trapping (historical review)
Food items	Female reproductive data
Food habit analyses	Growth/age data
Scat analyses	Stomach analyses (beaver/winter)
Feeding activity (transects)	Stomach analyses (nutria)
Habitat (vegetation) data	Stomach analyses (muskrat)
Mobility/distribution (radio telemetry data)	

b. Data Set Description

The recorded, analog data are in the library archive of the Columbia River Estuary Study Taskforce (CREST) as an informal collection of the original field data log sheets. The 8½ by 11 inch log sheets are contained in 24 manila folders occupying a space approximately 8 inches deep.

c. Sampling

Foot and boat transect searches for feeding areas were conducted in 11 different intertidal habitats. Small mammal trapping transects were established in five different habitat types. Nutria, muskrat, and raccoons were monitored by radio telemetry. Field sampling took place from April 1980 to June 1981.

d. Processing: None

e. Quality Control: None

f. Data Set Request Information

Contact: Director, CREST
P.O. Box 175
Astoria, OR 97103

g. Alternate Sources: None

J. MARINE MAMMALS

A National Marine Fisheries Service (NMFS) research contract was awarded to the Washington Department of Game (WDG) in March 1980 for the study of marine mammals and their relationship to fisheries of the Columbia River and adjacent coastal areas. The total study area for this research extended from Cape Lookout, Oregon, to Grays Harbor, Washington. Continued funding for this research was provided by NMFS and the U.S. Marine Mammal Commission in 1981 and 1982.

During the same period, the WDG received additional funding from CREDDP to conduct marine mammal research in the Columbia River to determine seasonal patterns of occurrence, distribution, and feeding habits. The overall research program took a multidisciplinary approach, documenting marine mammal species composition, distributions, abundance, population dynamics, feeding habits, and relationship of marine mammals to the various fisheries (sport and commercial) of the region.

The objectives of CREDDP-related research tasks in the Columbia River were to:

1) describe and map marine mammal species occurrence, distribution, and standing crop, and

2) describe the frequency of occurrence of the various prey species for harbor seals and identify those prey species which are most important to man and seals.

Principal investigator for this work unit was Steven J. Jeffries of the Washington Department of Game. For further information see:

Jeffries, S.J.; Treacy, S.D.; Geiger, A.C. 1984. Marine mammals of the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

J.1 DATA SET: Marine Mammal Aerial Survey

Aerial surveys were made of regional haulout locations in and around the mouth of the Columbia River. Flights were timed to coincide with the low tide cycle when maximum numbers of animals would be hauled out. Visual estimates of numbers of animals were logged and photographs taken for corroboration.

a. Variables

Marine mammal count

b. Data Set Description

This data set comprises 200 flight logs containing 2000 observations. A sample flight log data sheet is shown as Figure J1.

c. Sampling

Flights were made bi-monthly from April 8, 1980, to September 21, 1982.

d. Processing: None

e. Quality Control

In-flight estimates were checked against photographs.

f. Data Set Request Information

Contact: Director, CREST
P.O. Box 175
Astoria, OR 97103

g. Alternate Sources

Contact: Steven J. Jeffries
Washington Department of Game
Marine Station (Mail Stop EX-12)
Olympia, WA 98504

J.2 DATA SET: Marine Mammal Strandings

Information on marine mammal morphometry and causes of death was compiled by examining stranded animals.

a. Variables

Marine mammal morphometry

b. Data Set Description

This data set comprises 195 field recording forms containing measurements and descriptions of the stranded animals. A sample recording form is shown as Figure J2.

c. Sampling

Recordings were made between March 4, 1980, and May 19, 1983.

d. Processing: None

e. Quality Control: Collegial review

f. Data Set Request Information: Same as J.1.f

g. Alternate Sources: Same as J.1.g

J.3. DATA SET: Marine Mammal Feeding

Marine mammal feeding habits information was obtained by analyzing scats and the gastrointestinal tracts of dead animals. Identifications of prey were made to species, genus, or family in most cases. The otoliths of bony fish prey were identified by the late Mr. John Fitch, formerly with the California Department of Fish and Game.

a. Variables

Marine mammal prey species

b. Data Set Description

This data set is a 15-page compilation of the data resulting from the marine mammal feeding habits study. Species, date, collection site, and prey species identified are presented for each of the 441 scat samples and 95 gastrointestinal tracts examined.

c. Sampling

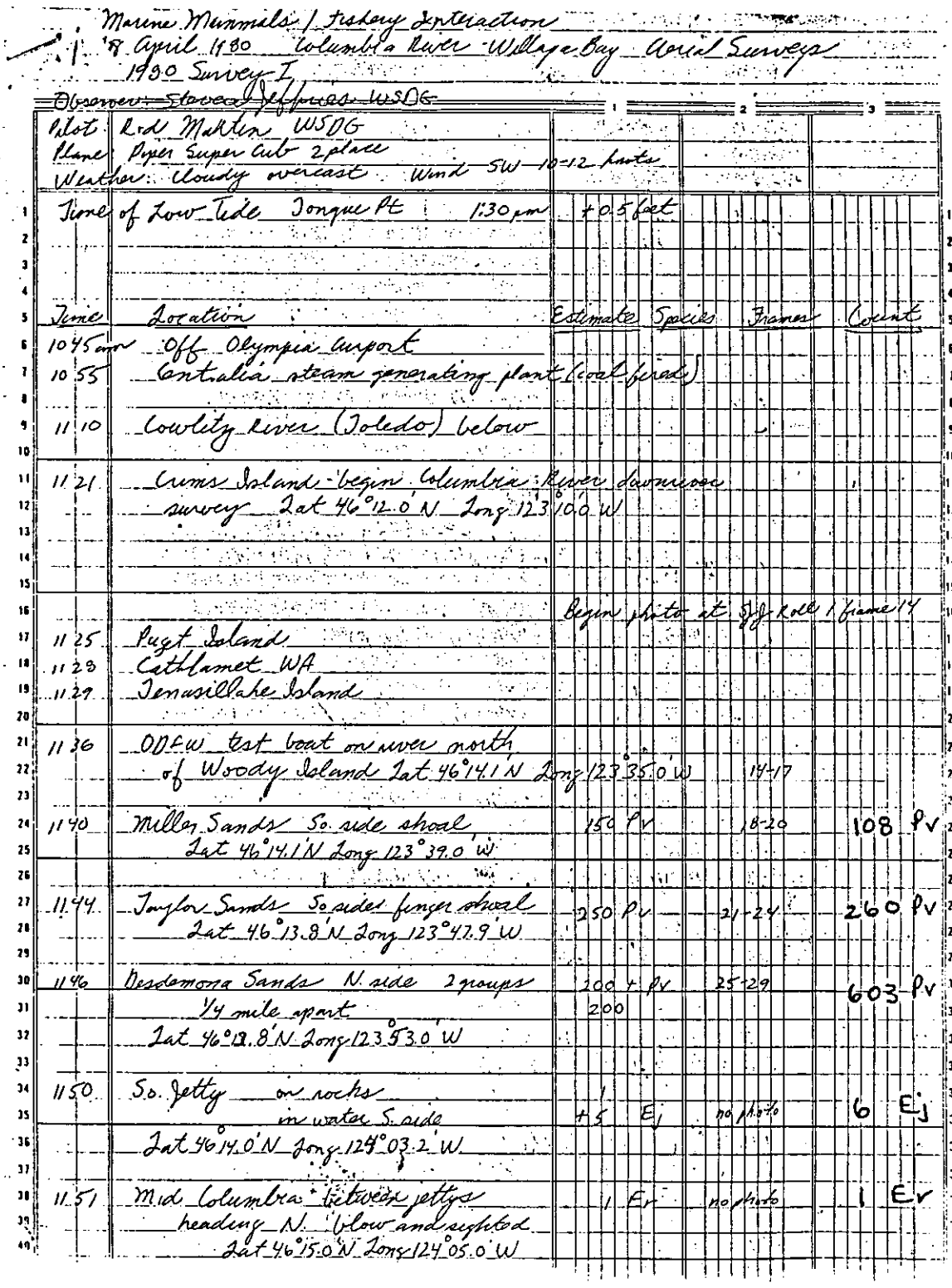
Observations were made sporadically between April 3, 1980, and May 20, 1982.

d. Processing: None

e. Quality Control: None

f. Data Set Request Information: Same as J.1.f

g. Alternate Sources: Same as J.1.g



Marine Mammals / fishery interaction
8 April 1980 Columbia River - Willapa Bay Aerial Surveys
1980 Survey I
Observer: ~~Steve Jeffries WSDG~~

		1	2	3
Pilot: Rod Matkin WSDG				
Plane: Piper Super Cub 2 place				
Weather: Cloudy overcast Wind SW 10-12 knots				
Time of Low Tide Tongue Pt 1:30 pm		+0.5 feet		
Time	Location	Estimate	Species	Frames	Count
1045 am	Off Olympia Airport				
10 55	Centralia steam generating plant (coal fired)				
11 10	Cowlitz River (Toledo) below				
11 21	Cums Island - begin Columbia River downriver survey 2at 46°12.0'N Long 123°10.0'W				1
		Begin photo at SJJ roll 1 frame 14			
11 25	Puget Island				
11 28	Cathlamet WA				
11 29	Tenasillahe Island				
11 36	ODFW test boat on river north of Woody Island 2at 46°14.1'N 2ong 123°35.0'W			14-17	
1140	Miller Sands So. side shoal 2at 46°14.1'N Long 123°39.0'W	150	Pv	18-20	108 Pv
11 44	Taylor Sands So. side finger shoal 2at 46°13.8'N 2ong 123°42.9'W	250	Pv	21-24	260 Pv
1146	Desdemona Sands N. side 2 groups ¼ mile apart	200 +	Pv	25-29	603 Pv
	2at 46°12.8'N 2ong 123°53.0'W	200			
1150	So. Jetty on rocks in water S. side	+5	Ej	no photo	6 Ej
	2at 46°14.0'N 2ong 124°03.2'W				
11 51	Mid Columbia between jetties heading N. below and sighted 2at 46°15.0'N 2ong 124°05.0'W	1	Ev	no photo	1 Ev

Figure J1. Sample flight log data sheet from Data Set J.1.

PINNIPED LIFE HISTORY FORM

Specimen # 35 Collected by Treacy / Geiger Species Callorhinus ursinus
Sex male Time 1030 Date 7/7/80 Location 1 mi So. Sunset Approach
Position (Lat./Long.) 46° 04' N 123° 56' W Method of Collection Stranding
Roll # ACG #12 Frames #'s 1-3 ext. dorsal, 4-6 ventral showing hole wound
7- genitalia 8- whole ventral

External Exam (Scars, Parasite, Pelage) dead more than 1 week. Barnacles on fur. Eyes missing. Small hole under left foreflipper. Vibrasse dark color with light tips.

Measurements				
1. (L) 118	2. (SL) 132	3. (TL) 4	4. (G) 93	
5. (AG) 93	6. (NA) 28.5	7. (PA) 16	8. (FFL) 33	9. (FFW) 12
10. (HFL) 37	11. (HFW) 15	Blubber th. 0.9 cm	Wt. est. 80 lb.	

Tissue/Histopath				
Blubber ___/___	Muscle ___/___	Heart ___/___	Brain ___/___	
Lung ___/___	Liver ___/___	Stomach ___/X	Spleen ___/___	Skull X/___
Pancreas ___/___	Kidney ___/___	Adrenal ___/___	Lymph Node ___/___	

Reproductive Tract			
U G Tract ___	Testis ___	Bacula X	
Fetus/Embryo ___	Lactation ___		

Comments, Notes, Drawings ribs intact & unbroken on left side. Collected skull, baculum, stomach contents. Condition of preservation fair. Buried remains.

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Figure J2. Sample recording form from Data Set J.2.

K. SEDIMENTATION AND SHOALING

A seasonal bottom sampling scheme was established to measure areal and seasonal variations in grain size parameters. A large baseline study was conducted in September 1979, with more than 1,800 samples collected. Seasonal samples were collected in February, June, and September 1980. All of the analyzed samples from September, February, and June are contained in the raw data and statistics files. Samples from previous cruises in and near the estuary (funded by the U.S. Corps of Engineers) are included in these files. All samples not destroyed during analysis are archived at the School of Oceanography, University of Washington.

Side-scan sonar records and accompanying depth recorder and navigation data were collected during four cruises (September 1979; February, June, and October 1980) and several visits during July and August 1982. Cruises were scheduled to study temporal variations in bottom topography and bedform distribution on a diurnal tidal scale. Intensive studies were conducted in the north channel in order to investigate changes caused by experimental dredge disposal at Site D.

One hundred sixty (160) vertical turbidity profiles were collected in time-series at channel stations during October 1980 in order to investigate the behavior of suspended sediment in the estuary and changes in the suspended sediment field over the daily and bi-monthly tidal cycle.

Principal investigators for this work unit were Joe S. Creager and Christopher Sherwood of the University of Washington. For further information see:

Sherwood, C.R.; Creager, J.S.; Roy, E.H.; Gelfenbaum, G.; Dempsey, T. 1984. Sedimentary processes and environments in the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

K.1 DATA SET: Sediment Grain Size

Bottom grab samples were taken during transects of the estuary. Samples were stored in plastic bags under refrigeration. Grain-size analysis was performed using standard seive and pipette techniques at ¼-phi intervals in the sand range, ½-phi intervals in the silt range, and 1-phi intervals in the clay range. The data were analyzed to characterize areal and seasonal variations in grain size.

a. Variables

Sediment weight by phi-size

b. Data Set Description

This data set comprises 31 files in the computer archive.

