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Discussion Document

**REPORT OF THE
FISHERIES INVENTORY TASK FORCE**

ON

FISHERIES CONSERVATION AND MANAGEMENT

INVENTORIES FOR THE FUTURE

B.C. RESOURCES INVENTORY COMMITTEE

FISHERIES INVENTORY TASK FORCE

MAY 1992

PREAMBLE

This report is submitted to the Resources Inventory Committee (RIC) by the Fisheries Inventory Task Force.

The Resources Inventory Committee consists of representatives from various ministries and agencies of the Canadian and the British Columbia governments. First Nations peoples are represented in the Committee. RIC objectives are to develop a common set of standards and procedures for the provincial resources inventories, as recommended by the Forest Resources Commission in its report The Future of Our Forests.

To achieve its objectives, the Resources Inventory Committee has set up several task forces, including the Fisheries Inventory Task Force. The terms of reference for the Task Force were to review information needed for the definition and monitoring of conservation levels for wild fish populations and for habitat preservation. This is the full report of that work.

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Contents of this report are presented for discussion purposes only. A formal technical review of this document has not yet been undertaken. Funding from the partnership agreement does not imply acceptance or approval of any statements or information contained herein by either government. This document is not official policy of Forestry Canada nor of any British Columbia Government Ministry or Agency.

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FISHERIES CONSERVATION AND MANAGEMENT:
INVENTORIES FOR THE FUTURE

EXECUTIVE SUMMARY

The B.C. Resources Inventory Committee (RIC) was established to deal with two critical issues concerning land and resource inventories:

1. What information is <u>vital</u> for effective land management, at what levels of detail and for what purposes?
2. How can this information most effectively be acquired in a manner that minimizes duplication, promotes cooperative data collection, and encourages broad application and long term relevance?

This report addresses the first of these issues for fish and fish habitat in stream and lake environments. Its findings, integrated with the needs and capabilities of other resource inventories, will provide direction for the development and testing of methods and standards over the next 3 years.

Inventory Levels of Detail

Three levels of detail or inventory "intensity" have been recognized in this report. They are intended primarily for convenience of discussion but provide some structure and are similar to those employed previously in fisheries and in the inventory of other resources.

overview: provides a context within which to discuss fish and fish habitat values and capabilities in a provincial context; where to manage rather than how to manage; focus on whole streams and areal units larger than 100 km^2; roll up of office-generated, anecdotal and existing data; presentation scale normally 1:250,000 but may range from 1:50,000 to 1:500,000.

reconnaissance: provides information on the abundance and location of important populations and habitats; used to group systems for management purposes and application of models; focus on stream reaches, individual lakes and watersheds greater than 5 km^2; field observations but few point/site examinations; presentation scale normally 1:20,000 to 1:50,000.

intensive: provides data for the management of individual populations, for specific operational applications and for the development of models and classification systems; focus on habitat units within stream reaches and lakes; extensive field

work with many point/site examinations; presentation scale larger than 1:20,000 and commonly 1:5,000 or larger.

What Information is Vital?

Vital information is information that can be used to help conserve the fisheries resource and its habitat. The major traditional users have been the regulatory agencies -- especially the federal Department of Fisheries and Oceans (DFO) and the Fisheries Program of the B.C. Ministry of Environment, Lands and Parks (MELP) -- and the proponents of development. The expectation at the beginning of this exercise was that careful focus on objectives would decrease the variety and quantity of information required for management.

That expectation has not been met. Expanding requirements for natives, environmental non-government organizations and the public together with a broadened environmental ethic have added to the variety of information that must be provided by inventories. Sport and commercial species remain important but there is now interest in the characteristics and vulnerability of populations of all species. Riparian environments are critical and often threatened habitats that have not been well incorporated into inventory systems and data needs have yet to be defined for sensitivity evaluation in most environments. The inventories of the future will be more rather than less complex.

Another side of this issue is that the existence of inventory data does not, in itself, serve the needs of users. Past inventories have been ignored or applied ineffectively because users were untrained and interpreted products were not supplied. Most users do not want raw data; they want easy access to information that can be rapidly applied to meet operational needs.

The State of Methodologies

There is a significant history of fisheries resource inventory in British Columbia although that history has been seriously tarnished by neglect over the past 10 years. For the most part, basic data collection methodologies do exist although many are not fully documented. Thorough reviews are required to provide the content, detail and standards needed for current interpretations. Sufficient consistency and statistical validity must be introduced to enable use for monitoring.

Specific issues include:

■ development of an effective sampling strategy for the broad range of species

that are of current interest;
- additional attention to tributaries of lakes;
- realistic treatment of riparian environments and of biological and habitat sensitivity;
- expansion of angler use indexing methodologies to cover all major fishery and habitat types;
- development of a data card and certification program to prevent further loss of data collected for fish/forestry guidelines classification;
- application-specific methodologies, particularly at the intensive inventory level; and
- examination of the opportunities and potential savings offered by new technologies including remote sensing.

Finally, one of the greatest immediate needs is for a computer-based overview methodology to provide data for the high profile conflict resolution initiatives (e.g. CORE, FLMP) that are driving the current high level support for inventory.

Classification, Models and Research

Province-wide classifications have the potential to generate valuable interpretive products for management but have not yet been used extensively. Examples range from value rating classes for stocks and habitats to watershed and channel response and sensitivity indexes to fishable waters classes. There is potential for using biophysical classification systems as the basis for estimates of habitat capability in areas where insufficient data exists to apply models on a system-specific basis.

There is also considerable opportunity for more effective use of models, especially models for habitat capability and survival. Research requirements need to be established in the context of a thorough review of existing models. The most important role for research, however, is to improve our understanding of how systems work. This is the only the way that we can expect to meet the many needs that cannot be anticipated today. Research basins like Carnation Creek are cost effective but the probability of any long term project surviving the changing priorities of government agencies must be considered.

Coverage and Access

Government inventory capability has declined dramatically over the past 10 years. Most recent data collection has been largely funded by development proponents. Only a small number of trained inventory practitioners remain in the province.

The net effect is both inadequate coverage and poor access to existing data. The most basic information to keep up with development is lacking in many areas. The federal-provincial Stream Information Summary System (SISS) brings together existing fisheries data for over 4,700 streams but focusses largely on anadromous sport and commercial species and is not fully georeferenced. At the reconnaissance level much of the inventory is old and there are large gaps in coverage, especially in the northern two-thirds of the province. Standard surveys have been completed for about 3,000 of 25,000+ lakes and for about 20% of the streams in the province. The recent guidelines-generated inventory is variable in both content and availability and many small but important stream reaches are not picked up at all. Verification and capture of even a portion of this data could be a significant short term gain.

Access to data is another major issue. One of the most urgent problems in fisheries agencies today is inability to rapidly locate and apply existing information, some digital, but most still hard copy in files, map cabinets, etc. Stream survey data, for example, is currently stored hard copy on cards -- in the order of 25,000 in total -- because no electronic data base has been developed. Computer systems can provide effective access and simplify data sharing but the cost of data conversion will be immense.

Management of Expectation

Cost-benefit judgements have not been rationally applied to inventory in the past. Outside of forestry, politicians and senior bureaucrats have tended to view most inventory as too expensive without looking in any detail at the costs of not having that inventory. The creation of RIC and support of its activities demonstrate a potential change in that point of view. The challenge will be to find enough short term successes to maintain support for inventory programs while modern methodologies and products are being developed, while existing data is expensively being converted to digital, and while new data relevant to today's issues and concerns is being acquired and analyzed.

B.C. RESOURCES INVENTORY COMMITTEE
FISHERIES INVENTORY TASK FORCE
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1.1 Context and Purpose

The British Columbia Resources Inventory Committee (RIC) was established to deal with two critical issues concerning land and resource inventories:

1. What information is <u>vital</u> for effective land management, at what levels of detail and for what purposes?
2. How can this information most efficiently be acquired in a manner that minimizes duplication, promotes cooperative data collection, and encourages broad application and long term relevance?

The Committee reflects the realization by government both that the state of inventories in the province is inadequate and that the costs of collecting information that is either not needed or not easily usable are potentially very high.

This report addresses the first of the above issues for fish and fish habitat, one of seven inventory components (now eight with the addition of climate) identified in a report prepared for RIC by G.G. Runka Land Sense Ltd. (1991). The findings summarize the collective inputs to a <u>Fisheries Inventory Task Force</u>, established to link the experiences and needs of the Department of Fisheries and Oceans (DFO), the Ministry of Environment, Lands and Parks (MELP), other federal and provincial agencies, educational institutions, industry and others. At this point in time, the report does <u>not</u> include inputs from aboriginal peoples or from many of the non-government organizations that could potentially contribute to the topic.

Appendix 1 lists the members of the Task Force Steering and Working Groups.

1.2 Content and Scope

The focus for this initiative has been on information needed for the definition and monitoring of conservation levels for wild fish populations, for the preservation of the habitat upon which those populations depend, and for co-operative management of the resource. Stream and lake environments are included here; the marine shore-zone is covered in a companion report being prepared under the leadership of D.E. Howes, Environmental Emergency Services Branch, MELP; ocean inventory has <u>not</u> been con-

sidered by the Task Force.

The most difficult part of the process has been the separation of user wants from user needs and the presentation of those needs in a structured and understandable format. Some assistance was provided by a previous "User Needs Analysis" (Mathers et al, 1985) but that investigation was much more limited in both scope and level of detail. Section 2 of this report deals with user needs and is followed in Section 3 by a summary of the status, history and availability of current and past fisheries inventories in the province. Requirements for non-fisheries data are noted as are gaps and overlaps, both thematic and spatial, in present inventory coverage. Comparison of needs with current status provides the basis for identification of the major issues facing fish and fish habitat inventory today and some indication of the most productive directions that could be taken in the near future. Issues and directions are discussed in Section 4.