These files contain 13,000 records of 80 bytes. Each file contains two record types. Record type 1 contains information on date, position, depth of collection, cruise, station, and sampler type. Each record of type 1 is followed by a variable number of records of type 2 containing the weight distribution. These record types are formatted as follows:

Record type 1:

Columns	Format	Contents
1-6	3I2	Date: MMDDYY
7-12	F2,F4.2*	Latitude: DDMM.MM
13-19	F3,F4.2*	Longitude: DDDMM.MM
20-24	F5.2*	Depth (ft)
25-56	32X	Blank
57	I1	Decimal point code (Table K1)
60-61	I2	Number of phi classes on subsequent type 2 records
63	I1	Record sequence number within sample
64-65	A2	Sampler type (Table K2)
66-68	A3	Sample number
69-71	A3	Extra identification
72-76	A5	Cruise code
77-79	I3	Station number
80	'1'	Record type

*The FORTRAN format specification indicates the location of an implied decimal point. Whenever an explicit decimal point appears, it overrides.

Record type 2:

Columns	Format	Contents
1-4	F4.2	Phi size
5-10	F6.3/4*	Weight at preceding phi (g)
11-14	F4.2	Phi size
15-20	F6.3/4*	Weight at preceding phi (g)
21-24	F4.2	Phi size
25-30	F6.3/4*	Weight at preceding phi (g)
31-34	F4.2	Phi size
35-40	F6.3/4*	Weight at preceding phi (g)
41-44	F4.2	Phi size
45-50	F6.3/4*	Weight at preceding phi (g)
51-54	F4.2	Phi size
55-60	F6.3/4*	Weight at preceding phi (g)
63	I1	Record sequence number within sample
64-65	A2	Sampler type (Table K2)
66-68	A3	Sample number
69-71	A3	Extra identification
72-76	A5	Cruise code
77-79	I3	Station number
80	'2'	Record type

*Format depends on code in column 57 of Record type 1 (see Table K1).

c. Sampling

Samples were obtained during transects of the estuary with grab-sampling devices (Shipek or Van Veen). Table K3 contains sampling information for each cruise. Maps depicting sample locations are included as Appendix B of Sherwood et al. (1984).

d. Processing: None

e. Quality Control

Data were key-verified during entry. Where subsequent plotting and statistical analysis indicated faulty data, corrections were made.

f. Data Set Request Information: Tape 6 Files 42-72 (see Table K3)

g. Alternate Sources

Contact: Curator of Geological Archives
School of Oceanography, WB-10
University of Washington
Seattle, WA 98195

K.2 DATA SET: Sediment Grain-Size Statistics

A variety of standard statistics calculated from the data in the preceding data set are presented for each of the preceding sediment grain-size data files.

a. Variables

Sediment composition
Shepard class
Phi-size classes
Trask statistics
Inman statistics
Folk and Ward statistics
First through fourth moments

b. Data Set Description

Each of the 31 files presents statistics for the corresponding raw grain-size data described in K.1. These files contain 15,000 records of 80 bytes. Each file starts with three header records naming the input raw data file, the output statistics file, and comments. Thereafter, the records are grouped 5 to a sample and formatted as follows:

Record type 1:

Columns	Format	Contents
1-5	A5	Cruise code
6-8	I3	Station number
9-14	A6	Subsample identifier
15-20	3I2	Date: MMDDYY
25-30	F2,F4.2*	Latitude: DDMM.MM
33-39	F3,F4.2*	Longitude: DDDMM.MM
42-46	F5.1	Depth
47-48	'FT'	Depth units
49-50	A2	Sampler type (Table K2)
51-72	22X	Blank
73	A1	Code for plotter label placement
74-78	I5	Ordinal number of sample
80	'1'	Record type

*The FORTRAN format specification indicates the location of an implied decimal point. Whenever an explicit decimal point appears, it overrides.

Record type 2:

Columns	Format	Contents
1-6	F6.2	Percent gravel
7-12	F6.2	Percent sand
13-18	F6.2	Percent silt
19-24	F6.2	Percent clay
25	A1	Silt/clay code. S indicates that clay (greater than 8 phi) is present and that an alternate averaging technique is being used.
26-31	F6.2	Sand/silt-plus-clay ratio
33-34	I2	Shepard class (Figure K1)
35-39	F5.2	Mode (phi class with most individuals)
40-73	34X	Blank
74-78	I5	Ordinal number of sample
80	'2'	Record type

Record type 3:

Columns	Format	Contents
1-5	F5.2	Phi-size at 1st percentile
6-7	A2	Interpolation code (Table K4)
8-12	F5.2	Phi-size at 5th percentile
13-14	A2	Interpolation code (Table K4)
		Pattern repeats at 16th, 25th, 35th, 50th, 65th, 75th, and 84th percentile.
64-68	F5.2	Phi-size at 99th percentile

69-70	A2	Interpolation code (Table K4)
73-78	I5	Ordinal number of sample
80	'3'	Record type

Record type 4:

Columns	Format	Contents
1-6	F6.3	Trask median
7-12	F6.3	Trask mean
13-18	F6.3	Trask deviation
19-24	F6.3	Trask sorting coefficient
25-30	F6.3	Common logarithm of Trask sorting coefficient
31-36	F6.3	Trask graphic skewness
37-42	F6.2	Inman median
43-48	F6.2	Inman mean
49-54	F6.2	Inman deviation
55-60	F6.2	Inman skewness
61-66	F6.2	Inman second skewness
67-72	F6.2	Inman kurtosis
74-78	I5	Ordinal number of sample
80	'4'	Record type

Record type 5:

Columns	Format	Contents
1-5	F5.2	Folk and Ward mean
6-10	F5.2	Folk and Ward deviation
13	I1	Folk and Ward deviation type (Table K5)
14-18	F5.2	Folk and Ward skewness
21	I1	Folk and Ward skewness type (Table K5)
22-26	F5.2	Folk and Ward kurtosis
29	I1	Folk and Ward kurtosis type (Table K5)
30-34	F5.2	First moment (mean)
35-39	F5.2	Second moment (standard deviation)
40-44	F5.2	Third moment (skewness)
45-49	F5.2	Fourth moment (kurtosis)
50-73	24X	Blank
74-78	I5	Ordinal number of sample
80	'5'	Record type

c. Sampling: Same as K.1.c

d. Processing

Statistics were computed via the FRACT and SEDAN programs of the University of Washington School of Oceanography.

e. Quality Control

The University of Washington FRACT and SEDAN programs are very well tested with superior error diagnostics. Internal

consistency is required. Use of the programs often serves to identify errors in input data sets that had been previously cleared.

f. Data Set Request Information: Tape 6 Files 11-41 (see Table K3)

g. Alternate Sources: Same as K.1.g

K.3 DATA SET: Bottom Sonar Scans

Side-scan sonar records and accompanying depth recorder and navigational data were collected to study temporal variations in bottom topography and bedform configuration on both diurnal and seasonal scales.

a. Variables

Acoustic reflectivity of estuary bottom and water column, especially subject to bedform topography and bottom sediment texture

b. Data Set Description

This data set comprises more than 100 rolls (each 24 inches by 100 yards) of graphic-recorder paper. Navigation records and graphic depth-recorder traces are also available. Samples are shown as Figure K2.

c. Sampling

Recordings were made in September 1979; February, June, and October 1980; and June, July, and August 1982.

d. Processing

None. Later data reduction involved scale correction and interpretive mapping of bottom features.

e. Quality Control

Navigation was by Miniranger (towfish not navigated); record quality is subjective.

f. Data Set Request Information

Because these rolls are difficult to reproduce, copies will not be provided. However, the rolls may be used at the University of Washington Geological Archives, where they are stored. Contact Joe S. Creager or the Curator of Geological Archives at the address listed at K.1.g.

g. Alternate Sources: None

K.4 DATA SET: Nephelometry

Vertical nephelometry profiles were taken throughout a tidal cycle at several locations along with measurements of salinity. Variations were observed on a semi-diurnal time scale during a low river-discharge condition. Suspended sediment samples were subjected to size analysis with a Coulter counter and organic content was determined with hydrogen peroxide.

a. Variables

Nephelometry
Salinity
Suspended sediment concentration
Suspended sediment size-distribution

b. Data Set Description

The raw data include 551 x-y plots (voltage vs. voltage) from the CTD-profiling nephelometer array, and water samples with suspended sediment collected using a P-61 integrating sampler. Some data have been digitized and processed and are available (see Data Set Request Information below) on tape or as depth/concentration/time plots.

c. Sampling

The data were taken between October 16 and 29, 1980, at 26 sites within the estuary. Point samples of suspended sediment were taken with a standard sampling device for calibration.

d. Processing

The x-y recorder plots are unprocessed and expressed as voltages. Selected data were digitized, depth-normalized, and depth-averaged in the lower, middle, and upper segments of the water column.

e. Quality Control

Data quality was monitored during collection. Lab procedures were based on standard techniques and verified with replicate samples. Computer programs were verified before and during use.

f. Data Set Request Information

The reproducible data are available at the cost of reproduction from either Guy Gelfenbaum or the Curator of Geological Archives, at the address listed at K.1.g.

g. Alternate sources: None

Table K1. Decimal Point Codes

Code	Usage
0	Fraction weights are read F6.3
1	Fraction weights are read F6.4 (most common usage)

In both cases the decimal point is implied.

Table K2. Sampler Type Codes

Code	Usage
GR	Grab
VV	Van Veen grab
SH	Shipek grab
Blank	Van Veen or Shipek (undifferentiated)

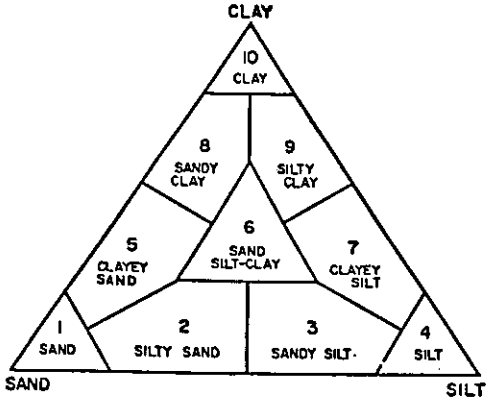


Figure K1. Shepard Class Codes

Table K3. Summary of Sampling Activity for the Data Sets of the CREDDP Sedimentation and Shoaling Work Unit

File # (Tape 6) K.1	K.2	Cruise	Equipment	Dates	Number of Stations	Positioning+ Technique	River Discharge (cfs at The Dalles)
63	32	WN7701*	Grab Sampler	1/22/77	42	SX,LR	132,000
48	17	DF7707	Grab Sampler	7/15/77	37	SX	116,000
46	15	DF7707A*	Grab Sampler	7/21/77	42	MR,SX	85,800
49	18	DF7708A	Grab Sampler	8/30/77	49	MR	83,500
47	16	DF7709*	Grab Sampler	9/6/77	46	MR	107,000
61	30	UW7803*	Unknown	3/16/78	7	SX	157,900
52	21	FR7804	Grab Sampler	4/21/78	40	RD	228,100
53	22	FR7804A	Grab Sampler	4/28/78	42	SX	243,200
64	33	WN7805A	Tripod	5/31/78	12	SX,RD	238,800
50	19	DF7806	Grab Sampler	6/12/78	19	SX	298,800
65	34	WN7807	Tripod	7/15/78	12	SX	182,900
66	35	WN7807A	Tripod	7/16/78	10	SX	145,000
51	20	DF7808	Grab Sampler	8/3,4,5/78	123	SX	144,100
67	36	WN7808A	Tripod	8/24/78	10	MR	134,000
68	37	WN7808B	Tripod	8/25/78	7	MR	126,500
69	38	WN7810	Tripod	10/28/78	9	MR	103,800
70	39	WN7810A	Tripod	10/30/78	9	SX	103,300
62	31	UW7810B*	Unknown	10/29/78	16	SX	103,300
54	23	FR7811	Grab Sampler	11/15/78	24	LR	181,400
55	24	FR7811A	Grab Sampler	11/22/78	35	MR	182,400
56	25	FR7812	Grab Sampler	12/7/78	71	MR	197,800
57	26	FR7904	Grab Sampler	4/20,21, 22/79	137	LR,RD	189,800
71	40	Z7907*	Grab Sampler	7/2,3,4/79	70	MR	?
72	41	A7910 C7910 Z7910	Grab Sampler	10/26-29/79 10/11-19/79 10/2-23/79	623	MR	147,100**
58	27	J8002	Grab Sampler	2/12-29/80	435	MR	213,600**
59	28	J8006	Grab Sampler	6/10-7/11/80	431	MR	321,000**
60	29	NB8106	Grab Sampler	6/25/81	18	MR	427,200**
42	11	BIDDL79*	Hopper Dredge	1979	-	-	?
45	14	BIOROY*++	Intertidal Grab	1980	-	-	?
44	13	BIOBAK*++	Intertidal Grab	5/80	-	-	?
43	12	BIO83*++	Intertidal Grab	7,9/80, 2,4/81	-	-	?

* Not included in the interpretations presented in Sherwood et al. (1984)
** Monthly mean discharge, based on calculations of Jay, 1984
\+ LR = Loran-C; SX = horizontal sextant fixes; RD = radar; MR = Miniranger or Del Norte
++ Collected by the CREDDP Benthic Primary Production work unit investigators

Table K4. Interpolation Codes

Code	Usage
A	Aitkens four-point interpolation
L	Linear interpolation/extrapolation
*	Extrapolation

Table K5. Folk and Ward Type Codes

Deviation Type: Grouping of standard deviations

Code	Usage
1	Very well sorted
2	Well sorted
3	Moderately sorted
4	Poorly sorted
5	Very poorly sorted
6	Extremely poorly sorted

Skewness Type: Grouping of skewness values

Code	Usage
1	Very negatively skewed
2	Negatively skewed
3	Nearly symmetrical
4	Positively skewed
5	Very positively skewed

Kurtosis Type: Grouping of kurtosis values

Code	Usage
1	Platykurtic
2	Mesokurtic
3	Leptokurtic
4	Very leptokurtic
5	Extremely leptokurtic

Errata: Kurtosis values of 10.0 and 11.0 represent a decimal error. Correct values are 1.00 and 1.10.

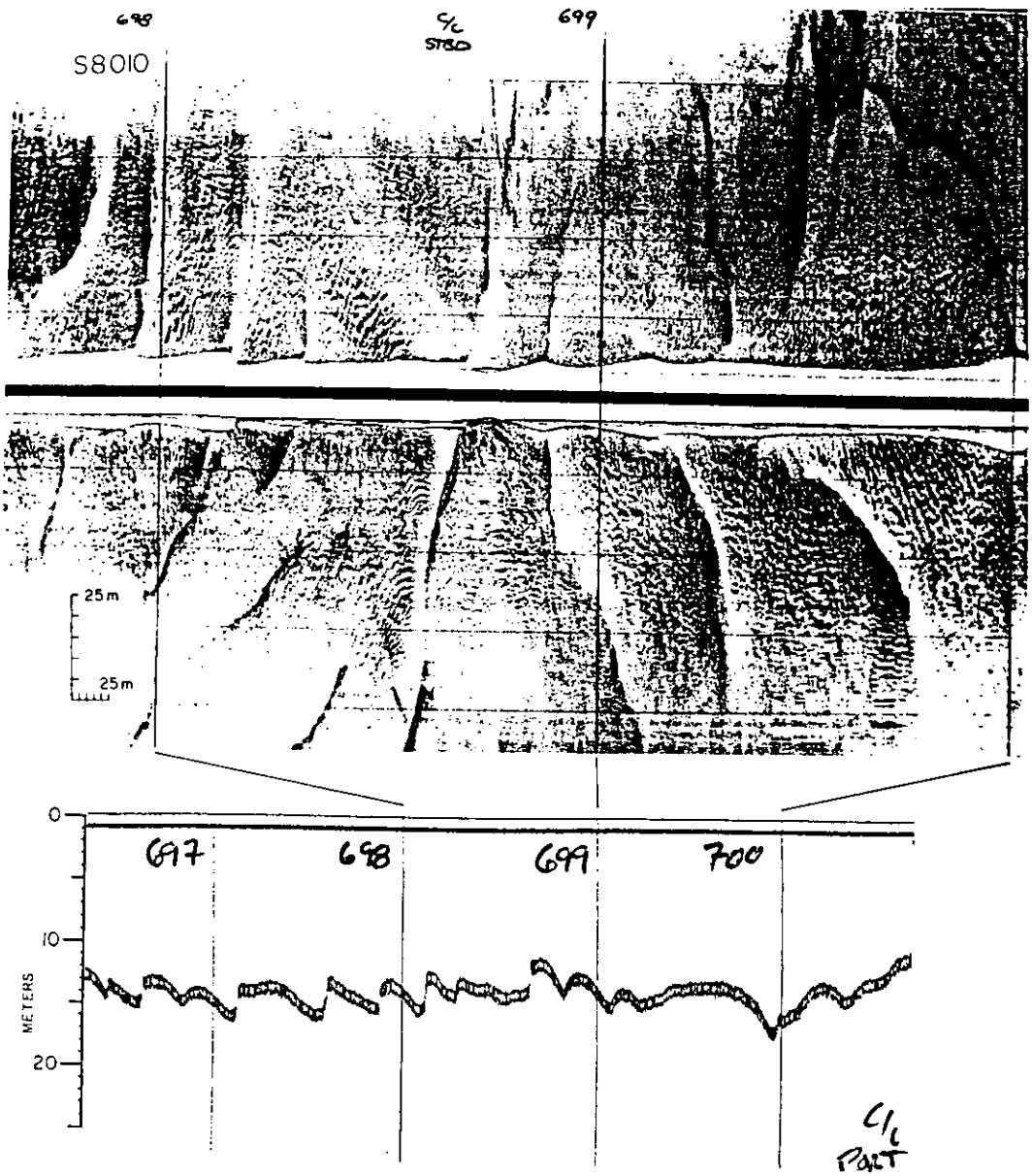


Figure K2. Example side-scan sonar record (top) and depth-recorder trace (bottom) from Data Set K.3. Scales have been added. Scale and navigation information is available in the original records and the ship's log. This record shows side-scan sonar and echo-sounder records of large-scale, seaward-oriented bedforms in the fluvially-dominated upper estuary (vicinity of Rice Island).

L. CURRENTS

The Currents work unit focused on three subjects: tidal circulation, salinity distribution, and the response of estuarine physical processes to "low-frequency forcing": forces with longer time scales (daily to seasonal) than the semidiurnal tides, such as the spring/neap tidal cycle and changes in wind, atmospheric pressure, and riverflow.

Two basic types of data were produced: time-series data and profile data. Time-series data are produced by instruments moored or fixed in the water for extended periods of time. The instrument collects data at regular intervals throughout the deployment period. Four time-series data sets have been created: tidal height, current, wind, and riverflow.

Profile data are produced by lowering an instrument package from a vessel. Again, the instruments collect data at regular time intervals, but the vertical location changes as the instruments are lowered. There is one profile data set: velocity-conductivity-temperature-depth (VCTD).

In addition to the data collected by CREDDP, data have been obtained from several other sources. These include the Army Corps of Engineers (COE), the National Ocean Service (NOS), the United States Geological Survey (USGS), and the National Data Buoy Office (NDBO).

Principal investigators for this work unit were J. Dungan Smith and David Jay of the University of Washington. For further information see:

Jay, D. 1984. Circulatory processes in the Columbia River Estuary. Astoria, OR: Columbia River Estuary Data Development Program.

L.1 DATA SET: Tidal Height

These time-series data include sets from COE, NOS, and USGS as well as those collected specifically for CREDDP. COE, NOS, and USGS used tide gauges while CREDDP investigators used Aanderaa pressure gauges. A tide gauge is mounted on a pier or other structure and records an analog or digital signal which is eventually processed into hourly tidal height observations. A pressure gauge is set on the bottom and records water pressure (and, in some cases, temperature), from which water surface elevation is calculated. Pressure gauge measurements involve several systematic sources of error; future users of these data should be aware of these problems. First, the instruments were (with two exceptions) not stable on the bottom; currents caused sediment transport and movement of the instrument. Vertical shifts of up to 15 cm were found to have occurred during the 1980 deployment for some gauges. Additional errors occur in the calculation of water surface elevation from the measured pressure. These are caused by the use of a constant density in this calculation.

a. Variables

Tidal height
Water temperature (some pressure gauge files only)

b. Data Set Description

This data set comprises 52 files in the computer archive. It contains 65,000 records of 132 bytes from 130,000 observations. The first ten records of each file contain information describing the file, including the collecting organization, station code and coordinates, sampling duration, and comments. Information relating to the processing organization's computer system is also included. The remainder of the records are formatted as follows:

Columns	Format	Contents
1-6	I6	Sample number
9-32	6I4	Date-time (YYYY//MM//DD//HH//MM//SS)
39-43	F5.2	Water temperature (°C) (some pressure gauge files only)
49-54	F6.2	Height (m)
67-72	I6	Sample number
75-98	6I4	Date-time (YYYY//MM//DD//HH//MM//SS)
105-109	F5.2	Water temperature (°C) (some pressure gauge files only)
115-120	F6.2	Height (m)

c. Sampling

The data were obtained at 33 sites in the estuary between April 12, 1977, and December 31, 1982. The Tongue Point tide gauge (station TG-21) has only a few short gaps during this period. Most other sites were sampled for a few months each. Table L1 shows sampling stations and dates. See Jay (1984) for more information on the sampling and station coordinates.

d. Processing

The tidal height files, whatever the source, have been processed into the same format and sampling interval (one hour). In the case of the pressure gauge files, this sampling was obtained by filtering and decimation, using a Lanczos filter with a half-power point of 1/(150 minutes) and a roll-off chosen to leave M8 and other tidal overtones unaffected. The original data have, in some cases, been manipulated to correct the timing, missing data, or spikes.

e. Quality Control

Since all these data were collected by or for federal agencies, CREDDP investigators had no control over the quality of the original record provided to them. They did, however,

evaluate the quality of the data by plotting and harmonic analysis. The quality of the data ranges from variable to excellent, depending on the source of the data. Only records believed to be of "reasonable" quality have been preserved. Sporadic errors of up to 15 minutes remain in USGS and COE data.

f. Data Set Request Information

These files are on Tape 5. File numbers are given in Table L1.

g. Alternate Sources

The data from sources other than CREDDP may be obtained from the collecting organization.

L.2 DATA SET: Currents and Associated Variables

Current meter data from the years 1975, 1977-78, and 1980-81 are available. The Corps of Engineers 1977-78 current data were collected with Endeco Model 105 ducted-impeller recording current meters. All other archived data were recorded with Aanderaa RCM-4 current meters. The Endeco meters recorded velocity only; the Aanderaa meters recorded velocity, (in most cases) temperature and conductivity, and (in some cases) pressure. Current meter data are subject to far more disturbing influences than tide gauges. Spikes in the data are much more common. Some influences (e.g., spin-up on surface waves) are very hard to evaluate and impossible to remove.

a. Variables

Water temperature	Current velocity
Conductivity	Salinity
Current direction	Sigma-t
Current speed	

b. Data Set Description

This data set comprises 261 files in the computer archive. Each record is 132 bytes long; there are approximately 135,000 records. The first ten records of each file contain information describing the file, including the collecting organization, station code and coordinates, sampling duration, and comments. Information relating to the processing organization's computer system is also included. In the remainder of the records, columns 1-32 have the same format as in Data Set L.1. Each record continues:

Columns	Format	Contents
39-43	F5.2	Water temperature (°C)

50-54	F5.2	Conductivity (micro-mhos)
61-65	F5.2	Depth (m) (or, on a few files, transmissivity in %)
71-76	F6.2	Current direction (degrees from true north)
82-87	F6.2	Current speed (cm/s)
92-98	F7.2	Current velocity - eastward component (cm/s)
103-109	F7.2	Current velocity - northward component (cm/s)
116-120	F5.2	Salinity (ppt)
127-131	F5.2	Sigma-t

c. Sampling

The data were obtained at 67 sites in the estuary between June 8, 1975, and December 11, 1981. Table L2 shows sampling stations and dates. See Jay (1984) for more information on the sampling and station coordinates.

d. Processing

Data from all sources have been transformed into a consistent format and sampling interval (1 hour), using a filter similar to that described in L.1.d above.

e. Quality Control

All current files were taken through a regular processing sequence designed to remove and detect errors. This sequence included, for 1980-81 data, plotting, harmonic analysis, statistical properties analysis, T-S (temperature-salinity) relationships (selected files), and (as needed) de-spiking, time correction, interpolation, etc. The 1977-78 COE files do not contain T, S, or P and were processed earlier in the program. The Endeco meters seem to be less reliable than the Aanderaas, and the 1977-78 data should be used with care.

f. Data Set Request Information

These files are on Tape 5. File numbers are given in Table L2.

g. Alternate Sources

Data from sources other than CREDDP can be obtained from the collecting organization.

L.3 DATA SET: Wind

Wind data were assembled from a variety of sources. Quality control for coastal wind data is notoriously difficult; no one data set can be considered authoritative. Calculated geostrophic wind

data (by the method of Andrew Bakun) were also obtained from NMFS.

a. Variables

Wind direction
Wind speed
Wind velocity
Water surface temperature
Atmospheric pressure

b. Data Set Description

This data set comprises 14 files in the computer archive. Each record is 132 bytes long; there are approximately 15,000 records. The first ten records of each file contain information describing the file, including the collecting organization, station code and coordinates, sampling duration, and comments. Information relating to the processing organization's computer system is also included. In the remainder of the records, columns 1-32 have the same format as in Data Set L.1 and L.2. Each record continues:

Columns	Format	Contents
38-43	F6.2	Wind direction (degrees from true north)
49-54	F6.2	Wind speed (cm/s)
59-65	F7.2	Wind velocity - eastward component (cm/s)
70-76	F7.2	Wind velocity - northward component (cm/s)
81-87	F7.2	Water temperature (°C) or air pressure (millibars)

c. Sampling

The data were obtained at six sites within the estuary. The sampling dates range from June 1, 1977, to December 28, 1981. Table L3 shows sampling stations and dates. See Jay (1984) for more information on the sampling and station coordinates.

d. Processing

Data from the various sources were transformed into a common format and were filtered and decimated to 1-, 3-, or 6-hour intervals. The filter used was that described in L.1.d.

e. Quality Control

Obvious spikes were removed, and isolated missing records were interpolated.

f. Data Set Request Information

These files are on Tape 5. File numbers are given in Table L3.

g. Alternate Sources

Data from sources other than CREDDP can be obtained from the collecting organization.