Note that no attempt is made here to describe detailed structures, contents, methodologies or products for any of the several aspects and levels of detail of fisheries-related inventory. That process awaits acceptance of this report and integration of the needs of other resource managers for information that can be most usefully collected as part of a fish and fish habitat inventory.

1.3 Methodology

The Fisheries Task Force approached this project by establishing a broadly based Steering Group (Appendix 1) and by contracting out specific tasks, canvassing of the forest industry, for example. A Provincial Working Group was also organized. The majority of the work, however, including preparation of this report, was carried out by MELP Fisheries and DFO Habitat Management HQ inventory staff. This reflected the difficulty of the task, primarily because of the legacy of chronic underfunding, the absence of experienced -- and available -- consultants, and the need and desire of HQ staff to develop a thorough understanding of the status, issues and best future directions for fisheries inventory.

The Steering Group met once to begin the process. The meeting provided an initial input of ideas and set directions and tasks to be dealt with by consultants, working groups and staff. Two meetings of the Provincial Working Group followed, focussing on the identification and definition of user needs. A 2-day meeting of a small number of Steering Group members served to emphasize the complexity of the task and to demonstrate the need for a written product to stimulate further constructive input.

Throughout the same period, a broad range of users and collectors of inventory data, both inside and outside government, were questioned about the status, use and

adequacy of existing and past inventories and their products. A provincial question-naire, modelled after the RIC standard, was distributed and then followed up by phone or visit. Approximately 200 additional questionnaires, focussing on the Stream Information Summary (SISS) and Stream Survey inventory systems, were circulated both internally and externally by DFO. A phone survey of inventory procedures and issues in neighbouring jurisdictions is also in progress: an annotated bibliography of relevant information is being compiled, with about 120 references to date.

The project is far from complete as of this writing. Methodology development and testing will take place over the next 3 years. Further examination of user needs will be included. For example, a contract to catalogue the needs and data sets of aboriginal peoples has been proposed but not let; this is a very important omission because of the large investments natives are currently putting toward the aquisition of information for land claims negotiations and for future resource co-management. This report presents only the information available to its authors at the date of publication.

1.4 Definitions

Any discussion of this sort is dependent upon a common understanding of funda-mental terminology. The most important in this context is the word inventory itself, defined here as:

inventory: basic descriptive data about the state of an element or entity, gathered by standard procedures and organized systematically, that can be applied for broad management purposes; inventory can include and should be structured for repeated data collection at a site.

Other terms worthy of definition include:

data: facts about things that we care about in our surroundings; strictly the plural of "datum" but now also well established as a mass singular noun denoting a collec-tion of material (Gillenson, 1990; Merriam-Webster, 1985).

information: data processed to be of use for some purpose (Gillenson, 1990).

application: a process where, together with other ingredients, information is applied to the achievement of a specific business objective.

Additionally in this report, and primarily for convenience of discussion, three levels of detail or inventory "intensity" have been recognized: overview, reconnaissance and intensive. The general characteristics of each are described in Table 1.

The levels overlap and the applications for which they are used vary among both individuals and areas of the province. They do provide some structure, however, and they are similar to those employed previously in fisheries and in the inventory of other resources.

Table 1. Inventory Levels of Detail

Overview

- presentation scale normally 1:250,000 but may range from 1:50,000 to 1:500,000.
- regional and sub-regional applications; values in a provincial context; where to manage rather than how to manage.
- spatial units: drainage basins or cumulations of drainage basins, 10,000 to 40,000 ha in area; could involve identification of macro stream reaches (e.g. zones with and without significant valley flat) but most frequently will deal with whole streams.
- comprised primarily of office-generated, anecdotal and existing data; may use satellite or small-scale photographic imagery.
- province-wide coverage required.

Reconnaissance

- presentation scale normally 1:20,000 to 1:50,000.
- local/basin scale applications; used for classification and management of groups of similar features.
- spatial units: drainage basins greater than 500 ha; stream reaches -- rarely whole streams -- and lakes as elements.
- reach/watershed/whole lake observations; few point/site examinations.
- field observations; medium-scale vertical aerial photography; aerial videotaping.
- priority to high value/high potential impact areas; sufficient provincial coverage to permit interpolation/extrapolation.

Intensive

- presentation scale larger than 1:20,000; commonly 1:5,000 or larger.
- operational applications; management of individual stocks.
- individual inventory variables may be acquired using provincial standards but variable "mix" will depend upon the specific application.
- spatial units: habitat units within reaches; many point/site examinations.
- extensive field work; detailed biological and physical measurements; large scale (usually custom) aerial photography; aerial and ground videotaping.
- highest priority areas only; also for point/site locations examined in detail in reconnaissance inventories.

2. INFORMATION NEEDS ANALYSIS

The results of the needs analysis are presented in tabular form in Appendix 2. A large amount of information is included but the volume hides significant constraints on the completeness and reliability of the content: many users have not yet been surveyed; there is some missing data for those that have; and, most importantly, we do not presently have a reasonable understanding of several/many of the components. These limitations are accentuated by a deliberate attempt in the needs analysis to go beyond what we "know" and to speculate on needs for the near future.

Key findings are discussed here and summarized briefly in Table 2.

2.1 Users and Their Objectives

Appendix 2.1 identifies present and potential users and lists their primary "business" objectives and specific applications for fisheries inventory information. The major traditional users, not surprisingly, are the provincial and federal government fisheries regulatory agencies who have also historically been the major data collectors. These organizations use the information primarily for resource and habitat management but there has been a recent shift in focus to include conservation as well as resource use. Managers of associated resources, e.g. water, parks, are also major users.

The second most important group of users are the proponents of development, both government and industry. Their primary objective, usually, is to use inventory information in order to comply with regulations and guidelines. The need to monitor the impacts of development has led to recent increased interest in fish as indicators of environmental health.

There are a number of other collectors/users that must be considered more carefully in the future: aboriginal peoples; environmental and other non-government interest groups; and the public because of improved environmental awareness and freedom of information legislation.

2.2 Applications and Information Needs

Appendix 2.2 takes the applications identified in Appendix 2.1, stratifies them by level of information detail required and lists associated information needs for each application. The data and methods needed to develop usable products are discussed for each information need in Appendix 2.3. This appendix also includes comments about specific issues that need to be resolved in order to effectively meet each information need.

2.2.1 Overview Level

The general characteristics of overview level inventory, as the term is used here, are described in Table 1. At this level, information needs for fisheries focus on fish and habitat values -- social, economic and biological, on sensitivities and on human activities, both past and projected. A fundamental requirement is to define the state of the resource province-wide and and to express it in understandable form so that defendable values can be assigned to individual parts. The most important applications for overview data are large area planning and public communication.

Most users see overview inventory as a roll up of data acquired at the reconnaissance and intensive levels. The products developed would use models, classification systems and biostandards developed at these more detailed levels. The objective would normally be a compilation of existing data in a form permitting rapid generation of summary products on demand, during planning processes, for example.   This, in turn, would demand a sophisticated geographical information system (GIS) environment: i.e., fast and flexible access to the information products by geographical location.

New high profile planning initiatives -- the Commission on Resources and the Environment (CORE), Forest Land Management Planning (FLMP) -- make the need for effective inventories at this level of detail urgent.

2.2.2 Reconnaissance and Intensive Levels

Again, the general characteristics are described in Table 1. The two levels are considered together here because the data and models employed are frequently similar, differing only in intensity of sampling and in understanding of processes and responses.

a) Fisheries Values

The establishment of fisheries values is also an essential component of most inventory applications at the reconnaissance and intensive levels of detail. Data needs include population identification, classification, size, life history, dynamics and vulnerability. An expansion of interest to include all species, especially rare and endangered, is relatively recent. In the past DFO focussed on salmon and provincial Fisheries primarily on trout and char. This new and broadened focus demands appropriate sampling methodologies and intensive sampling, at least at representative sites.

Significant effort is needed to develop appropriate classification systems for conservation and management: wild/augmented/hatchery stock classes, stock value ratings,

etc. Recent judicial decisions give natives priority rights to harvestable surpluses. For this reason alone, the determination of acceptable conservation levels for streams province-wide has become essential. The few proven methods available, unfortunately, require intensive time-consuming sampling. In many instances, though, good classification systems have the potential to allow effective management of stocks and habitats of similar character even in the absence of detailed sample data.

Monitoring of both the state of the environment and of development specific impacts demands inventory systems that are statistically repeatable. In practice, however, this is often difficult to achieve for fish because of the confounding effects of habitat changes.

b) <u>Habitat Values</u>

Habitat information needs include quantification of available habitat area as well as description and classification. Fish/forestry guidelines classifications require only simple reach-level data about habitat (e.g. gradient) and/or fish presence but more detail is needed for most applications. Critical habitat locations for fish (shore spawning areas in large lakes, for example) need to be identified and mapped. Inventories must include "habitat" for anglers and other users as well as for fish.

Initial inventory objectives are usually to quickly determine whether or not a stream or lake can support fish (by winter O_2 survey on lakes, for example) and to identify the fishery type (e.g. wilderness). The next step is to plan for protection of important values, viewscapes, etc. -- a mix of reconnaissance and intensive inventory.

Capability and constraints for fish production are critical for many applications: e.g. definition of conservation levels, prescriptions for enhancement. Reliable models for determining the productive capacity of habitat and for assigning survivals are required. These models can be expected to differ both among and within habitat types: lakes vs. streams; monoculture vs. coarsefish lakes, for example. They will usually be developed from intensive data but will frequently be applied at the reconnaissance and overview levels. Models -- and inventories -- for lake populations should consider the role of tributary streams.

Riparian environments are critical and often threatened habitats that, to date, have not been well incorporated into inventory systems. The term as used here encompasses all land "influenced by the presence of the adjacent ponded or channelled water" (Bunnell et al, 1991) and, as such, includes floodplains as well as channel bank environments. Riparian areas significantly affect many stream processes and can provide essential habitat for fish away from mainstem channels.

Finally, the need was also expressed for the development of province-wide

watershed classification systems. An updated hierarchical watershed coding system (see Guide to the Hierarchical Watershed Coding System for British Columbia, 1988 for a description of the present system), for example, could be used in some instances to define and stratify both inventory content and use: low stream order (small units) for information related to the application of logging guidelines; higher order (larger units) for fishing regulations. More comprehensive sytems based on physical, climatic and biologic variables would be used to organize information, to assist in extrapolation, and to identify critical locations for research.

c) <u>Sensitivity</u>

The term sensitivity refers to the ability of an organism or habitat to resist or quickly recover from changes in controlling factors. These changes may be natural or man-induced. The concept also includes sensitivity to long-term combination or cumulative effects. <u>Biological sensitivity</u> encompasses the susceptibility of a population at a specific life stage to changes in environmental variables like water quality and temperature, to loss of habitat, and to levels of exploitation. The other major component of sensitivity assessment, <u>habitat sensitivity</u>, includes watershed, riparian and in-channel components.

Specific data needs for sensitivity evaluation have yet to be defined for most environments. They will be generated by the development of systems for flagging potentially sensitive populations and areas and for assessing their ability to recover from impacts. The "Watershed Workbook" for coastal British Columbia watersheds (Wilford, 1987), currently under major revision, provides an interesting example of an approach to the cumulative effects issue for habitat, an approach that defines a range of data requirements that are not traditionally associated with fisheries inventories.

For most environments and situations, the development of effective systems, most importantly systems with relatively simple data requirements, awaits research to provide an improved understanding of species requirements and process-response relationships.

d) <u>Resource Use</u>

This component of a fisheries inventory package includes both present effort, harvest and use by various interest groups and the data needed to project future demand. Needs are reasonably well defined in this instance but substantial investment is required in methodology development, especially development that takes advantage of today's technologies. Meaningful analysis of trends is critical for most applications of resource use data and this demands consistent methodologies over time.

e) <u>Management Practices</u>

Management practices inventories contain records of fishery types, hatchery releases, transplants and lake rehabilitations. Catalogues of enhancements are also included. Easily accessible regulations data is particularly essential because most management of fisheries is by regulation. Again needs are reasonably well defined and, in this case, many methodologies are as well.

2.3 Beyond Inventory Content

The survey also identified important user needs concerning the inventory of fish and fish habitat that go beyond the actual content of that inventory.

Most imperative is the need for fast, flexible, low-cost access to data. One of the most urgent problems in fisheries agencies today is inability to rapidly locate and apply existing information, some digital, but most still hard copy in files, map cabinets, etc. The same access is required to other people's data: fisheries management does not occur in a vacuum. The often-stated assumption by users is that access will be provided primarily by computerized information systems, especially geographic information systems (GIS).

Non-fisheries data requirements include:

- assorted administrative and cultural themes
- property types and boundaries (cadastral)
- present and proposed land use
- development locations and descriptions, both existing and proposed
- effluent sources and water withdrawal locations
- topography
- terrain and soil type including erosion hazards
- environmentally sensitive area designations
- vegetation
- water quantity and quality
- climate, especially precipitation

Most users were supportive of the Resources Inventory Committee Terms of Reference. Integrated inventories are widely viewed as essential, not only for the success of inventory programs but also of associated computerized information systems and, in the end, for the effective conservation and management of fish and fish habitat. There are reservations associated with this view, however: users are concerned that compromises associated with integration not be permitted to diminish the quality and timeliness of resource-specific activities.

The need for flexible systems that look to future demands and technologies was also raised, the only certainty for the future being that applications and information requirements will change.

Table 2. Summary of User Needs

General

- major traditional users are provincial and federal fisheries regulatory agencies.
- second are development proponents; needs are primarily dictated by regulations and guidelines.
- expanding needs for natives, environmental and other non-government organizations and the public.
- need for fast, flexible, low-cost access to existing data is as important as new data; this includes access to a wide assortment of non-fisheries information.
- new methodologies must be both integrated and flexible; change is the only certainty for the future.

Overview

- fish values: state of the resource.
- habitat values: critical habitats; capability.
- biological (population) and habitat (watershed) sensitivity.
- human activities including resource use and proposed development.
- most important applications are large area planning and public communication.
- requires ability to rapidly generate summary products on demand (GIS).

Reconnaissance and Intensive

- fish values: past focus on a narrow range of gamefish has given way to interest in the characteristics and vulnerability of populations of all species; need to define conservation levels requires good systems for classification.
- habitat values: critical areas for fish and for users; capability and constraints for fish production; must include riparian environments; must provide data for fish/forestry guidelines classifications; watershed classification system needs to be developed.
- sensitivity: specific methodologies have yet to be defined for most environments; research and development needed.
- resource use: must include location-specific projections of future demand as well as present use; trend analysis is critical; substantial methodology development required.
- management practices: effective access to regulations data is particularly essential; methodologies are reasonably well defined.

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3. THE CURRENT STATUS OF INVENTORIES

Appendix 3.1 summarizes individual inventories reviewed during the project by level of detail, name, collecting agency, status, and inventory type. Full questionnaire returns for some of the major inventories are included as Appendix 3.2. Those without completed questionnaires are outlined in a consistent format in Appendix 3.3.

The key findings are reviewed in this section of the report and summarized in Table 3.

3.1 Collectors and Their Inventories

The major collectors of fisheries information in British Columbia are the federal Department of Fisheries and Oceans (DFO) and the Fisheries Program of the provincial Ministry of Environment, Lands and Parks (MELP). The Ministry of Transportation and Highways (MOTH) has also been a significant collector as has the forest industry, primarily for input into interagency guidelines and referral processes and for mitigation/compensation activities. Recently, B.C. Hydro has funded large inventory programs as part of compensation agreements and various native organizations have used government funding to compile fisheries-related information to use in land claims negotiations. Museum and educational institutions remain the centers for much of the expertise in fish taxonomy and for biodiversity considerations.

Government in-house capability has declined dramatically over the past 10 years. Most recent data collection has been carried out by consulting companies, largely funded by development proponents but frequently following methods suggested by the agencies. Only a small number of trained inventory practitioners remain in the province.

Inventories range from major province wide programs to those focussed at specific projects. The data types collected can be categorized as:

- fish and fish population only
- habitat or biophysical, usually including fish, and commonly directed at one of lake, stream or riparian habitat types or at watershed sensitivity
- resource use
- management practices

These current inventory types closely match the user need areas identified in Section 2.

The discussion which follows is ordered by inventory type. Again, overview level inventories, which commonly represent roll-ups of a broad range of existing more detailed inventory products, are treated separately.

3.2 Existing Overview Inventories

Six overview inventories are listed in Appendix 3.1. DFO and MELP are identified as the collectors for all of them but other agencies provide non-fisheries information relevant to the overview products.

The major federal-provincial overview product is SISS, the Stream Information Summary System. This inventory, which is also a computerized relational attribute database, brings together data from a variety of sources to provide a snapshot of the fish and fish habitat data available for a stream. Information includes stream location, gradient, obstructions, flow, fish distributions, escapements, life history timing, enhancement and management activities, land use, water use and water quality, fish production capability and potential constraints. New field information is not collected.

Coverage by SISS includes over 4,700 streams in all DFO Pacific Region subdistricts. Emphasis has been placed on anadromous streams and the East Kootenays. Products include hardcopy maps and bound catalogues and reports, with limited access to the database. SISS is viewed as a very valuable product and is used by a large number of internal (DFO/MELP) and external users for initial information gathering, for input to large area planning processes and for screening of referrals. Problems include the focus on sport and commercial species, restricted coverage in areas without anadromous species, and the lack of a digital map product.

The National Survey of Sportfishing is another broadly useful overview-level inventory. This Canada-wide survey generates information on angler use, angler harvest by species, satisfaction and economics. A provincial summary is prepared. The National Survey is very useful for determining trends and future needs.

The "bottom line", however, is that a comprehensive overview product for both streams and lakes that summarizes fish and habitat values and sensitivities together with human activities does not yet exist.

3.3 Fish Inventories

Virtually all of the inventories listed in Appendix 3.1 have components dealing with fish. At the reconnaissance level, data sets include species presence/absence, identification and cataloguing, and distribution and relative abundance. The intensive

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level adds estimates of current juvenile or adult population size, and studies related to stock specific population dynamics.

Some inventories specialize in the identification and cataloguing of fish. The Royal B.C. Museum (RBCM) and educational institutions (e.g. UBC) have long been involved with the inventory of fish populations. The RBCM guide to freshwater fish of B.C. is an example. Collections of fish are held at both UBC and at the RBCM and both conduct research into fish taxonomy. The MELP Conservation Data Centre (CDC) is relatively new on the provincial scene and is actively preparing catalogues of rare and endangered species of fish using existing data.

Other fish data collection programs include DFO and MELP reconnaissance level biophysical surveys and intensive surveys to determine current population status and the productive capability of habitats. The standard reconnaissance lake and stream survey methodologies are dated, however, and do not adequately characterize the broad range of species that are of interest today. Escapement estimates are done for most salmon streams (SEDS) and for kokanee in several interior large lakes. Intensive level fish data, suitable for determining stock status, is collected in Habitat Capability Stream Surveys and age and growth information is provided by creel/angler surveys of individual small lakes. Levels of contaminants in fish are included in the DFO Habitat Dioxin data base. An extensive and often unorganized collection of stock management data resides in both provincial and federal regional files.

3.4 Biophysical Inventories by Habitat Type

a) <u>Lake Surveys</u>

Standard reconnaissance level surveys have been completed for about 3,000 of the 25-30,000 lakes in the province (10 %) by MELP Fisheries. Much of the data was collected in the early 1950's and 60's. Methodologies have developed over time and are now standardized; a draft methodology is available. The information collected is reasonably complete, but that for associated streams is not.