L.4 DATA SET: Flow

Riverflow is a scalar calculated from river stage and given in 100,000 cubic feet per second (cfs). The Bonneville Dam hourly flows for 1980 have been put into two files because of a lengthy gap in the data in September. The daily riverflows at the mouth (Station TG-F1) have been calculated based on the data from Bonneville Dam and data from the Willamette River at Portland, with appropriate lag and scaling factors. They are accurate within approximately 5% when averaged over a month, but may be considerably in error for any given day.

a. Variables

Riverflow

b. Data Set Description

This data set comprises five files in the computer archive. Each record is 132 bytes long; there are approximately 9,000 records containing 18,000 observations. The first ten records of each file contain information describing the file, including the collecting organization, station code and coordinates, sampling duration, and comments. Information relating to the processing organization's computer system is also included. In the remainder of the records, columns 1-32 and 67-98 have the same format as in Data Set L.1. The other columns in these records are formatted as follows:

Columns	Format	Contents
50-54	F5.2	Flow (hundred thousand cfs)
116-120	F5.2	Flow (hundred thousand cfs)

c. Sampling

The data were collected or calculated at daily or hourly intervals by USGS or COE.

d. Processing

Flows for Bonneville Dam were computed from river stage measurements obtained from the Corps of Engineers. Riverflow at the mouth was computed by adding the flow of the Willamette River at its confluence with the Columbia.

e. Quality Control

No information is available concerning the accuracy of USGS and COE observed or calculated flows. The algorithm used to calculate flow at the mouth was chosen to minimize errors in monthly averaged data. When compared to USGS-calculated monthly flow at the mouth, the algorithm accounted for about 93% of the variance for 12 high-flow months and 97% of the variance for 44 low-flow months.

f. Data Set Request Information

These files are on Tape 5. File numbers are given in Table L4.

g. Alternate Sources: None

L.5 DATA SET: VCTD

Vertical profiles of salinity, temperature, and the horizontal current velocity were obtained from two VCTD (Velocity, Conductivity, Temperature, and Depth) probes. These two VCTD probes each consisted of an electromagnetic velocity sensor (which measured two orthogonal components of velocity in a plane perpendicular to the axis of the cylindrical instrument case), a compass (to provide the orientation for the velocity sensor), a pressure transducer, a temperature sensor, a conductivity sensor, and two tilt sensors. The data from the probes were transmitted to a deck unit on board the vessel through a connecting cable and then recorded on a magnetic tape using an audio cassette tape recorder. The data were collected to evaluate the relationship of the velocity and density structure to tidal forcing under low-flow conditions.

a. Variables

Water pressure	Sigma-t
Water temperature	Current speed
Conductivity	Current direction
Salinity	Current velocity

b. Data Set Description

The VCTD data set comprises 458 files in the computer archive. Each file contains data from a single cast of the instrument case. Each record is 132 bytes long; there are approximately 750,000 records. The first nine records of each file contain information describing the file, including the station code and coordinates, time of cast, and comments. The remainder of the records are formatted as follows:

Columns	Format	Contents
1-7	F7.2	Time since start of cast (s)
8-14	F7.2	Pressure (decibar)
15-21	F7.2	Depth of conductivity sensor (m)
22-28	F7.2	Temperature (°C)
29-35	F7.4	Conductivity ratio - ratio of measured conductivity to conductivity at the following standard conditions: S = 35 ppt; T = 15°C; pressure (P) at zero (atmospheric)
36-42	F7.2	Salinity (ppt)
43-49	F7.2	Sigma-t
64-70	F7.2	Depth of velocity sensor (m)
71-76	F6.1	X tilt (degrees from vertical)
77-82	F6.1	Y tilt (degrees from vertical)
83-89	F7.1	X velocity (cm/s)
90-96	F7.1	Y velocity (cm/s)
97-103	F7.1	Orientation (degrees from magnetic north)
104-110	F7.1	Current speed (cm/s)
111-117	F7.1	Current direction (degrees from true north)
118-124	F7.1	Current velocity - eastward component (cm/s)
125-131	F7.1	Current velocity - northward component (cm/s)

c. Sampling

The VCTD profiling was carried out over a period of 13 days from the two vessels Thorfinn and U&I. Thorfinn, which was the larger of the two, carried out profiling at a number of anchor stations which it occupied for periods between 12 and 48 hours. The U&I generally made profile measurements while moored to a series of tie-up buoys to prevent drift. Whenever the weather and sea state precluded the movement of the U&I around the circuit, VCTD casts were taken while at anchor. At each anchor station Thorfinn was profiling at an average rate of two per hour. Towards the middle of the program, it was decided to take replicate casts, so that the sampling frequency was increased to four per hour. The sampling frequency of the U&I was determined by the speed at which the vessel could travel around the circuit of stations. Between October 16 and 27, 1980, approximately 1,600 VCTD casts were taken from the two vessels. Since processing all these data would have been very time-consuming and hence costly, it was decided that only a subset of the data would be selected for processing at this time. This subset includes approximately one cast per hour at each of the Sections 2, 4, 5, and 6, thus providing sufficient spatial and temporal resolution for the preliminary interpretation of the data. The 458 processed casts are summarized in Table L5. For station locations, see Figure 6 in Jay (1984). Exact latitude and longitude coordinates are included in the header records of each file.

d. Processing

The data collected by the VCTD probes and recorded on the audio cassette magnetic tapes were translated into computer-compatible format, calibrated, and then de-spiked. During calibration, the digitized voltages in every sample were converted to physical measurement values, using the calibration formulae appropriate to each sensor. The surface pressure offset was also removed from the pressure record, as was the pressure differential caused by the separated positions of the velocity and pressure sensors in the probe.

e. Quality Control

A de-spiking program was applied to the calibrated data to correct for spikes, if any. Two criteria were used in de-spiking: the range criterion, wherein values exceeding a given limit are considered to be spikes and are replaced; and the first difference criterion, wherein the value may still be in the allowable range but is replaced if the difference between that value and the preceding or following value is greater than a predetermined magnitude. The second criterion was also used to locate and correct groups of spikes up to a maximum of ten successive records. If more than ten consecutive spikes occurred, the automatic mode of de-spiking left the spikes in the data. These were then corrected manually.

f. Data Set Request Information

These files are on Tapes 1-4. Tape and file numbers are given in Table L5.

g. Alternate Sources

These data may also be obtained from:

Dr. Savithri Narayanan
Dobrocky SEATECH, Ltd.
P.O. Box 6500
Sidney, B.C. V8L 4M7

Table L1. Tidal Height Files, Tape 5

File	Station	Starting Date	Ending Date	Source	Comments
1	TG-B1	2/22/78	6/1/78	COE	Ilwaco tide gauge
2	TG-B2	3/19/78	6/8/78	COE	Tide gauge behind Jetty A
3	TG-B3	12/22/77	6/30/78	COE	NMFS pier tide gauge; 854 nine-filled records cover data gap
4	TG-B3	2/23/78	5/30/78	COE	Tide gauge at NMFS pier
5	TG-B4	2/23/78	6/9/78	COE	Port of Astoria Pier 1 tide gauge
6	TG-B6	2/28/78	6/8/78	COE	Tongue Point combined file; 218 missing records 999 filled
7	TG-B8	3/10/78	6/9/78	COE	Skamokawa tide gauge. Quality deteriorates after the first 670 hours.
8	TG-B9	2/24/78	6/8/78	COE	Bradwood tide gauge
9	TG-B10	2/26/78	4/9/78	COE	Eagle Cliff tide gauge
10	TG-B1	4/4/78	6/1/78	COE	Ilwaco tide gauge
11	TG-B5	4/7/78	6/9/78	COE	Hungry Harbor tide gauge, second deployment
12	TG-B6	4/13/78	6/8/78	COE	Tongue Point tide gauge
13	TG-B7	4/7/78	6/9/78	COE	Altoona tide gauge
14	TG-21	4/12/77	12/31/77	NOS	Tongue Point tide gauge. Starts in April because of blanks.
15	TG-21	2/20/79	12/31/79	NOS	NOS hourly tidal height data. First 50 days of year omitted.
16	TG-B3	6/9/77	9/12/77	COE	NMFS pier tide gauge
17	TG-B4	6/1/77	9/18/77	COE	Tide gauge Pier 1. 9999 filled data corrected. Data after 7/1/77 is questionable.
18	TG-6	6/20/80	7/4/80	CREDDP	NMFS boathouse, Hammond. Lanczos filtered.
19	TG-19	6/19/80	7/22/80	CREDDP	Light #76. Lanczos filtered.
20	TG-20	6/19/80	7/22/80	CREDDP	Beaver Army Terminal. Lanczos filtered.
21	TG-2	6/20/80	7/23/80	CREDDP	On Daymark 1, east end of Lower Sand Island. Lanczos filtered.
22	TG-7	6/20/80	7/22/80	CREDDP	Chevron fuel dock, Astoria. Lanczos filtered.
23	TG-15	6/19/80	7/23/80	CREDDP	Bradwood Pier. Lanczos filtered.
24	TG-19	3/27/80	5/21/80	CREDDP	At light 76. Lanczos filtered.
25	TG-20	3/27/80	5/21/80	CREDDP	Beaver Army Terminal. Lanczos filtered.
26	TG-1	5/13/80	10/15/80	USGS	Jetty A tide gauge combined record for Summer and Fall. Timing problems ± 30 minutes.
27	TG-2	10/15/80	11/16/80	CREDDP	Sand Island. Lanczos filtered.

Table L1. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
28	TG-7	10/16/80	11/15/80	CREDDP	Chevron fuel wharf, Astoria. Lanczos filtered.
29	TG-24	10/15/80	11/15/80	CREDDP	US Coast Guard Wharf at Tongue Point. Lanczos filtered.
30	TG-22	10/15/80	11/15/80	CREDDP	Marker 12A north of Svensen Island. Lanczos filtered.
31	TG-15	10/14/80	11/15/80	CREDDP	Bradwood - Old Mill Pier. Lanczos filtered.
32	TG-19	10/15/80	11/15/80	CREDDP	Beacon 76 near Beaver. Lanczos filtered.
33	TG-20	10/14/80	11/15/80	CREDDP	Beaver army terminal. Lanczos filtered.
34	TG-19	7/22/80	10/14/80	CREDDP	Beacon 76 near Beaver. Lanczos filtered.
35	TG-29	7/22/80	10/14/80	CREDDP	Beaver Army Terminal. Lanczos filtered.
36	TG-21	1/1/80	12/1/80	NOS	Tongue Point tide gauge; some blanks filled by their programs
37	TG-21	1/1/78	12/31/78	NOS	NOS tide gauge; some blanks filled by their programs.
38	TG-20	6/19/80	11/15/80	CREDDP	Beaver army terminal combined records. Laczos filtered.
39	TG-N1	4/27/81	12/11/81	NOS	Jetty A tide gauge. Datum level unknown.
40	TG-N2	4/27/81	12/9/81	NOS	Ft. Stevens tide gauge. Datum correction made.
41	TG-N3	6/16/81	8/24/81	NOS	Youngs Bay, corrected to MLLW.
42	TG-21	12/31/80	12/31/81	NOS	Tongue Point tide gauge reference station - corrected to MLLW.
43	TG-N5	4/27/81	11/4/81	NOS	Chinook tide gauge. Datum corrected to MLLW.
44	TG-N6	5/1/81	10/12/81	NOS	Knappton tide gauge. First deployment corrected to MLLW.
45	TG-N7	5/12/81	12/7/81	NOS	Altoona tide gauge not reduced to MLLW.
46	TG-N8	9/16/81	12/6/81	NOS	Knappa slough tide gauge corrected to MLLW.
47	TG-N9	7/1/81	10/18/81	NOS	Skamokawa tide gauge corrected to MLLW.
48	TG-N10	5/14/81	9/15/81	NOS	Cathlamet tide gauge.
49	TG-N11	5/7/81	9/14/81	NOS	Wauna tide gauge, MLLW unknown.
50	TG-N12	4/28/81	12/1/81	NOS	Beaver tide gauge, not referenced.
51	TG-N13	7/13/81	10/10/81	NOS	Kalama tide gauge, not referenced.
52	TG-N6	10/26/81	12/1/81	NOS	NOS Knappton tide gauge, second deployment.

Table L2. Current Meter Files, Tape 5. All files are Lanczos filtered except as indicated.