Preliminary lake surveys are used to determine if lakes do or could support sport fish. A winter limnological survey methodology which focusses on the risk of winterkill is employed in several regions of the province and coverage exists for over 500 lakes. Preliminary surveys are viewed by resource managers as extremely valuable for planning purposes.

Several provincial government regions modify the standard reconnaissance survey to provide only that information vital to the protection of fisheries values in the face of imminent development. This forms the major lake inventory work in

theThompson/Nicola region, for example. Methods for these abbreviated surveys have been documented but not standardized.

Data from all lakes surveyed is being entered into the new B.C. Lakes Database, a computerized relational database management system that can be accessed by GIS software.

b) <u>Stream Surveys</u>

The reconnaissance stream survey is the most widely used stream inventory method. The current DFO/MELP Fish Habitat Information and Inventory Program (FHIIP) format evolved from 1970's provincial Resource Analysis Branch (RAB) methodologies. Surveys are focused on stream reaches. Descriptions include basic stream channel physical properties, obstructions, flow, water quality and fish species presence, especially game fish. Methods are documented and are widely used although, as previously noted, the biological component does not meet current needs and is frequently augmented in the field. Approximately 20% of the province was covered in a systematic fashion up to the early 1980's. Since that time, only project related and opportunistic data collecting has occurred. Data is currently stored hard copy as cards - in the order of 25,000 in total - because no electronic data base has been developed.

Habitat Capability Stream Surveys are conducted using standard population survey methodologies. Intensive juvenile fish population estimates are carried out in discrete habitat units within stream reaches. Coverage is limited to project specific areas in the Skeena and Thompson drainages, the Kootenays, the Lower Mainland and on Vancouver Island. The basis for data interpretation is a family of habitat models including a habitat productivity model (currently under review) relating fish size and density to habitat. These models can be applied at all levels of detail using map and regionalized water chemistry and hydrology information. The habitat productivity model has been applied at the overview level for Skeena and Thompson steelhead. Determination of stock productivity and definition of conservation levels for fish stocks are the major applications.

The large volume of stream data being collected under the B.C. Coastal Fisheries/Forestry Guidelines (1988) process is not so easy to categorize (Bruce & Assoc., 1992). The final product is a hard copy map showing stream reach classes but the data behind the classification may not be easy to capture. There is usually no indication of who collected the data, whether fish sampling was carried out, or whether the reach class was derived solely on the basis of gradient. In some cases, classification may be based entirely on overview-level agency data, resulting in a high potential for missing small, very high value stream segments.

c) <u>Riparian Habitat</u>

No major inventories were found that deal strictly with riparian habitat. Several project specific inventories do mention riparian habitat as being part of the dataset and the original RAB methods included some riparian factors. This is a major gap in present inventory coverage in British Columbia.

d) <u>Watershed Sensitivity</u>

There are also no standard inventories of watershed sensitivity at present although some data has been acquired for applications of the "Watershed Workbook" (Wilford, 1987) and relevant information is collected in several of the overview, reconnaissance and intensive level inventories. Watershed area and drainage network (stream order) data exist but not in a standard province-wide digital format. Data is generally collected from available mapping and much comes from non-fisheries inventories: hydrological data for example.

3.5 Resource Use

The major collectors of resource use data are DFO and MELP Fisheries.

At the reconnaissance level, DFO has several systems for tracking the use of salmon including SPORT, an angler survey tied to sport fishing licences. Commercial Catch and Native Food Fishery data bases also exist as does a Conservation Database which includes use and salmon escapements.

The province also has several wide area reconnaissance systems, including the Steelhead Harvest Analysis and the Vancouver Island Lakes Questionnaire. These generate angler effort and catch data on individual lakes and streams. The Steelhead Harvest Analysis has been conducted for 25 years, while the Lakes Questionnaire was done in 1986 and again in 1989. The Questionnaires may have certain statistical problems but both of these products provide extremely useful information for management purposes.

The Small Lakes Index Management program (SLIM) determines angler effort using index boat counts and provides coverage of a large number of lakes at reasonable cost. An index for determining trends is generated. SLIM is restricted to the southern interior of the province because of logistical and cost considerations. It is one of the very few fisheries inventories that uses statistically valid sampling methodologies. No

similar coverage exists for large lakes or inland river stocks, a significant gap in the data needed for management.

One further reconnaissance level source of resource use inventory is the provincial Angling Guide Management System. Reporting of catch by species is mandatory.

At the intensive level, data is collected on individual lakes and streams through intensive angler survey programs. Coverage is restricted to intensively managed lakes and rivers.

3.6 Management Practices/Activities

Several databases include information about fisheries and habitat management practices. Regulations, licences, and enhancement activities are included. Activities are conducted at both the reconnaissance and intensive levels. Many of these are reported in SISS.

Major inventories of management practices include the provincial Hatchery Release Records data base which documents water specific locations of hatchery fish releases and Transplant Records which register fish transplants into or within the province. In addition, the published B.C. Sportfishing Regulations provide annual hardcopy summaries of both regulations and management strategies for public consumption. A Regulations Database has yet to be developed.

There are also several inventories of habitat enhancement activities including various SEP databases, Habitat Conservation Fund projects and the Lake Rehabilitation database.

Table 3. Summary of Current Status

General

- major collectors have been DFO and MELP Fisheries; both MOTH and the forest industry have also been significant; museums and educational institutions for taxonomy.
- recent important investments by B.C. Hydro and native organizations.
- government in-house capability has declined greatly; most recent data collection has been carried out by consulting companies, largely funded by development proponents.

Overview

- primary federal-provincial product is the Stream Information Summary System (SISS) which brings together existing fisheries data for over 4,700 streams.
- the National Survey of Sportfishing provides trend information on angler use, harvest by species, satisfaction and economics.
- SISS has focussed on anadromous sport and commercial species; a comprehensive, province-wide overview inventory for streams and lakes does not yet exist.

Reconnaissance and Intensive

- fish: catalogues and collections by the Royal B.C. Museum and the provincial Conservation Data Centre; MELP/DFO biophysical surveys (but biological methodologies need updating); provincial Habitat Capability Stream Surveys; Salmon Escapement Database (SEDS).
- biophysical: standard reconnaissance lake surveys completed for about 3,000 out of 25,000+ lakes; reconnaissance stream surveys for about 20% of the province; specific area coverage for stock productivity and definition of conservation levels.
- large volume of stream data being collected under the Coastal Fisheries/Forestry Guidelines but variable in content and frequently not easily accessible.
- no specific inventories focussing on riparian habitat and only very limited data sets for watershed sensitivity.
- resource use: several DFO systems including SPORT, an angler survey tied to sport fishing licences; provincial inventories include the Steelhead Harvest Analysis and the Small Lakes Index Management program which samples angler effort; no similar coverage exists for other species or habitat types, a significant gap.
- management practices/activities: SEP and Habitat Conservation Fund activities, provincial Hatchery Release Records, and a Lake Rehabilitation Database; a major gap is the lack of a computerized Regulations Database.

4. ISSUES AND DIRECTIONS

Issues and directions for the near future follow from a comparison of user needs with the current status of fish and fish habitat inventory in British Columbia. This section of the report, summarized in Table 4, covers these topics.

4.1 What Information Is Vital?

Vital information is information that can be used to help conserve the fisheries resource and its habitat. The expectation at the beginning of this project was that careful focus on objectives would decrease the variety and quantity of information required for management.

Exclusion of information has proven to be difficult, however, because of the wide variety of known and anticipated applications. In fact, that variety has increased significantly in the past few years. The need to expand inventory of fish beyond the traditional focus on sport and commercial species is fundamental to the conservation of wild stocks and to biodiversity. Aboriginal values and those of non-consumptive users also must now be explicitly considered. Our inventories have barely begun to move in these directions.

Another side of this issue is that the existence of data does not, in itself, serve the needs of managers. The 25,000 infrequently used stream survey cards in a storeroom in Victoria provide a classic example. The needs are for interpreted data and those interpretations are not generally available at the present time.

All levels of detail are required; they are interdependent.

- overview: provides a context within which to discuss the importance of individual components of fish and fish habitat in the province (populations, fishery types, etc.).
- reconnaissance: provides information on the abundance of resources provincially, determines where important populations and habitats exist, and is used to group systems for management purposes and application of models.
- intensive: provides data for the development of models and classification systems.

The net effect of all this may be more rather than less complex inventories in the future, although individual components may well be more focussed. This complexity will -- hopefully -- be alleviated by increasingly easy access to data.

4.2 The State of Methodologies

There is a significant history of inventory in the fisheries regulatory agencies in this province although that history has been seriously tarnished by the neglect of the past 10 years. For the most part, basic data collection methodologies do exist although many are not fully documented. Thorough reviews are required to provide the content, detail and standards needed for current interpretations (for example, the need for additional fish data in reconnaissance stream surveys to meet the requirements of conservation and biodiversity).

Immediate action is required if the data collected for fish/forestry guidelines classification is to become a usable part of available inventory. Much of this information is collected by non-fisheries personnel (Bruce & Assoc., 1992). We need a very simple data card with proper georeferencing that can be filled out for each stream segment examined and copied to fisheries agencies. This should be accompanied by training and formal certification of classifiers.

We must also anticipate the use of inventory for monitoring. This requires statistically valid sampling and historical consistency, characteristics that are rare in present fisheries inventories. Future inventories will be used for measuring the effectiveness of mitigation and regulations, monitoring the effects of global warming and acid rain, and assessing the impacts of cumulative effects.

At the intensive level and to some extent at the reconnaissance level, there is a need for application-specific methodology menus: choose the specific variables that are appropriate for your application and use standard methods for collecting each.

The opportunities and potential savings offered by new technologies including remote sensing have not been seriously investigated in recent years because of lack of funding. Low level aerial and ground videotapes, for example, have proven invaluable for understanding and mapping in coastal environments and experience to date suggests that the same will be true for streams.

Some of the more important specific issues include:

- development of an effective sampling strategy for the broad range of species that are of current interest;
- additional attention to tributaries of lakes;
- realistic consideration of riparian environments;
- development of acceptable methodologies for evaluation of biological and habitat sensitivity;
- expansion of angler use indexing methodologies to cover all major fishery and habitat types.

Finally, one of the greatest immediate needs is for a summary overview methodology to provide data for the modern computer-based information systems that will be used in the land use planning processes that are driving the current high level support for inventory. These systems will generate the critical products for the planning and public information processes that will be used to resolve conflicts.

4.3 Classification, Models and Research

Province-wide classifications for populations, habitats and watersheds either do not exist or have not been broadly applied. Such classifications are one significant approach to the reduction of the vast range of potential inventory data to a more limited set of interpretive products that can be used for management. Examples range from value rating classes for stocks and habitats to watershed and channel response and sensitivity indexes to fishable waters classes. There is potential for using biophysical classification systems as the basis for estimates of habitat capability in areas where insufficient data exists to apply models on a system-specific basis.

There is also considerable opportunity for more effective use of models in resource management decision making. Research requirements need to be established in the context of a thorough review of existing models by species and habitat type. The demand for refined capability and survival models, particularly, will increase as the pressure to allocate among user groups increases.

Most importantly, however, research must supply improved understanding of species-habitat interactions and ecosystem functional relationships. A species inventory means nothing without knowledge of natural variations in population levels, preferred habitat, seasons of use, etc. If we don't understand how systems work, we will not be able to design inventories and ways of extending inventory data to meet needs that can't be anticipated today.

The idea of research basins as sources of knowledge and as controls for monitoring long term natural variability remains attractive. The experience of Carnation Creek suggests that such basins are probably very cost effective. That same experience, however, indicates strongly that long term projects, no matter how inexpensive, seldom can survive the changing priorities of government agencies.

4.4 Coverage and Access

Inadequate inventory coverage and poor access to existing data are two of the biggest problems for fisheries management today. The most basic information to keep

up with development is lacking in many areas. Even with the Stream Information Summary System, an effective and accessible province-wide overview inventory does not exist. SISS maps, one of the most used components, are hardcopy only and cannot be easily updated. Nor does DFO have any plans to update the attribute database in the near future.

There are problems at the reconnaissance level as well. Much of the inventory is old and there are large gaps in coverage, especially in the northern two-thirds of the province. The recent guidelines-generated inventory, as we have seen, is variable in both content and availability. Many small but important stream reaches that are being impacted by development are not picked up at all, even where inventory coverage is considered "good".

Realistically, complete provincial coverage at the overview level is the best that can be hoped for in the near to medium future. Even that will require substantial investment because it implies expanded reconnaissance coverage and classification systems for interpolation and extrapolation. Verification and capture of even a portion of the existing guidelines classification data could be a significant short term gain. Intensive coverage in the province will be limited to index streams and lakes and "hot spot" areas. Even cooperation and integation with related inventories will not substantially diminish the size of the task.

Access to data is another major issue. Computer systems can provide effective access but the cost of data conversion will be immense. The benefits will also be immense, however. The technology to display maps, satellite images, tabular and graphical data, together with video and audio, is here now. With the right data and the right technology, a tremendous amount of information can be very quickly and flexibly brought to bear on any management issue.

There are indirect benefits to computer systems that are also very important. These systems encourage standard methodologies and this, in turn, can simplify data sharing among all groups collecting inventory data. For fisheries, this is a substantial benefit: much of the inventory data collected in the future will be by the proponents of development and by natives, not by the traditional government agencies.

Access to other peoples' data is of almost equal importance. Non-fisheries data requirements for fisheries applications are many and varied.

4.5 Management of Expectation

Cost-benefit judgements have not been rationally applied to inventory in the past. Outside of forestry, politicians and senior bureaucrats have tended to view most

inventory as too expensive without looking in any detail at the costs of not having that inventory. The assumption seemed to be that British Columbia was a land of unlimited resources.

Both this Resources Inventory Committee initiative and the recent successful provincial multi-ministry inventory issue paper request demonstrate a potential change in that point of view and a new appreciation for the value of information. The permanence of the change is far from assured, however. There remains substantial controversy about how much information is needed for where and at what level of detail. A major problem is that inventory and the methodology development and research associated with it are not by nature activities that provide immediate benefits.

The challenge will be to find enough short term successes to maintain support for inventory programs while modern methodologies and products are being developed, while existing data is expensively being converted to digital, and while new data relevant to todays' issues and concerns is being acquired and analysed. Perhaps this perspective is the most realistic one to use in deciding, in the short term, if an information set is both vital and affordable.

Table 4. Summary of Issues and Directions

What Information Is Vital?

■ expansion beyond traditional focus on sport and commercial species.
■ consideration of aboriginal values and those of non-consumptive users.
■ provision of interpreted products, not just data.
■ more rather than less complex inventories in the future.

The State of Methodologies

■ most data collection methodologies exist but need updating.
■ a data card and certification program are needed for fish/forestry guidelines classifi-
cation.
■ require the consistency in methodology appropriate for monitoring.
■ menus of standard methods for specific applications.
■ new technologies have not been seriously investigated.
■ priority need for a summary overview methodology to provide information for high
profile planning initiatives (e.g. CORE, FLMP).

Classification, Models and Research

■ province-wide classifications have the potential to generate valuable interpretive
products for management but have not yet been used extensively.
■ also opportunity for more effective use of models, especially models for habitat
capability and survival.
■ all require research but the most important role for research is to improve our
understanding of how systems work.
■ research basins may not be politically practical but they would be cost effective.

Coverage and Access

■ fisheries inventory coverage is generally poor.
■ even complete overview level coverage will require substantial investment.
■ capture of existing guidelines classification data could be a significant gain.
■ computer systems can provide effective access but costs will be immense.
■ computerized data bases will encourage standard methodologies and sharing.

Management of Expectation

■ the challenge will be to find short term successes that meet immediate needs.

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APPENDIX 1

Fisheries Inventory Task Force

**Steering and Working Group
Membership**

FISHERIES INVENTORY TASK FORCE
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May 1, 1992

FISHERIES INVENTORY TASK FORCE
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APPENDIX 2

User Needs Analysis

2.1   User Applications by Objective

2.2   Information Needs by Application and Level of Detail

2.3   Data Requirements, Methods and Issues by Information
       Need
              a) Overview
              b) Reconnaissance
              c) Intensive

Appendix 2.1 User Applications by Objective for Fisheries Inventory Information.			
User	Objective	Application	Level of Detail
DFO Fisheries Branch, Habitat Management Div.	Fish habitat conservation, development and restoration (no net loss policy)	Protection and compliance	Intensive
		Integrated resource planning	Overview
		Scientific research	Intensive
		Public consultation	All
		Public information and education	Intensive
		Cooperative action	Reconnaissance
		Habitat improvement	Intensive
		Habitat monitoring	Reconnaissance
		Plan and respond to environmental emergencies	Reconnaissance, Intensive
		Production plans	Overview, Reconnaissance
		Enforcement	Intensive
		Referrals	All
DFO Fisheries Branch Fraser River Task Force	Develop fisheries habitat plans for the Fraser River basin	Production plans	Reconnaissance
		Develop sensitivity indices for streams	Reconnaissance
		Document salmonid use and status of habitat for all watersheds with salmon in the Fraser River basin	Reconnaissance
		Identify other resource users in the basin and interactions with fisheries	Reconnaissance
		Identify restoration and enhancement opportunities	Intensive
DFO Fisheries Branch	Manage sport fishery	Determine allocations	Reconnaissance

Appendix 2.1 User Applications by Objective for Fisheries Inventory Information.			
User	Objective	Application	Level of Detail
Recreational Fisheries Division			
		Manage sportfishing closure information system	Reconnaissance
DFO Fisheries Branch Salmonid Enhancement Program	Increase west coast salmon production	Rehabilitate and improve salmonid habitat Identify and design new enhancement facilities Conduct stock assessment studies	Intensive
	Operate hatcheries, spawning channels, and other enhancement projects	Manage existing facilities	Intensive
	Promote public awareness of the need to conserve salmonids and their habitats	Public involvement programs and small scale fisheries and habitat enhancement projects	Intensive
DFO Science Sector Biological Sciences Branch	Address knowledge gaps and provide scientific information necessary for the sustainable development of Canada's fisheries and oceans	Establish conservation goals for salmon	Intensive
		Research and development for habitat sensitivity	Intensive
		Research and development for impact assessment	Intensive
		Research and development for population dynamics	Intensive
	Determine habitat carrying capacity and population dynamics	Research and development for population dynamics, restoration and assessment of restoration.	Intensive
MELP Fisheries Program (HQ and Regions)	Manage fish, fish habitat and sport fishing	Define the State of the Fisheries resource.	Overview
		Planning: Regional Fisheries Plans	Reconnaissance
		Planning: Priorize inventory	Overview, Reconnaissance
		Provide Public Information	All

User	Objective	Application	Level of Detail
		Research and Development	All
	Conserve Wild Stocks of Fish	Develop classification systems for stocks and habitats	Intensive
		Identify and classify wild fish populations	Reconnaissance
		Determine conservation levels for wild fish stocks	Intensive
		Develop management objectives by stock and habitat type	Reconnaissance, Intensive
		Assess and monitor: harvest and use status of wild populations stock status in key fisheries effects of management strategies	Intensive
		Develop and apply regulations	Intensive
	Protect and Manage Fish Habitat	Quantify fish habitat	(Overview), Reconnaissance, Intensive
		Quantify angler use areas	(Overview), Reconnaissance, Intensive
		Determine factors that limit fish production and angler satisfaction.	operational
		Identify high priority areas for protection (fish, habitat and angler use areas).	(Overview), Reconnaissance, Intensive
		Develop classification systems for guidelines development	Intensive
		Assess and monitor: changes to fish habitat changes to angler use areas	Intensive
		Mitigation/Compensation	Reconnaissance, Intensive
	Serve the Public Interest	Provide Public Information	All
		Assess and monitor public knowledge, preferences and attitudes.	Intensive

Appendix 2.1 User Applications by Objective for Fisheries Inventory Information.