File	Station	Starting Date	Ending Date	Source	Comments
53	CM-A1	6/9/75	6/18/75	COE	Near Buoy 1. Second meter from bottom.
54	CM-A3	6/9/75	6/19/75	COE	Top meter off tip of South Jetty.
55	CM-A3	6/9/75	6/19/75	COE	Bottom meter off tip of South Jetty.
56	CM-A2	6/9/75	6/19/75	COE	Top meter off tip of North Jetty.
57	CM-A2	6/9/75	6/19/75	COE	Bottom meter off tip of North Jetty.
58	CM-A1	6/9/75	6/19/75	COE	Bottom meter near Buoy 1.
59	CM-M1	6/15/77	6/29/77	COE	Bottom meter at RM 4.9 east of Jetty A. Lanczos squared filtered.
60	CM-M1	6/15/77	6/29/77	COE	Middle meter at RM 4.9 east of Jetty A. Lanczos squared filtered.
61	CM-M1	6/15/77	6/29/77	COE	Top meter at RM 4.9 east of Jetty A. Lanczos squared filtered.
62	CM-M2	6/15/77	6/29/77	COE	Bottom meter at RM 5.2 at south edge of ship channel. Lanczos squared filtered.
63	CM-M2	6/15/77	6/29/77	COE	Middle meter at RM 5.2 at south edge of ship channel. Lanczos squared filtered.
64	CM-M2	6/15/77	6/28/77	COE	Top meter at RM 5.2 at south edge of ship channel.
65	CM-M3	6/16/77	6/29/77	COE	Middle meter near Buoy 12.
66	CM-M3	6/16/77	6/30/77	COE	Top meter at RM 5.2 near Buoy 12. Lanczos squared filtered.
67	CM-M4	6/15/77	6/30/77	COE	Bottom meter at RM 0.9 north of ship channel. Lanczos squared filtered.
68	CM-M4	6/15/77	6/30/77	COE	Middle meter at RM 0.9 north of ship channel. Lanczos squared filtered.
69	CM-M4	6/15/77	6/29/77	COE	Top meter at RM 0.9 north of ship channel. Lanczos squared filtered.
70	CM-M5	6/15/77	6/29/77	COE	Bottom meter at RM 0.6 just south of ship channel. Lanczos squared filtered.
71	CM-M5	6/15/77	6/29/77	COE	Middle meter at RM 0.6 just south of ship channel. Lanczos squared filtered.
72	CM-M5	6/15/77	6/29/77	COE	Top meter at RM 0.6 just south of ship channel. Lanczos squared filtered.
73	CM-M6	6/15/77	6/29/77	COE	Bottom meter at RM 0.5 near Buoy 8. Lanczos squared filtered.
74	CM-M6	6/15/77	6/29/77	COE	Middle meter at RM 0.5 near Buoy 8. Lanczos squared filtered.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
75	CM-M6	6/15/77	6/29/77	COE	Top meter at RM 0.5 near Buoy 8.
76	CM-T1	3/9/78	4/6/78	COE	Top meter at RM 5.2 north of ship channel.
77	CM-T1	3/10/78	4/6/78	COE	Bottom meter at RM 5.2 north of ship channel.
78	CM-T2	3/9/78	4/6/78	COE	Top meter at RM 10 north of main ship channel, NE of Tansy Pt.
79	CM-T2	3/9/78	4/6/78	COE	Bottom meter at RM 10 NE of Tansy Pt.
80	CM-T4	3/9/78	4/6/78	COE	North channel upstream of bridge.
81	CM-T5	3/9/78	4/6/78	COE	Top meter RM 16.9 north of ship channel.
82	CM-T5	3/9/78	4/6/78	COE	Bottom meter at RM 16.9 off coast guard pier.
83	CM-T6	3/9/78	4/6/78	COE	North channel Cathlamet Bay.
84	CM-T7	3/9/78	4/6/78	COE	North of ship channel, RM 20.6, opposite Buoy 52.
85	CM-T8	3/9/78	4/6/78	COE	North of ship channel off Altoona Cannery.
86	CM-T9	3/9/78	4/6/78	COE	Woody Island.
87	CM-T10	3/9/78	4/6/78	COE	South of ship channel at RM 29.2.
88	CM-T11	3/9/78	4/6/78	COE	Top meter west of ship channel at RM 37.
89	CM-T11	3/9/78	4/6/78	COE	Bottom meter west of ship channel at RM 37.
90	CM-T12	3/9/78	4/6/78	COE	Clifton channel off Bradwood.
91	CM-1C	6/20/80	7/1/80	CREDDP	Bottom meter in 19.8 m of water; upper meters lost. Rotor lost during deployment.
92	CM-1D	6/20/80	7/1/80	CREDDP	Top meter off clatsop Spit, water depth 16.8 m. Speed bad after rotor loss.
93	CM-1D	6/20/80	7/1/80	CREDDP	Middle meter off Clatsop Spit, in 15.2 m of water. Speed bad after rotor loss.
94	CM-1D	6/20/80	6/30/80	CREDDP	Bottom meter Sand Island. Clatsop Spit transect velocity questionable.
95	CM-4A	6/25/80	7/3/80	CREDDP	Top meter 10.7 m from bottom, direction edited for entire file.
96	CM-4A	6/25/80	7/3/80	CREDDP	Bottom meter, 3.0 m off bottom.
97	CM-4B	6/20/80	6/25/80	CREDDP	Top meter 7.6 m from bottom.
98	CM-4B	6/20/80	6/25/80	CREDDP	Bottom meter, 3.0 m off bottom.
99	CM-5A	6/20/80	7/5/80	CREDDP	Top meter, South Channel A-M Bridge. Corrected file.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
100	CM-5A	6/20/80	7/5/80	CREDDP	Meter depth is 25 ft. from bottom.
101	CM-5A	6/20/80	7/5/80	CREDDP	Mooring is 4.6 m off bottom.
102	CM-5B	6/21/80	7/4/80	CREDDP	Moored depth is 14.9 m off bottom, depth increased by 2.1 m 6/21/80.
103	CM-5B	6/20/80	7/4/80	CREDDP	Pressure channel replaced with transmissometer #SN 12.
104	CM-7D	6/21/80	7/3/80	CREDDP	Mooring is 7.6 m from bottom.
105	CM-7D	6/21/80	7/3/80	CREDDP	Bottom meter, 3.0 m off bottom.
106	CM-7E	6/21/80	7/2/80	CREDDP	4.6 m from bottom. Iron filings found around rotor magnets, meter possibly dragged to shallow water.
107	CM-5A	3/25/80	5/21/80	CREDDP	Middle meter, South Channel, A-M Bridge.
108	CM-5B	3/27/80	5/21/80	CREDDP	Bottom meter, North Channel, A-M Bridge.
109	CM-5A	3/25/80	4/16/80	CREDDP	Bottom meter, South Channel, spring deployment.
110	CM-5A	3/25/80	5/18/80	CREDDP	A-M Bridge, South Channel, top meter. Hourly Lanczos filtered.
111	CM-2S	10/15/80	10/27/80	CREDDP	Bottom meter.
112	CM-2S	10/15/80	10/27/80	CREDDP	Middle meter.
113	CM-2S	10/15/80	10/27/80	CREDDP	Middle meter, entrance. Salinity corrected for neap tide period. Hourly low pass filtered.
114	CM-2S	10/15/80	10/27/80	CREDDP	Top meter.
115	CM-3S	10/15/80	10/27/80	CREDDP	Bottom meter.
116	CM-3S	10/15/80	10/27/80	CREDDP	Middle meter.
117	CM-3S	10/15/80	10/27/80	CREDDP	Top meter.
118	CM-5A	10/16/80	10/30/80	CREDDP	Bottom meter, South Channel. Low passed, long.
119	CM-5A	10/16/80	10/30/80	CREDDP	Middle meter.
120	CM-5A	10/16/80	10/30/80	CREDDP	Top meter.
121	CM-5B	10/16/80	10/30/80	CREDDP	Middle meter.
122	CM-5B	10/16/80	10/30/80	CREDDP	North Channel, A-M Bridge, top meter. Low passed.
123	CM-6S	10/16/80	10/27/80	CREDDP	Middle meter.
124	CM-6S	10/16/80	10/20/80	CREDDP	AP tide salinity data interpolated. Salinity = 136.8 - 9.86 *temp.
125	CM-6S	10/23/80	10/27/80	CREDDP	Interpolated salinity data. Spring tide salinity = 201.06-14.07 *temp.
126	CM-6S	10/16/80	10/27/80	CREDDP	Top meter.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
127	CM-7N	10/16/80	10/27/80	CREDDP	Bottom meter.
128	CM-7N	10/16/80	10/20/80	CREDDP	Salinity interpolated in hourly low passed file. Salinity = 139.8 - 9.18* temperature.
129	CM-7N	10/16/80	10/27/80	CREDDP	Top meter.
130	CM-7M	10/15/80	10/29/80	CREDDP	Only meter at this location.
131	CM-7S	10/15/80	10/29/80	CREDDP	Top meter.
132	CM-5A	7/5/80	10/14/80	CREDDP	Bottom meter.
133	CM-5A	7/5/80	10/14/80	CREDDP	Middle meter.
134	CM-5A	7/5/80	10/14/80	CREDDP	A-M Bridge, South Channel, top meter, summer.
135	CM-5B	7/4/80	10/14/80	CREDDP	A-M Bridge, North Channel, top meter, summer.
136	CM-5B	7/4/80	10/14/80	CREDDP	A-M Bridge, top meter, North Channel. Hourly low pass.
137	CM-1	4/30/81	5/19/81	NOS	Clatsop Spit, RM-5, top meter. Long.
138	CM-1	4/30/81	5/19/81	NOS	Clatsop Spit, RM-5, top meter.
139	CM-1	4/30/81	5/19/81	NOS	Clatsop Spit, RM-5, bottom meter.
140	CM-1	5/19/81	6/5/81	NOS	Clatsop Spit, RM-5, top meter. Long. Speed bad after 5/27 2:00.
141	CM-1	5/19/81	6/5/81	NOS	Clatsop Spit, RM-5, lower meter.
142	CM-1	6/5/81	6/23/81	NOS	Clatsop Spit, RM-5, upper meter.
143	CM-1	6/5/81	6/23/81	NOS	Clatsop Spit, bottom meter RM-5.
144	CM-1	6/23/81	7/6/81	NOS	Clatsop Spit, RM-5, top meter.
145	CM-1	6/23/81	7/2/81	NOS	Clatsop Spit, RM-5, bottom meter.
146	CM-1	7/2/81	7/6/81	NOS	Clatsop Spit, RM-5, top. Too short for most purposes.
147	CM-1	8/13/81	8/31/81	NOS	Clatsop Spit, RM-5, top meter. Speed bad after 8/27/81 3:00.
148	CM-1	8/13/81	8/31/81	NOS	Clatsop Spit, RM-5, middle meter.
149	CM-1	8/13/81	8/31/81	NOS	Clatsop Spit, RM-5, bottom meter.
150	CM-1	8/31/81	9/14/81	NOS	Clatsop Spit, RM-5, top meter.
151	CM-1	8/31/81	9/18/81	NOS	Clatsop Spit, RM-5. Bottom meter. Velocity bad after 09/09/81 1:00 S and T spikes edited.
152	CM-1	11/12/81	12/2/81	NOS	Clatsop Spit, RM-5, single meter; winter.
153	CM-1	12/2/81	12/14/81	NOS	Clatsop Spit, RM-5, winter deployment, single meter.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
154	CM-1	4/30/81	7/6/81	NOS	Clatsop Spit, RM-5. Long combined file at 7M. All gaps interpolated.
155	CM-1	12/2/81	12/14/81	NOS	Clatsop Spit, RM-5, winter deployment.
156	CM-1	11/12/81	12/14/81	NOS	Clatsop Spit, RM-5, combined winter deployment.
157	CM-1	6/23/81	7/6/81	NOS	Clatsop Spit, RM-5, lower meter, combined.
158	CM-1	8/13/81	9/14/81	NOS	Clatsop Spit, RM-5, top meter, combined. Speed filled from 8/26/81 12:00 to 9/1/81 4:00.
159	CM-1	8/13/81	9/18/81	NOS	Clatsop Spit, RM-5, middle meter, combined. Speed bad after 9/9/81
160	CM-3	8/13/81	9/1/81	NOS	Clatsop Spit, RM-5, mid-depth.
161	CM-3	8/13/81	9/1/81	NOS	Upper meter off Clatsop Spit, RM-5.
162	CM-4	8/13/81	9/1/81	NOS	Off Clatsop Spit, RM-5, upper meter. Speed flat spots filled.
163	CM-4	8/13/81	9/1/81	NOS	Off Clatsop Spit, RM-5, mid depth, lower of two. Extension of direction 8/22 20:00 to 8/28 00:00.
164	CM-4	9/1/81	9/17/81	NOS	Off Clatsop Spit, mid-depth (upper of two). Two speed flat spots interpolated.
165	CM-4	9/1/81	9/17/81	NOS	Off Clatsop Spit; deep, lower of two. One speed flat spot filled.
166	CM-4	11/13/81	12/2/81	NOS	Off Clatsop Spit, upper of two, RM-5.
167	CM-4	11/13/81	12/2/81	NOS	Off Clatsop Spit, RM-5, lower of two.
168	CM-3	8/13/81	9/7/81	NOS	Off Clatsop Spit, mid-depth combined. 2 hr gap filled.
169	CM-4	8/13/81	9/17/81	NOS	Off Clatsop Spit, mid-depth, combined. Interpolation of dir in 502.
170	CM-8	4/30/81	5/19/81	NOS	Off Clatsop Spit, RM-5, near surface.
171	CM-8	5/19/81	6/9/81	NOS	Off Clatsop Spit at RM-5, upper of two.
172	CM-8	5/19/81	6/9/81	NOS	Off Clatsop Spit, lower of two. Speed still poss. bad after 6/03/81.
173	CM-8	8/17/81	8/31/81	NOS	At RM-5 off Clatsop Spit, upper of two. Conductivity spikes and one speed flat spot interpolated.
174	CM-8	8/17/81	8/31/81	NOS	At RM-5 off Clatsop Spit, lower meter of 2. One speed flat spot interpolated.