Appendix 2.1 User Applications by Objective for Fisheries Inventory Information.			
User	Objective	Application	Level of Detail
		Allocate fisheries resource (provide diversity of opportunities)	Reconnaissance, Intensive
		Enhance/restore fish stocks through hatchery introductions	Intensive
		Enhance/restore habitat	Intensive
MELP Integrated Management Branch (HQ and Regions)	Protect fish habitat	Planning: large area, development related, internal	Overview, Reconnaissance
		Screen referrals	Overview, Reconnaissance
		Process referrals	Intensive
		Develop guidelines	Intensive
MELP Wildlife Branch Conservation Data Center	provide information to minimize impacts on rare species and habitats	Manage rare species	Intensive
		Habitat aquistion priorities	Reconnaissance
MELP - Parks	Manage provincial parks		
MELP - Environmental Protection	Minimize impacts to fish habitat		
MELP - Water Management	Minimize impacts to fish habitat		
MELP - Environmental Assessment	Major Project Review	Planning	Intensive
		Baseline studies	Intensive
		Impact assessment	Intensive
		Mitigation/compensation	Intensive
		Monitoring	Intensive
Ministry of Tourism and Culture	collect and preserve examples of natural	Catalogue information to describe and maintain	Intensive

Appendix 2.1 User Applications by Objective for Fisheries Inventory Information.			
User	Objective	Application	Level of Detail
Royal B.C. Museum	history	biodiversity	
Ministry of Transportation and Highways	Comply with agency regulations and guidelines to minimize impacts of development on fisheries resource	see Major Project Review	Intensive
Ministry of Energy Mines and Petroleum Resources	Comply with agency regulations and guidelines to minimize impacts of development on fisheries resource	see Major Project Review	Intensive
Ministry of Agriculture and Fisheries and Food	Comply with agency regulations and guidelines to minimize impacts of development on fisheries resource	Site suitability: see Major Project Review	Intensive
Ministry of Forests	Comply with agency regulations and guidelines to minimize impacts of development on fisheries resource	Research (eg. FFIP)	Intensive
		Guideline development, application and monitoring (eg. CFFG)	Intensive
Ministry of Health	Public Health	Public Health Advisories	Intensive
Industry	Comply with agency regulations and guidelines to minimize impacts of development on fisheries resource	Industry/impact specific requirements; access to relevant data.	Intensive
		planning	Intensive
		baseline studies	Intensive
		impact assessment	Intensive
		mitigation/compensation	Intensive
		monitoring of impacts	Intensive
B.C. Hydro	Comply with agency regulations and guidelines to minimize impacts of development on fisheries resource. Conserve fisheries resources in Hydro impact areas.	as above	Intensive

Appendix 2.1 User Applications by Objective for Fisheries Inventory Information.			
User	Objective	Application	Level of Detail
Consulting Community	Serve Clients needs	as above	
Educational Institutions (Universities, Colleges)	Awaiting responses. Education, training, research and development	Varied	All
Non-Government Organizations	Not surveyed in this phase of the RIC process.		
Aboriginal Peoples	Survey in progress.		
Public	Freedom of Information	Varied	All

Appendix 2.2 Information Needs by Application and Level of Detail.		
Level of Detail	Application	Information Needs
Overview	Define the State of the fisheries resource; description of values in a provincial context	Summary operational and reconnaissance level information regarding: Fisheries values Habitat values Past development history and impacts
	Land Use Planning (watershed planning units) Integrated Resource Planning Forest Land Management Planning Inventory priorization Screening of referrals	above plus: Biological sensitivity (Species level) Habitat sensitivity (Watershed level) Development Pressure Future demands on fish resources
	Provide public information Public consultation	any and all

Reconnaissance	Identify and classify fish populations	reach/local population level information on: species/stock identification and distribution fish production capability classification system
	Priorize detailed Inventory Screen referrals Environmental Emergencies Identify high priority areas for protection Determine habitat acquisition priorities	Reach/local population level information on: species/stock identification, distribution and classification, habitat description and classification, fish production capability, quantify angler use areas, habitat sensitivity (reach level), biological sensitivity, past development history and impacts, development pressure and potential impacts.
	Classify waters of similar character for consistent management	quantify habitat quantify angler use areas stock identification and classification public preference
	Fisheries Management Planning Regional Plans Production Plans Allocation Determine management objectives by stock and habitat type	Targets for fish stocks by species and habitat types based on: species/stock identification, distribution and classification, current and historic populations, quantification of habitat, fish production capability and constraints. Targets for (angling) use by species and habitat type based on: fish stock targets, quantification of angler habitat, user preferences. Present use of fish resources Future demand on fish resources Management activities (regulations, enhancement, etc.)
	Provide Public Information	any and all
	Assess and monitor public preferences	Public preferences

Intensive	Identify and classify fish populations	species/stock identification and classification
	Catalogue information to describe and maintain biodiversity	catalogue of rare elements (fish, ecosystems, etc.)
	Quantify fish habitat	site level lake and stream physical data.
	Determine conservation levels for fish stocks	species/stock identification, distribution and classification, population dynamics quantified habitat fish production capability current populations allowable exploitation
	Management objectives by stock and habitat type	conservation level detail plus: resource use future demand
	Determine factors limiting fish production	current populations stock productivity quantified habitat (capability) resource use past development and impacts
	Quantify angler use areas	site specific location of angler use areas
	Develop classification systems for fish stocks, habitats and angling.	Summary information on the types and status of fish stocks, habitats and angler use opportunities.
	Identify high priority areas for habitat protection	site specific: biological sensitivity habitat sensitivity critical habitats valuable habitats
	Referrals	site and impact specific (eg. water withdrawal, forest harvesting, etc.): fish presence, Species identification and classification, fish production capability, habitat description and classification, site specific habitat sensitivity, biological sensitivity, angler use areas,

		development plans.
	Develop guidelines	life history characteristics and timings habitat requirements by life stage evaluation of development impacts on fish and habitat
	Assess and monitor public preferences	
Intensive (con't)	Develop regulations	identification of critical life history characteristics and timings. identification of critical habitats resource use population dynamics future demand
	Fisheries allocation	user preference, quantify fish habitat, quantify angler habitat, fish production capability
	Enhance/restore fish stocks through hatchery introductions	present use future demand current fish populations fish production capability limiting factors site specific enhancement prescriptions
	Enhance/restore habitat	above plus: site specific habitat data
	Mitigation/compensation	value of resources impacted alternatives to development (sites, methods) Plus enhancement needs above
	Assess and Monitor:	status of fish populations resource harvest and use stock status in key fisheries effectiveness of guidelines effectiveness of management strategies fish habitat angler use areas public preferences
	plan and respond to environmental emergencies	potential spill locations

		habitat sensitivity fisheries sensitivity fisheries values habitat values spill countermeasure plans
	Research and Development	Varied

Appendix 2.3a Overview Level Data Requirements, Methods and Issues by Information Need.			
Information Need	Data	Methods	Comments
Fisheries Values	"Values" based on a set of criteria including: - Known (and potential) sport, commercial or native fishery use. - Presence of rare or unique fish or habitat element. - Fish production capability and constraints.	Available data and regional knowledge (eg. SISS level): summary of reconnaissance and operational level information from existing data and local knowledge eg. Steelhead Harvest Analysis, Escapement Database	Detailed description of data requirements and framework for collection, analysis and presentation of overview product is required.
a) Species/stock identification and classification	Known and suspected distribution by species and stock. General habitat and life history requirements.	Existing data and local knowledge.	Gaps in fish/species presence will exist. Models based on known distributions, habitat requirements and habitat variables need to be developed. Need definitions and classification systems for fish populations including rare and unique elements (eg. Conservation Data Center) of fish and fishery types. Genetic factors must be considered. Need status reports by (rare and unique) species and stock.
b) Current and historic fish populations	Escapements Catch statistics	Existing data and local knowledge	Comparison to past records, documentation or system capability model. Annual update and improved techniques required.
Habitat Values	"Values" based on presence of rare, unique or otherwise valuable habitat.	summarized reconnaissance and operational level information from existing sources.	Description of data requirements and framework for collection and presentation of overview product is required.
a) Identification and classification of habitat	Known or suspected presence of valuable habitat elements		Need methods to identify and classify important habitats. Need status report by (rare or unique) habitat type.
b) Fish production capability	Fish species and characteristics. Stream habitat: watershed area, stream length, area, major reach designation, known obstructions, productivity based on regionalized water chemistry, regional hydrology. Lake habitat: number and size of lakes in watershed, elevation, biogeoclimatic zone,	Regional or modelled estimate of capability using map/existing knowledge derived habitat availability and productivity, and biostandards. Application of watershed coding system in blue line atlas in a GIS environment.	Need "overview" level capability models by species and habitat type, based on research at more detailed levels. Blue line atlas needs to be corrected, updated, and maintained. Lakes boundaries need to be mapped and classified.

Appendix 2.3a Overview Level Data Requirements, Methods and Issues by Information Need.			
Information Need	Data	Methods	Comments
	winterkill potential from air photo's, regionalized water chemistry.		

Sensitivity			
a) Biological Sensitivity (species level)	Species/stock identification and classification, life history characteristics, population dynamics, habitat requirements and suitability	summarized reconnaissance and operational level information from existing sources	Species sensitivity to land use changes, temperature, exploitation, etc. Need summary life history characteristics and population dynamics by species. Need summary habitat requirements by species.
b) Habitat Sensitivity (large watershed level)	Region/watershed sensitivity to specific impacts (eg.): water withdrawal - regional hydrology (low flows) acidification - regional water chemistry forest management - hydrology - basin relief - soils - channel characteristics - existing roads and harvest Petroleum exploration and extraction - linear developments - oily waste - well sites	existing knowledge and reports, landsat interpretation, acquired knowledge from application of (eg.) Coastal Fish/Forestry classification system, biogeoclimatic and hydro-physiographic classification systems, access SEAM and WSC data bases	Need a sensitivity rating system.
Resource Use			
a) Present Resource use	Known harvest and use by: Sport Commercial Aboriginal peoples Non consumptive use	Exixting data and local knowledge. eg. Steelhead Harvest Analysis, Angling Guide Management System, Conservation Database	
b) Future Demand on Fish Resources	Angler preference surveys	National Survey of Sportfishing	Projected future trends in resource use.

Human Activities			

a) Development Activities	Land use
	  - km of roads/seismic lines
	  - area of harvest
	   (% watershed)
	  - mining/petroleum
	   development
	  - urban development
	  - agricultural land (grazing)
	Point source effluents and water withdrawals
	Future development plans
		landsat imagery, aerial photographs,
		forestry five year development plans
		access to MINFIL, HYDAT, SEAM, NAQUADAT,
		and WSC databases	

b) Past Impacts on Habitat	Comparative data (eg.)
	  - riparian vegetation removed
	  - channel characteristics
		Historical aerial photography and habitat data:
		summarized reconnaissance and operational
		level information from existing sources, temporal
		comparisons.
			Methods need to be developed.

Appendix 2.3b Reconnaissance Level Data Requirements, Methods and Issues by Information Need.			
Information Need	Data	Methods	Comments
Fisheries Values			
a) Species/stock identification, distribution and classification	Georeferenced fish sampling and identification.	netting, angling, snorkelling, electrofishing, trapping, etc. (habitat and species specific). Few point samples per reach.	Verified results and classifications as per RBCM standards in priority locations.
b) Current population size	Adult population size from escapement counts. Relative abundance in site sampling.	existing information from BC 16 and SEDS data base and stream catalogues. New inventories and stock assessments. Fence counts and other sources of information	access and link to SEDS data base for regular updates develop new methodologies for indexing, standardizing, and improving escapement counts (eg.) the joint MELP/DFO/SNTC North Thompson index proposal develop a low cost method for enumerating juvenile production test video applications for enumeration purposes conduct new field inventories
Habitat Values			
a) Habitat (reach/lake) identification, description and classification	Description of aesthetics, access etc.	Presence of rare, unique or valuable habitat as determined by field reconnaissance.	Needs classification and status reports for comparison. Classification to group waters of similar character for management purposes.
b) Quantify habitat availability by reach/lake	Individual lake habitat: surface area, mean depth, water chemistry, inlet/outlet identification, winter oxygen. Stream reach identification and characteristics including gradient, flow, obstructions, water quality, channel pattern, etc.	Air photo and map interpretation Few point samples per reach Digital elevation models in GIS	Need to develop and test GIS as an analytical tool.
c) Fish production capability	Fish distribution and species composition. Habitat availability (quantification).	Models for estimating productive capacity	Need to review, develop and test models to predict productive capacity for all species and habitat types.
d) Quantify angler "habitat"	Georeferenced location and characteristics of angler use areas in lakes and streams. Includes aesthetic values.		

Sensitivity			
a) Biological Sensitivity	Sensitivity of species/life stage located within reach based on: habitat availability, habitat requirements by life stage, habitat use by life history stage, stock productivity,		
b) Habitat Sensitivity (small basins)	Sensitivity related to impacts (forestry, petroleum, mining, urban development, etc.) eg. forestry: high value fisheries habitats, precipitation, topography, drainage density, channel type and morphology, extent/nature of valley flat, lake/swamp area, landslide density, areas of high erosion hazard, area of commercial/accessible timber, past logging/development, areas in roads/landings, present vegetation	topographic maps, existing thematic maps: hydromorphic, surficial geology, forest cover, wildlife biophysical. Air photo interpretation/photogrammetry. ESA/slope stability mapping. Existing forestry and other development maps/plans.	Watershed Workbook Version 2 (for coastal basins) is an example; not yet complete and needs field testing. Similar watershed sensitivity processes needed for other environments. Also need to develop processes for directly assessing riparian sensitivity.
Resource Use			
a) Present Resource Use	Angler use and harvest Use by aboriginal peoples Commercial harvest Non consumptive use	SLIM Questionnaires (regional, Steelhead Harvest Analysis)	Methods required for all habitat types.
b) Future Demand	Public preference Population trends Development plans	National Survey of Sportfishing Lake/stream specific user preference surveys.	

Enhancement and management activities	SISS, existing data and reports .	Release Records Database, Transplant database.	maps should include codes for passive and active management of stocks
Human Activities			
a) Past development impacts			
b) Development pressure and potential impacts.	Land Use Access Development plans		

Appendix 2.3c Intensive Level Data Requirements, Methods and Issues by Information Need.			
Information Need	Data	Methods	Comments
Fisheries Values			
a) Species/stock identification and classification	as above for reconnaissance	many samples per reach by specific habitat type.	Research into stock genetics.
b) Catalogue of rare elements	Verified and georeferenced referenced biological collections	collection, identification and storage standards developed through RBCM.	Policy development required; coordination with interests (UBC, CDC, etc)
c) Current populations: current habitat use by fish and life history stage	fish population estimates: fish by species and age group per unit area detailed habitat descriptions:	juvenile population estimates by electrofishing, intensive snorkel surveys.	
d) Life history characteristics and timings	habitat requirements by life stage migration patterns temporal requirements and movements.		Need literature review/research into life history characteristics and habitat requirements for all species.
e) Population Dynamics Stock Productivity	fish age and growth fecundity mortality rates population numbers by life stage habitat requirements by life stage habitat availability by life stage data from wild stocks are required to compare with production from enhanced stocks		Need further research on stream size influence/hydrology on population dynamics.
Habitat Values			
a) Quantification of habitat, Identify critical habitats	site level habitat data requiring more detail: Lakes - bathymetry, water quality (nutrients). Streams - individual habitat type (eg. pool/riffle) channel characteristics, substrate, debris, hydraulic characteristics (incl. stream transects) to determine usable habitat area,		Use of low level video needs to be developed.

Appendix 2.3c Intensive Level Data Requirements, Methods and Issues by Information Need.			
Information Need	Data	Methods	Comments
	water quality, historic flow records		

b) Fish production capability and constraints	Lake productive capacity and associated stream productive capacity. Stream capacity - habitat availability, productivity, stock population dynamics and productivity.	Various models exist. Comparison of current populations to productive capacity to identify need for enhancement or restoration of stocks.	Need to review, research and develop capability models for all species and habitat types.
c) Quantification of (angler) use areas	site level data on: lake types angling locations within a stream use by aboriginal peoples		
Sensitivity			
a) Biological sensitivity	Population dynamics. Location (including temporal) of critical life history stages. Background stresses.		susceptibility of species and local populatins given current conditions.
b) Habitat sensitivity	location of sensitive habitats: water quality (acid rain) hydrology (water withdrawal) slope stability		
Resource Use			
a) Present Resource Use	Use and harvest on individual stocks. Monitoring trends.	Local creel surveys. SLIM/SHA trend analysis. Kootenay Lake rainbow tagging program.	Need standard methods for creel surveys.
b) Future Demand	site (lake, fishery) specific user preference surveys	questionnaires public meetings	
Human Activities			
a) Past development and Impacts			
b) Future Plans			
Monitoring	Relevent historical data. Repeated sampling.	historical and baseline data for monitoring must be relevent and repeatable (logistically and statistically).	
Research and Development			All aspects of above: calibration studies, technique development, population dynamics, biostandards, habitat requirements by life stage, quantifying habitat, impact assessment, model development, etc.

APPENDIX 3

Current Inventory Status

3.1 Summary of Fisheries Inventory Systems

3.2 Completed Questionnaires for Major Province-Wide Inventories

3.3 Summary of Other Inventories

Appendix 3.1 Summary of Fisheries Inventory Systems

Level/Detail	Name of Inventory	Agency	Active/ Inactive	Fish	Habitat	Habitat Type				Resource Use	Mgmt	Product Type[1]	Comments
						Lake	Stream	W/shed	Ripar-ian				
Overview													
	Stream Info. Summary Sys. (SISS)	DFO MELP	A	Y	Y	N	Y	Y	N	N	Y	E/H	summary data system for over 4 400 BC and Yukon streams; focused on anadromous salmonids
	Habitat Inv. Program	DFO	I	Y	Y	N	Y	Y	Y	N	Y	H	father of SISS; east coast of Vancouver Island
	Salmonid Hab. Inventory Program (SHIP)	DFO MELP	I	Y	Y	N	Y	Y	Y	N	Y	H	available length of stream in different categories for fish production; 5 major and 35 minor river basins on Vancouver Island and mainland coast; used to screen SEP projects
	Coho Initiative	DFO	A	Y	Y	N	Y	Y	Y	Y	Y	H	program to protect small streams for wild coho in Georgia Strait; set-back zoning at land use planning level
	Nat. Sport-fishing Survey	DFO MELP	A	Y	N	N	N	N	N	Y	N	H	conducted at five year intervals since 1975
	Licence Sales Data Base	MELP	A	N	N	N	N	N	N	N	Y	E/H	angling licence trend analyses for licence design and fee structure
Reconnaissance													
	Salmon Escape-ment Data Base and Reporting System (SEDS)	DFO	A	Y	N	N	N	N	N	N	Y	E	salmon escapements linked to specific streams; includes run timing and enumeration methodologies
	BC 16's	DFO	A	Y	Y	N	Y	N	N	Y	Y	H	Fishery Officer narratives on spawning escapements
	Museum Collections	RBCM others	A	Y	N	N	N	N	N	N	N	E/H	various sampling programs for reference collections
	Preliminary Lake Survey	MELP	A	Y/N	Y/N	Y	N	N	N	N	N	E/H	procedures manual in process; variations used by MELP regional staff (eg. winter O_2 surveys)
	Reconnaissance Lake Survey	MELP BC Hydro	A	Y	Y	Y	N	N	Y	N	Y	E/H	approximately 3 000 lakes (10% of BC lakes) surveyed to 1990; data collected includes basic bathymetry, fish species (presence, size, condition, relative numbers), water chemistry, inlet/outlet spawning and rearing potentials, and other misc. details related to surrounding features, land use and access; older surveys have less reliable data than more recent surveys; procedures manual in progress; about 15% of information from surveyed lakes entered into BC Lakes Data Base
Reconnaissance Cont'd	Reconnaissance Stream Survey (RAB; FHIIP)	MELP DFO BC Hydro	A	Y	Y	N	Y	Y	N	N	N	H	approximately 20% of BC covered in systematic manner between mid-1970's and early 1980's; more recently opportunistic basis only; data collected includes stream channel physical properties, obstructions to fish passage,