175	CM-8	8/31/81	9/16/81	NOS	At RM-5 off Clatsop Spit near bottom. Meter speed bad after 9/14/81 4:00.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
176	CM-8	4/30/81	6/9/81	NOS	Off Clatsop Spit. RM-5, near surface. Long combined file.
177	CM-8	8/17/81	9/16/81	NOS	At RM-5 off Clatsop Spit, lower meter. Combined file.
178	CM-9	5/4/81	5/20/81	NOS	Astoria, RM-15, top meter of 2.
179	CM-9	5/4/81	5/20/81	NOS	Astoria, RM-15, bottom meter of 2.
180	CM-9	5/20/81	6/11/81	NOS	Astoria, RM-15, top meter of 2.
181	CM-9	5/20/81	6/11/81	NOS	Astoria, RM-15, bottom meter of 2.
182	CM-9	5/28/81	6/12/81	NOS	Astoria, RM-15, near bottom. Speed bad after 6/10 13:00. Questionable 6/8 1:00 - 6/10 13:00.
183	CM-9	6/11/81	7/10/81	NOS	Astoria, RM-15, mid-depth.
184	CM-9	7/10/81	7/27/81	NOS	Astoria, RM-15, top meter of 2.
185	CM-9	7/10/81	7/27/81	NOS	Astoria, RM-15, bottom meter of 2.
186	CM-9	7/27/81	8/12/81	NOS	Astoria, RM-15, top meter of 2.
187	CM-9	7/27/81	8/12/81	NOS	Astoria, RM-15, bottom meter of 2.
188	CM-9	8/12/81	8/28/81	NOS	Astoria RM-15, top meter of 2, meter moved shallower 8/26/81. Temperature and salinity edited.
189	CM-9	8/12/81	8/28/81	NOS	Astoria, RM-15, bottom meter of 2. Direction edited 8/25 22:00 to end.
190	CM-9	8/28/81	9/17/81	NOS	Astoria, RM-15, bottom meter of 2.
191	CM-9	9/17/81	9/25/81	NOS	Astoria, RM-15, mid-depth.
192	CM-9	10/16/81	10/29/81	NOS	Astoria, RM-15, top meter of 2.
193	CM-9	10/16/81	10/29/81	NOS	Astoria, RM-15, bottom meter of 2.
194	CM-9	10/29/81	11/13/81	NOS	Astoria, RM-15, top meter of 2, spike edited 11/4 22:00.
195	CM-9	10/29/81	11/13/81	NOS	Astoria, RM-15, bottom meter of 2.
196	CM-9	5/4/81	6/11/81	NOS	Astoria, RM-15, near surface, combined. Gap interpolated.
197	CM-9	5/4/81	9/1/81	NOS	Astoria, RM-15, mid-depth. combined and interpolated.
198	CM-9	10/16/81	11/13/81	NOS	Astoria, RM-15, mid-depth, combined.
199	CM-9	10/16/81	11/13/81	NOS	Astoria, RM-15, near bottom, combined.
200	CM-10	4/30/81	5/9/81	NOS	Port of Astoria, RM-11.5, top meter of 2.
201	CM-10	4/30/81	5/13/81	NOS	Port of Astoria, RM-11.5, bottom meter of 2, velocity bad after 5/11 1:00.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
202	CM-10	5/13/81	6/1/81	NOS	Port of Astoria, RM-11.5, single meter.
203	CM-10	6/9/81	6/26/81	NOS	Port of Astoria, RM-11.5, single meter, temperature noisy.
204	CM-10	11/13/81	12/1/81	NOS	Port of Astoria, RM-11.5, single meter.
205	CM-11	6/17/81	7/2/81	NOS	Youngs Bay, single meter.
206	CM-12	4/29/81	5/6/81	NOS	Hammond, RM-8.5, single meter.
207	CM-12	5/21/81	6/9/81	NOS	Hammond, RM-8.5, single meter, velocity bad after 6/1 19:00.
208	CM-13	6/23/81	7/5/81	NOS	Desdemona Sands, RM-9, single meter.
209	CM-14	5/4/81	5/19/81	NOS	Fort Columbia, RM-9, single meter, odd depth fluctuations after 5/14.
210	CM-14	5/19/81	6/4/81	NOS	Fort Columbia, RM-9, top of 3. Bad velocity after 5/30 16:00.
211	CM-14	5/19/81	6/4/81	NOS	Fort Columbia, RM-9, middle of 3.
212	CM-14	5/19/81	6/4/81	NOS	Fort Columbia, RM-9, bottom of 3.
213	CM-14	6/4/81	6/21/81	NOS	Fort Columbia, RM-9, top of 3.
214	CM-14	6/4/81	6/23/81	NOS	Fort Columbia, North Channel below bridge, RM-9, middle of 3, time corrected by -60 min. from original file.
215	CM-14	6/4/81	6/23/81	NOS	Fort Columbia, RM-9, bottom of 3.
216	CM-14	6/23/81	7/6/81	NOS	Fort Columbia, RM-9, top of 3.
217	CM-14	6/23/81	7/6/81	NOS	Fort Columbia, RM-9, middle of 3.
218	CM-14	6/23/81	7/6/81	NOS	Fort Columbia, RM-9, bottom of 3.
219	CM-14	11/18/81	12/4/81	NOS	Fort Columbia. RM-9, top of 2.
220	CM-14	11/18/81	12/4/81	NOS	Fort Columbia, RM-9, bottom of 2.
221	CM-14	5/19/81	6/23/81	NOS	Fort Columbia, RM-9, mid-depth meters, combined.
222	CM-14	5/19/81	7/6/81	NOS	Fort Columbia, RM-9, near bottom meters.
223	CM-16	4/29/81	5/19/81	NOS	Hungry Harbor, N. Channel, RM-12, single meter.
224	CM-16	5/19/81	6/9/81	NOS	Hungry Harbor, N. Channel, RM-12, top of 2.
225	CM-16	5/19/81	6/10/81	NOS	Hungry Harbor, N. Channel, RM-12, bottom of 2, salinity edited 5/22 & 6/10.
226	CM-16	6/12/81	7/6/81	NOS	Hungry Harbor, N. Channel, RM-12, top of 2.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
227	CM-16	6/10/81	7/6/81	NOS	Hungry Harbor, N. Channel, RM-12, bottom of 2, edited depth 6/24 and salinity 7/5.
228	CM-16	11/18/81	12/7/81	NOS	Hungry Harbor, N. Channel, RM-12, top of 2.
229	CM-16	11/18/81	12/7/81	NOS	Hungry Harbor, N. Channel, RM-12, bottom of 2.
230	CM-19	6/15/81	7/2/81	NOS	Grays Point, N. Channel RM-16, bottom of 1.
231	CM-16	4/29/81	6/9/81	NOS	Hungry Harbor, N. Channel RM-12, near surface meters combined.
232	CM-16	5/19/81	7/6/81	NOS	Hungry Harbor, N. Channel RM-12, near bottom meters, combined.
233	CM-17	5/4/81	5/19/81	NOS	Off Trestle Bay, RM-6, near surface meter.
234	CM-17	5/20/81	6/4/81	NOS	Off Trestle Bay, RM-6, near bottom meter. Pressure set constant, 2 salinity spikes edited.
235	CM-17	8/31/81	9/17/81	NOS	Off Trestle Bay, RM-6, near surface.
236	CM-17	11/13/81	12/1/81	NOS	Off Trestle Bay, mid-depth, RM-6.
237	CM-18	4/30/81	5/18/81	NOS	Off Sand Island dike, RM-7, near surface of 3.
238	CM-18	4/30/81	5/18/81	NOS	Off Sand Island dike, north channel, RM-7, mid-depth of 3.
239	CM-18	4/30/81	5/18/81	NOS	Off Sand Island dike, north channel, RM-7, mid-depth of 3.
240	CM-18	5/18/81	6/4/81	NOS	Off Sand Island dike, near surface of 3.
241	CM-18	5/18/81	6/4/81	NOS	Sand Island dike, north channel, RM-7, mid depth of 3. Rec 1765-98 bad cond, salinity and sigma-t from T-S.
242	CM-18	5/18/81	6/4/81	NOS	Off Sand Island dike, north channel, RM-7, bottom of 3.
243	CM-18	8/13/81	8/31/81	NOS	Off Sand Island dike, north channel, RM-7, near surface of 2.
244	CM-18	8/13/81	8/25/81	NOS	Off Sand Island dike, north channel, RM-7, mid-depth of 2. Speed flat spots fixed.
245	CM-18	8/31/81	9/17/81	NOS	Off Sand Island dike, north channel, RM-7, mid-depth of 2. 5 speed flat spots fixed.
246	CM-18	8/31/81	9/17/81	NOS	Off Sand Island dike, north channel RM-7, bottom of 2.
247	CM-18	4/30/81	6/4/81	NOS	Off Sand Island dike, north channel, RM-7, near surface of 3. Combined, 6 records interpolated.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
248	CM-18	4/30/81	6/4/81	NOS	Off Sand Island dike, north channel, RM-7, combined. 7 records interpolated.
249	CM-18	4/30/81	6/4/81	NOS	Off Sand Island dike, north channel, RM-7, near bottom of 3, combined. 7 records interpolated.
250	CM-18	8/26/81	9/17/81	NOS	Off Sand Island dike, RM-7, north channel, mid depth combined.
251	CM-20	5/21/81	6/17/81	NOS	Tongue Point, RM-17.5, top meter of 3.
252	CM-20	5/21/81	6/17/81	NOS	Tongue Point, RM-17.5, mid meter of 3.
253	CM-20	5/21/81	6/17/81	NOS	Tongue Point, RM-17.5, bottom meter of 3. Salinity & depth edited.
254	CM-20	11/17/81	12/4/81	NOS	Tongue Point, RM-17.5, top meter of 2. Depth questionable.
255	CM-20	11/17/81	12/4/81	NOS	Tongue Point, RM-17.5, bottom meter of 2. Salinity edited at 12/3 23:22.
256	CM-23	9/16/81	10/2/81	NOS	Off Altoona, RM-24, record number discrepancy.
257	CM-23	10/19/81	11/9/81	NOS	Off Altoona at RM-24, upper of 2.
258	CM-23	10/19/81	11/9/81	NOS	Off Altoona at RM-24, lower of 2.
259	CM-24	9/11/81	9/26/81	NOS	South of Miller Sands, north of Woody Island Channel.
260	CM-25	9/10/81	9/25/81	NOS	Woody Island Channel off Seal Island.
261	CM-25	9/10/81	9/28/81	NOS	Woody Island Channel off Seal Island, combined.
262	CM-32	6/30/81	7/15/81	NOS	Off Quinns Island, Prairie Channel, RM-31.
263	CM-33	7/15/81	8/4/81	NOS	Off Tenasillahe Island, Clifton Channel, RM-36. Depth edited.
264	CM-35	7/16/81	8/4/81	NOS	Off Cathlamet, Cathlamet Channel, RM-39.
265	CM-38	7/16/81	8/3/81	NOS	Off Nassa Point, Cathlamet Channel, RM-47.
266	CM-42	7/30/81	8/19/81	NOS	Walker Island, RM-61, top meter of 2.
267	CM-42	7/30/81	8/19/81	NOS	Walker Island, RM-61, bottom meter of 2.
268	CM-31	6/29/81	7/16/81	NOS	Three Tree Point, RM-31, top meter of 2.
269	CM-31	6/29/81	7/16/81	NOS	Three Tree Point, RM-31, bottom meter of 2.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
270	CM-31	7/16/81	8/4/81	NOS	Three Tree Point, RM-31, top meter of 2.
271	CM-31	7/16/81	8/4/81	NOS	Three Tree Point RM-31, bottom meter of 2.
272	CM-34	6/29/81	7/15/81	NOS	Price Island, RM-35, top meter of 2.
273	CM-34	6/29/81	7/15/81	NOS	Price Island, RM-35, bottom meter of 2.
274	CM-36	7/8/81	7/16/81	NOS	Hunts Mill Point, RM-38.5, top meter of 2. Depth edited in first records.
275	CM-36	6/30/81	7/16/81	NOS	Hunts Mill Point, RM-38.5, bottom meter of 2.
276	CM-36	7/16/81	8/3/81	NOS	Hunts Mill Point, RM-38.5, top meter of 2.
277	CM-36	7/16/81	8/3/81	NOS	Hunts Mill Point, RM-38.5, bottom meter of 2.
278	CM-37	6/30/81	7/15/81	NOS	Puget Island upper end, RM-45.5, top meter of 2. Depth and velocity edited.
279	CM-37	6/30/81	7/15/81	NOS	Puget Island upper end, RM-45.5, bottom meter of 2. All variables edited.
280	CM-37	7/15/81	8/4/81	NOS	Puget Island upper end, RM-45.5, top meter of 2.
281	CM-37	7/15/81	8/4/81	NOS	Puget Island upper end, RM-45.5, bottom meter of 2. Depth odd in section.
282	CM-31	6/29/81	8/3/81	NOS	Three Tree Point, RM-31, mid-depth meters. Combined.
283	CM-36	7/9/81	8/3/81	NOS	Hunts Mill Point, RM-38.5, mid-depth meters. Combined and gaps interpolated.
284	CM-37	6/30/81	8/3/81	NOS	Puget Island upper end, RM-45.5., top meters. Combined.
285	CM-39	5/5/81	5/19/81	NOS	Beaver Army Terminal, RM-53.5. Temperature noisy, depth odd.
286	CM-39	5/20/81	6/3/81	NOS	Beaver Army Terminal RM-53.5, top of 3.
287	CM-39	5/20/81	6/3/81	NOS	Beaver Army Terminal, RM-53.5, mid of 3.
288	CM-39	5/20/81	6/3/81	NOS	Beaver Army Terminal, RM-53.5, bottom of 3.
289	CM-39	6/4/81	6/19/81	NOS	Beaver Army Terminal, RM-53.5, top of 2.
290	CM-39	6/4/81	6/19/81	NOS	Beaver Army Terminal, RM-53.5, bottom of 2.

Table L2. (cont.)

File	Station	Starting Date	Ending Date	Source	Comments
291	CM-39	6/23/81	7/7/81	NOS	Beaver Army Terminal, RM-53.5.
292	CM-39	7/8/81	7/29/81	NOS	Beaver Army Terminal, RM-53.5, top of 2.
293	CM-39	7/8/81	7/24/81	NOS	Beaver Army Terminal, RM-53.5, bottom of 2.
294	CM-39	7/30/81	8/20/81	NOS	Beaver Army Terminal RM-53.5, top. Depth and direction edited, temperature may be off.
295	CM-39	10/8/81	10/22/81	NOS	Beaver Army Terminal, RM-53.5, top of 2.
296	CM-39	10/8/81	10/22/81	NOS	Beaver Army Terminal, RM-53.5, bottom of 2.
297	CM-39	5/20/81	6/18/81	NOS	Beaver Army Terminal, RM-53.5, top meters. Combined and interpolated.
298	CM-39	5/5/81	6/19/81	NOS	Beaver Army Terminal RM-53.5, mid meters. Combined.
299	CM-39	6/23/81	7/24/81	NOS	Beaver Army Terminal, RM-53.5, mid meters. Combined and interpolated.
300	CM-40	7/30/81	8/10/81	NOS	Stella, RM-56.
301	CM-41	7/30/81	8/19/81	NOS	Fisher Island, RM-61, top of 2. Temperature off scale.
302	CM-41	7/30/81	8/19/81	NOS	Fisher Island, RM-61, bottom of 2. Temperature off scale.
303	CM-43	7/16/81	8/3/81	NOS	Off Longview, RM-64, top of 3.
304	CM-43	7/16/81	8/3/81	NOS	Off Longview, RM-64, mid of 3.
305	CM-43	7/16/81	8/3/81	NOS	Off Longview, RM-64, bottom of 3.
306	CM-43	8/4/81	8/19/81	NOS	Off Longview, RM-64, top of 2. Temperature off scale.
307	CM-43	8/4/81	8/19/81	NOS	Off Longview, RM-64, bottom of 2. Temperature off scale.
308	CM-45	7/30/81	8/7/81	NOS	Cottonwood Island, RM-70.
309	CM-46	7/16/81	8/3/81	NOS	Kalama, RM-75, top of 3. Depth constant entire file.
310	CM-46	7/16/81	8/3/81	NOS	Kalama, RM-75, mid of 3.
311	CM-46	7/16/81	8/3/81	NOS	Kalama, RM-75, bottom of 3. Time corrected.
312	CM-46	8/4/81	8/19/81	NOS	Kalama, RM-75, top of 2. Temperature off scale.
313	CM-46	8/4/81	8/17/81	NOS	Kalama, RM-75, bottom of 2, temperature off scale, shortened file.

Table L3. Wind Files, Tape 5

File	Station	Starting Date	Ending Date	Source	Comments
314	WM-3	2/13/78	5/5/78	COE	Astoria airport wind data decimated to 3-hour intervals.
315	WM-2	6/18/80	7/21/80	NDBO	Columbia River lightship. Winds and sea water temperature.
316	WM-2	3/25/80	5/21/80	NDBO	Anemometer at Columbia River lightship site; no temperature.
317	WM-1	10/14/80	10/28/80	CREDDP	Installed on the Astoria-Megler bridge.
318	WM-4	1/1/80	12/31/80	NMFS	Geostrophic winds calculated every 6 hours; pressure replaces temperature.
319	WM-2	6/18/80	9/30/80	NDBO	Columbia River lightship. Winds and sea water temperature (wind direction corrected).
320	WM-3	2/16/78	5/1/78	COE	Astoria airport wind data decimated to 6-hour intervals with (32 hr)-1 low pass filter.
321	WM-2	6/21/80	9/8/80	NDBO	Columbia River lightship site; sea water temperature; (32 hr)-1 low pass decimated to 6 hours.
322	WM-4	1/4/80	12/28/81	NMFS	Geostrophic winds calculated every 6 hours; has pressure; (32 hr)-1 low pass filter.
323	WM-4	6/1/77	6/30/78	NMFS	Geostrophic winds calculated every 6 hours; with pressure.
324	WM-2P	5/6/81	6/17/81	NOS	Pillar Rock anemometer; 32 hour low pass decimated to 6 hours; no pressure.
325	WM-2P	6/22/81	11/1/81	NOS	Pillar Rock Aanderaa anemometer; long combined file; 32 hour low pass decimated to 6 hour.
326	WM-1D	7/30/81	8/23/81	NOS	Desdemona Sands anemometer, with pressure; (32 hour)-1 low pass, decimated to 6 hours.
327	WM-1D	10/12/81	12/6/81	NOS	Desdemona Sands anemometer, with pressure; (32 hour)-1 low pass, decimated to 6 hours.

Table L4. Flow Files, Tape 5

File	Station	Starting Date	Ending Date	Source	Comments
328	TG-D1	3/1/78	4/16/78	COE	Bonneville Dam flows in 100,000 cfs.
329	TG-D1	1/1/80	9/4/80	COE	Hourly Bonneville Dam flows
330	TG-D1	9/11/80	12/31/80	COE	Hourly Bonneville Dam flows
331	TG-F1	10/1/77	12/31/81	COE & USGS	6-hourly flow at mouth*
332	TG-F1	10/1/77	12/30/81	COE & USGS	Daily flow at mouth*

*High flow = - 10300 cfs + 1.084*Bonneville + 1.757*Willamette at Portland
Low flow = 4139 cfs + 1.003*Bonneville + 1.632*Willamette at Portland

Table L5. VCTD Files

Tape	Files	Station	Starting		Ending	
			Date	Time	Date	Time
1	1-18	2N	10/18/80	9:30	10/19/80	2:30
1	19-41	2S	10/18/80	12:30	10/19/80	9:30
1	42-54	4NA	10/20/80	21:15	10/21/80	17:45
1	55-66	4NB	10/20/80	21:05	10/21/80	17:30
1	67-92	4SA	10/26/80	0:07	10/27/80	8:32
1	93-123	4SB	10/25/80	23:50	10/27/80	8:20
2	1-40	5NA	10/20/80	17:33	10/22/80	9:30
2	41-67	5NB	10/20/80	20:25	10/22/80	9:13
2	68-93	5NC	10/21/80	9:35	10/22/80	10:03
2	94-122	5SA	10/24/80	8:30	10/25/80	23:31
2	123-147	5SB	10/24/80	11:26	10/25/80	11:30
3	1-68	6SA	10/16/80	8:20	10/24/80	6:29
3	69-92	6SB	10/16/80	20:29	10/24/80	5:38
3	93-101	6SC	10/16/80	20:51	10/18/80	4:25
4	1-15	6SD	10/16/80	21:20	10/17/80	23:45
4	16-68	6SE	10/17/80	11:52	10/24/80	7:30
4	69-87	6SF	10/22/80	17:00	10/24/80	6:09

M. BATHYMETRY

Several hydrographic studies were undertaken by Northwest Cartography, Inc., between 1979 and 1982 for CREDDP, the U.S. Army Corps of Engineers Portland District, and the Corps' Waterways Experiment Station. Their purpose was to provide a bathymetric data base that could be used to study sediment accretion and erosion patterns within the Columbia River Estuary. Data from approximately 80 bathymetric surveys dating from 1852 to 1982 were grouped into eight survey periods and standardized. Programs were written to compute bedform surface areas within different depth regimes for each survey period, volumes of sediment displaced between pairs of survey periods, and differences in bedform surface areas between pairs of survey periods.

The primary difficulty in using any historical series of hydrographic surveys to develop bathymetric statistics is the non-uniformity of the surveys. There are cartographic inconsistencies within the hydrographic surveys such as tidal datum, geodetic control, and planimetric development of the shoreline. These anomalies can be dealt with adequately. The troublesome inconsistency which remains is intrinsic to the nature of hydrographic surveying, and it may be simply stated that the survey vessel does not repeat its survey track lines in identical locations from survey year to survey year. Thus, computing statistics from survey data that span a period of years (and in the case of the Columbia River Estuary a period of 130 years) would involve comparing a series of differently positioned arrays of point data. Organizing these data into a system for analytic processing was a major goal within the framework of these studies.

In addition to compiling contour maps, Northwest Cartography has produced a digital bathymetry index for locating and recalling specific subarea data; calculated sediment volume changes in the 6,528 grid cells that cover the estuary; calculated net changes in bedform surface area by grid cell and depth regime; and tabulated bathymetry and bathymetric differences in a series of five books with over 2,200 tabular files. The associated digital data set is described below.

Principal investigator for this work unit was R. Bradford Harvey of Northwest Cartography, Inc. For further information see:

Columbia River Estuary Data Development Program. 1983. Bathymetric atlas of the Columbia River Estuary. Astoria, OR.

M.1 DATA SET: Bathymetry

Digital representations of bathymetric data were made for approximately 80 historic and current surveys of the estuary to provide an overview of sediment accretion and erosion patterns. The data were grouped into eight survey periods and were used to produce high quality contour and differencing maps.

a. Variables

Bedform surface area
Displaced sediment volume
Water depth

b. Data Set Description

The bathymetry data set is one of the files in the computer archive. It contains 9 record types as described below. There are 350,000 records of 80 bytes. The data are associated with a region in the estuary by using quads and cells as explained and located on Figure M1. Data are presented in two ways: values for a given survey period, and differences between successive survey periods. All records begin with a 12-byte record identifier. The data set is sorted according to this identifier.

Record identifier:

Columns	Format	Contents
1	I1	Record type (Table M1)
3-6	I4	Survey identifier (Table M2)
7-12	F6.2	Location identifier: qqq.ee qqq is always the quad number (Figure M1); ee is usually the cell identifier but has other meanings in Record types 3 and 6.

Record type 1: Bedform surface areas for each survey period

The bedform surface areas for the 64 cells which comprise a quad are presented 8 lines per quad and 8 values per line. The bedform surface area for cell 34 is the fourth value on the line with cell identifier 31. Columns 13-80 are read 4X, 8F8.4. Units are hundred thousand square yards.

Record type 2: Sediment volume differences between survey periods

Data are presented in the same format as for Record type 1. Areas of accretion are positive values; areas of erosion are negative values. The data are presented in units of 10 million cubic yards.

Record type 3: Cell depth regimes and quad bedform surface areas by regime for each survey period

Regimes are depth classes as given in Table M3. Thus a value of 3.0 indicates the average depth of the cell was 3 to 6 feet below Columbia River Datum (CRD). The data are presented in the same manner as for Record types 1 and 2, with the addition of another record with cell identifier 01. The 8 values on

this record give the total bedform surface areas in the quad within each of the 8 depth regimes. These bedform surface areas are given in units of hundred thousand square yards.

Record type 4: Quad sediment volume differences between survey periods

These data are the sums of the 64 cellular values given for a quad on Record type 2. Columns 13-32 are read 4X, 2F8.3. The first value is the sediment volume difference; the second is the order of magnitude by which to multiply to get cubic yards (always 10E7.0).

Record type 5: Quad bedform surface areas for each survey period

This record is reformatted as for Record type 4. These data summarize Record type 1 values. The order of magnitude by which to multiply to get square yards is always 10E5.0. 1982 data are given in 2F8.4 format (others are 2F8.3).

Record type 6: Quad water depth values relative to CRD for each survey period

These data are presented as a 17 by 17 matrix whose values are depths along the transects which divide the quad into cells and along transects through the center of each cell. On each record the 2-digit extension to the quad number is the row number within the matrix. The row numbers are assigned from bottom (south) to top (north) within the quad. Thus the odd-numbered rows contain data from the corners and mid-points of the upper and lower boundaries while the even-numbered rows contain data from the centers and mid-points of the sides. The seventeen values on each record (row) are the depths along the transect from left (west) to right (east). Depths are expressed in feet below CRD. Negative values represent sample points above CRD. Columns 13-80 are read 17I4. For example, the second element of row 412.16 is the depth in feet at the center of cell 412.11.

Record type 7: Estuarine bedform surface area totals by depth regime for the survey periods

These data are the sums of the 01 records of Record type 3. Columns 13-80 are read 4X, 8F8.3. These data for 1885 are entered as Record type 8 (erratum) and are therefore out of order.

Record type 8: Estuarine bedform surface area totals for the survey periods

These data are the sums of the type 5 records.

Record type 9: Estuarine sediment volume differences between survey periods

These data are the sums of the type 4 records.

c. Sampling

The data were derived from USC&GS, NOS, and COE hydrographic survey sheets.

d. Processing

Hydrographic survey maps were digitized on a 15-second grid. Depth values were linearly interpolated to provide data at regularly spaced intervals. Displaced sediment volumes and bedform surface areas were computed.

e. Quality Control

The interpolated depth values along grid lines were displayed graphically as estuary transects to correct digitizing errors or to flag illogical depth values for review and editing.

f. Data Set Request Information: Tape 6 File 86

g. Alternate Sources

Contact: R. Bradford Harvey
Northwest Cartography, Inc.
9618 Roosevelt Way N.E.
Seattle, WA 98115

Table M1. Record Types

Type	Contents
1	Bedform surface areas by cell
2	Displaced sediment volumes by cell
3	Depth regimes by cell and bedform surface areas at each depth regime by quad
4	Quad summary of displaced sediment volumes
5	Quad summary of bedform surface areas
6	Water depths (in feet below CRD)
7	Estuary summary of bedform surface areas at each depth regime
8	Estuary summary of bedform surface areas
9	Estuary summary of displaced sediment volumes

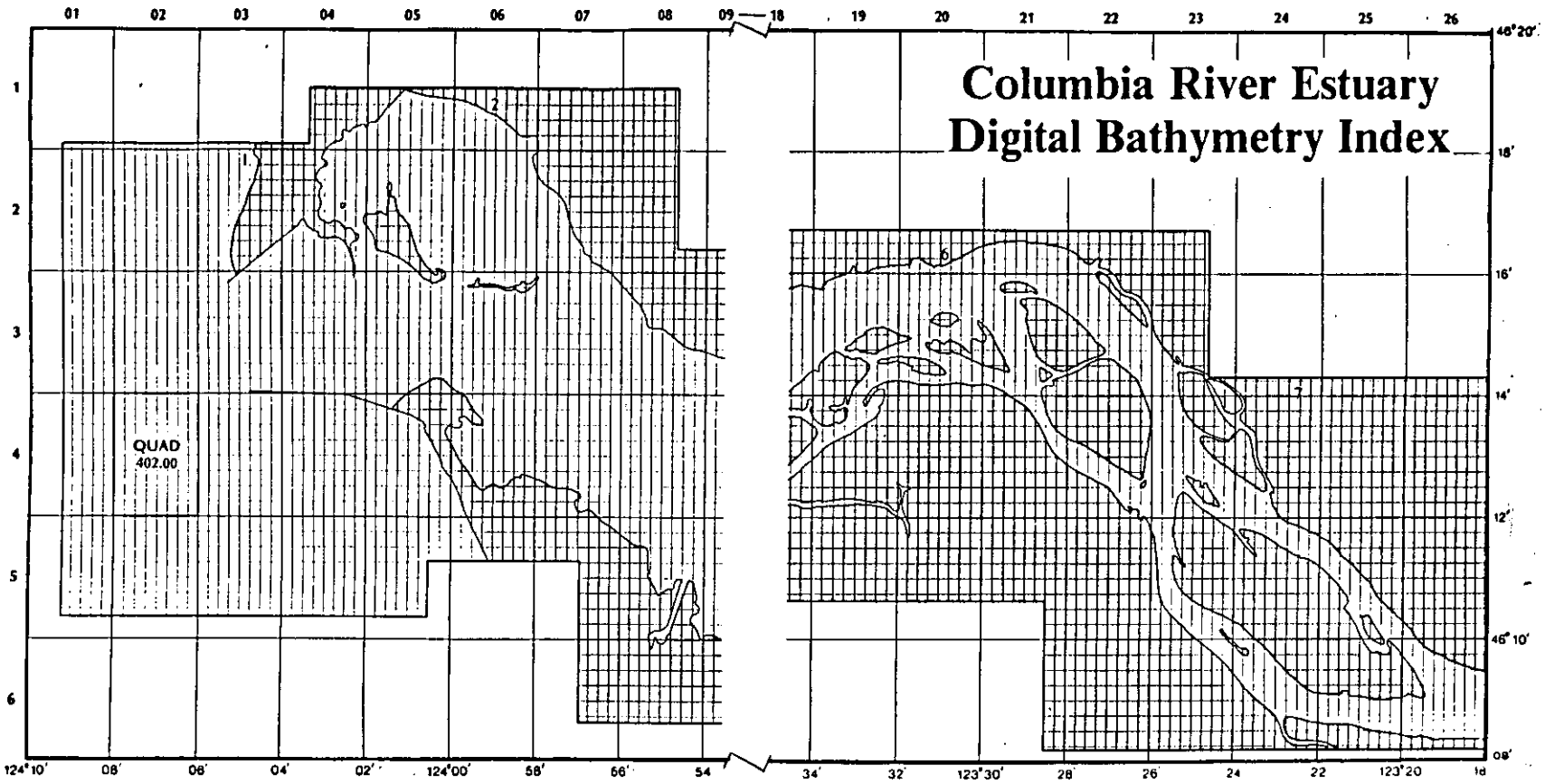
Table M2. Survey Identifier Codes

Code	Usage
0082*	1982 survey period
1852	1852 survey period
1868	1868-75 survey period
1875	1868-75 survey period
1885	1885 survey period
1895	1895 survey period
1902	1902-11 survey period
1911	1902-11 survey period
1935	1935 survey period
1958	1958 survey period
1982	1982 survey period
3558	Differences, 1935 vs. 1958
3559	Differences, 1935 vs. 1958
5268	Differences, 1852 vs. 1868
5882	Differences, 1958 vs. 1982
6835	Differences, 1868 vs. 1935
6882	Differences, 1868 vs. 1982
6885	Differences, 1868 vs. 1885
7535	Differences, 1875 vs. 1935
7582	Differences, 1875 vs. 1982 (1875 fills in gap of 1868 survey)
8595	Differences, 1885 vs. 1895
9502	Differences, 1895 vs. 1902
9511	Differences, 1895 vs. 1902
9535	Differences, 1895 vs. 1935

*Erroneously recorded identifier - should be 1982

Table M3. Depth Regime Codes

Code	Usage
1	CRD or above
2	0-3 feet below CRD
3	3-6 feet below CRD
4	6-12 feet below CRD
5	12-18 feet below CRD
6	18-30 feet below CRD
7	30-60 feet below CRD
8	More than 60 feet below CRD

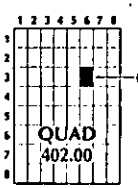


Columbia River Estuary Digital Bathymetry Index

Bathymetric data for approximately forty river miles of the Columbia River Estuary have been computerized and analyzed for processes related to bathymetric conditions such as river depth, sediment transport and river bottom surface area. These data may be retrieved to a unit cell size of fifteen seconds (latitude/longitude), a quad size of two minutes, by groupings of quads and/or cells comprising user-defined study areas, and by the estuary as a whole.

Indexing of the data has been organized using a six character identifier that specifies quad and cell in a decimal representation.

The integer component of the identifier is always a three digit number specifying a quad. The fractional component is a two-digit number specifying a cell within a quad. Thus, quad/cell identification is contructed as follows:



QUAD CELL 402.36

Position	Identifies	Numeric Range
1	Quad row number	(1-6)
2 & 3	Quad column number	(01-26)
4	Decimal point	—
5	Cell row number	(1-8)
6	Cell column number	(1-8)

Thus, the identifier 402.36 represents the cell in the third row, sixth column of the quad in the fourth row, second column of the Columbia River Estuary Digital Data Index.

Figure M1. Columbia River Estuary Digital Bathymetry Index

APPENDIX: Data Management Quality Assurance

There are several sources of error that might be introduced in either the processing or the archiving steps. Following is a discussion of the most likely problems and the steps taken to prevent them.

1. Processing

The errors introduced during processing are limited to some extent by the processing performed. In all cases the processing consisted of:

- reading an input record;
- finding associated data elements in a table; and
- writing an output record and its associated data in a new format.

This sounds reasonably straightforward. Table 1 shows some of the problems that might occur and the steps taken to prevent them.

Table 1. Processing Errors and Preventatives

Error	Checks
1. Records improperly read/written	A,B,C,F
2. New data elements improperly inserted	A,C,D
3. Records lost	B,E
4. Spurious records introduced	B,E

Preventative Checks

A. Periodic input/output check during processing
B. Output data sets printed and scanned
C. Sample input/output shown to originator for validation
D. Programming safeguards
E. Records counted during sorting, listing, and processing steps
F. System output log check

Improper reading of data has two basic causes and can have many consequences:

- the programmer might misinterpret the data specifications provided by the investigators; or
- the investigators might supply data that do not match their own specifications.

Improper writing of data that were properly read is strictly a programming problem.

Most mismatches between data and program will cause a failure of the program or produce obvious nonsense. These errors are detected when reading the system output log for each run. Occasionally data input errors are more subtle, causing misplaced decimal points or decimal places truncated. When feasible, the sample output was shown to the originator for validation. In some cases the sample data did not

adequately reflect the entire data set. To guard against unanticipated data or changes in format, many processing programs were written to print periodically an input record and its corresponding output. This technique was effective for data sets with a single format. All processed data sets were printed and scanned. This technique was effective for the shorter sets.

The reason for processing the data sets was to insert additional information into the file. What the new data would be was determined by matching data elements in the input record. For example, a station code was frequently used to find latitude and longitude in a table. Thus reading problems could cause insertion errors. All processing programs had traps to abort a run or print an error list if a table look-up failed.

Data files can also be corrupted if records are lost or spurious records introduced. Many files were sorted before processing. The sorting utility gives a count of the records. Other input files were printed with line numbers. The processing routines were designed to count the output records for comparison.

Knowledge of the structure of a data set can also help preserve its integrity. For instance, if it is known that each sample has six replicates, then both input and output count must be divisible by six. In at least two cases this type of analysis has led to the discovery and inclusion of records omitted from data sets sent to Data Management. In other instances knowledge of file structure has pointed out data entry errors.

2. Archiving

The archiving process consists of copying files from some source to the reels of magnetic tape which comprise the archive. Some of the most likely errors and ways to detect them are shown in Table 2.

Table 2. Archiving Errors and Validation Checks

Error	Checks
1. File truncated during copy	A
2. One file copied over another	B
3. Wrong file archived	C,D
4. Wrong tape mounted	D

Validation Checks

A. System output log checked
B. New directory produced after each update
C. Selected records checked on output tape
D. Selected files retrieved from archive and checked

The copy process is accomplished by invoking a system utility which requires the programmer to supply the location of the input file and the name and sequence number that the file is to have on the archive tape.

Each time this utility is invoked the computer prints a log detailing the attempts to locate and copy the file. If this log specifies a successful completion, it is virtually certain a faithful image has been produced on tape.

The most likely source of error in this process is specification of the wrong input file or archive sequence number. The latter is protected against by producing a table of contents each time a tape is updated. The new table is compared with the prior to make sure a file has not been overwritten.

The problem of archiving the wrong file is more difficult to deal with. Each data set has a unique format. If the data set consists of a single file, the data set may be identified by inspecting a single record. On the other hand, if there are many files in a data set, a single record cannot be traced to a particular file unless there is some unique data element in that record. Data sets from two work units (Sediments and Currents) have several files apiece. Because of the large number of files (approximately 1,000) the archival process was automated. The order of these files on the source tape was determined by directories supplied by the originators. These directories were input to programs which generated instructions to the copy utility. If the directory was inaccurate or if a computer operator mounted the wrong input tape, the wrong file would be archived. There is a way to check most of these files once they are on the archive tapes. All but the Sediment raw data files contain header records which identify the file. Thus, if the header records can be seen the file can be validated. A utility was available which scanned a tape and printed periodic records. By a stroke of good luck, the header record with the identifying data was printed for several of the data sets. For the other data sets, spot-checking has revealed no archiving errors.

Data sets from work units other than Sediments and Currents consist of one file each. Most of these required processing. Standard operating procedure was to archive the files when they were ready, produce a new directory of tape contents, then produce a back-up copy of the archive tape. The utility which produced the back-up copy also printed periodic records. Thus, these files could be identified and confirmed.

3. Quality Improvement

The previous sections have dealt with defensive strategies: ways to prevent a deterioration of the data during processing or archiving. It should be kept in mind that the goal in processing data files was to improve them, to include associated data that if left in printed form or on a separated file might get lost, and to standardize formats to some extent.

In two instances the efforts went much further. Programs were written to screen data files, tabulating frequencies of data elements. On the basis of this effort numerous data entry or record order problems were discovered and corrected.

CREDDP DATA REQUEST FORM

1. REQUESTER INFORMATION

Name_____

Organization_____

Street_____

City_____State_____Zip_____

Telephone (____)_____

Intended use of the data_____

_____

_____

2. REQUEST INFORMATION

Output media:

( ) Print
( ) Magnetic tape (must be supplied by requester)

Magnetic tape labels:

( ) IBM standard label
( ) No labels

Requested files:

Tape	File numbers
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____

Mail to:
Department of the Army
Portland District, Corps of Engineers (NPPL)
P.O. Box 2946
Portland, OR 97208
ATTN: Planning Division