Appendix 3.1 Summary of Fisheries Inventory Systems

Level/Detail	Name of Inventory	Agency	Active/ Inactive	Inventory Types								Product Type[1]	Comments
				Fish	Habitat	Habitat Type				Resource Use	Mgmt		
						Lake	Stream	W/shed	Ripar-ian				
													fish presence (some detail on life stage, size, condition), water properties and land/water use; approx. 25 000 data cards in existence; data also summarized on Aquatic Biophysical maps; data collection manual published 1989; survey methods manual in progress; 2 stream data bases (overview and reconnaissance levels) under development
	Coastal Fish/Forestry Guidelines Stream Classication	Industry MOF	A	Y/N	Y	N	Y	N	N	N	N	H	extensive recent coastal coverage; hard copy maps showing stream reach classes; underlying data variable in content and frequently not easily accessible
	Stream Catalogues	DFO	I	Y	Y	N	Y	N	N	N	Y	H	Fishery Officer narratives on salmon spawning habitat
	Conservation Data Centre (CDC)	MELP	A	Y	Y	Y	Y	Y	Y	N	N	E/H	largely summary data system; rare and vulnerable taxa only
	Habitat Man. Plans for the Fraser River Basin	DFO	A	Y	Y	Y	Y	Y	Y	N	Y	E	Fraser River Task Force; compilation of existing inventories; development of models to determine production goals for salmon; development of stream sensitivity indices
	SEP Assessment and Planning	DFO	I	Y	Y	N	Y	N	N	N	Y	H	biophysical surveys, enhancement opportunities, carcass counts
	Small Lakes Index Mgmt (SLIM)	MELP	A	Y	N	N	N	N	N	Y	N	E/H	summary of angler use estimates from aerial boat counts; annual monitoring on specified lakes with associated creel data; approximately 400 lakes in southern interior of BC
	Steelhead Harvest Analysis	MELP	A	Y	N	N	N	N	N	Y	N	E/H	trend information on angling catch and effort; currently 25 years of consecutive data
	Angling Guide Mgmt System	MELP	A	Y	N	N	N	N	N	Y	N	H	summary of angling guides in BC, including number of days allocated to each on classified and unclassified waters and the catch by guided anglers (resident, non-resident, alien)
	SPORT	DFO	A	Y	N	N	N	N	N	Y	Y	E	sample angler survey of Tidal Waters Sport Fishing Licences
Reconnaissance Cont'd	Commercial Salmon Catch Spreadsheet Program (CSCSP)	DFO	A	Y	N	N	N	N	N	Y	N	E	stock assessment information on fishing effort and gear types; summary of sales slip data from 1952 to present
	Commercial Catch Stat. System	DFO	A	Y	N	N	N	N	N	Y	N	E	commercial sales slips (fisherman to commercial processor)

Appendix 3.1 Summary of Fisheries Inventory Systems

Level/Detail	Name of Inventory	Agency	Active/ Inactive	Fish	Habitat	Lake	Stream	W/shed	Riparian	Resource Use	Mgmt	Product Type[1]	Comments
	Native Food Fishery Data Base	DFO	A	Y	N	N	Y	N	N	Y	N	E	location, band name, gear, no. of permits, species, no. of fish; used to produce Indian Food Fishery annual report; does not, but should, contain detailed Fraser River Division catch data
	Vancouver Isl. Lakes Questionnaire	MELP	A	Y	N	N	N	N	N	Y	N	H	angler questionnaires for angler effort and catch on Vancouver Island lakes; done for 1986 and 1989 angling seasons
	Juvenile Salmonid Abundance	DFO MELP	A	Y	N	N	N	N	N	N	Y	E	evaluation of SEP production and net benefits
	Finclip Recov. Data Base and Reporting Sys. (FRDRS)	DFO	A	Y	N	Y	N	N	N	Y	N	E	commercial troll, net, and hatchery escapements; designed to evaluate success of hatchery production
	Conservation Goals Data Base for Salmon	DFO	A	Y	N	N	Y	N	N	Y	Y	E	data base for establishing conservation goals for each species of salmon; salmon escapements, Indian Reserves and Native fishery data; Fraser River basin done, Skeena/Nass basins in progress, Barkley Sound planned
	SEP Assess-ment Data Base	DFO MELP	A	Y	N	N	N	N	N	N	Y	E	evaluation of SEP production and net benefits
	Mark Recovery Program	DFO	A	Y	N	N	N	N	N	N	N	E	coded wire tag recovery data
	Sport Spot Closures	DFO	A	Y	N	N	N	N	N	N	Y	E	list of closure areas, boundaries, gear and species prohibitions, etc.
	Forest Industry	Various Companies	A	Y	Y	Y	Y	N	Y	N	N	H	Various methods used by the Forest Industry to input to the interagency referral process (eg. Coast Fish Forestry Guidelines) and plan logging activities.
Intensive													
	Research Data	DFO	A	Y	Y	Y	Y	Y	Y	Y	N	H	research on habitat sensitivity, impact assessment and population dynamics; establishment of conservation goals for salmon; mostly conducted by PBS
Intensive Cont'd	Research Data	MELP	A	Y	Y	Y	Y	N	N	N	Y	H	research on population dynamics and enhancement techniques; Research Section, Fisheries Branch, MELP (UBC, Vancouver)
	Escapement/ Spawning Counts/Surveys	MELP DFO	A	Y	Y/N	N	N	N	N	N	N	H	various surveys to determine numbers of fish heading to or on spawning grounds (eg. kokanee escapement)

Appendix 3.1 Summary of Fisheries Inventory Systems

Level/Detail	Name of Inventory	Agency	Active/ Inactive	Inventory Types								Product Type[1]	Comments
				Fish	Habitat	Habitat Type				Resource Use	Mgmt		
						Lake	Stream	W/shed	Ripar- ian				
	Index Netting/ Fishing	MELP DFO	A	Y	N	N	N	N	N	N	N	H	collection of sport fish samples for age/growth studies, etc.; various locations
	Kokanee Echo- sounding	MELP	A	Y	N	Y	N	N	N	N	N	E/H	4 large lakes (Okanagan, Kootenay, Arrow and Quesnel) to determine kokanee population densities
	Habitat Capability Stream Survey (FIAU)	MELP	A	Y	Y	N	Y	Y	Y	N	N	H	determination of resource status, carrying capacity, sustainable use, resource rarity/limitations and hatchery stocking rates; for resource management of wild stocks, resource monitoring, mitigation and compensation; data collected on fish abundance/species composition, habitat description and stream transects; methodologies are documented
	Urban Streams	DFO	A	Y	Y	Y	Y	Y	Y	N	Y	H	inventory for mitigating urban impacts on fish, fish habitat and production
	Fish Forestry Interaction Program	MELP MOF	A	Y	Y	N	Y	Y	Y	N	Y	H	studies on mass wasting and effects on fish and fish habitat for extensive areas of the Queen Charlotte Islands, BC; also studies on fish habitat restoration techniques
	N. Thompson Coho Index Program	DFO MELP SNTC	I	Y	N	N	Y	N	N	N	N	H	develop coho keystream program N. Thompson R. tributaries; assess smolt carrying capacity; develop alternate escape- ment enumeration methodology
	Nechako River Physical Data	DFO MELP Alcan	A	Y	Y	N	Y	N	Y	N	N	E	application of physical data to a monitoring/remedial measures pilot testing/applied research program
	Snorkel Surveys	MELP	A	Y	Y	N	Y	N	N	N	N	H	estimates of fish abundance (eg. adult steelhead, inland river trout) for comparison with production capability estimates
	Creel Surveys	MELP BC Parks	A	Y	N	N	N	N	N	Y	N	H	water-specific creel surveys for determining angler use and harvest; coverage restricted to important or problem fisheries
	Referral System	DFO MELP	A	Y	Y	Y	Y	Y	Y	Y	Y	E	information regarding development proposals that may impact fish or fish habitat (eg. logging, mining, urban development, etc.)
	Foreshore Referrals Program	DFO	A	Y	Y	N	N	N	Y	N	Y	H	designed to assist in evaluating coastal/estuarine refer- rals; procedure for conducting on-site habitat description and assessment
Intensive Cont'd	BC Sportfish- ing Regula- tions	MELP	A	Y	N	N	N	N	N	Y	Y	H	summary of sportfishing regulations and individual lake/ stream management strategies; data base under development
	Release Records Data Base	MELP	A	Y	N	N	N	N	N	N	Y	E/H	complete summary of fish stocking (location, species, numbers, etc.) by the Provincial hatchery system
	Transplant	DFO	A	Y	N	N	N	N	N	N	N	H	outlines history of number and type of fish or aquatic

Appendix 3.1 Summary of Fisheries Inventory Systems

Level/Detail	Name of Inventory	Agency	Active/ Inactive	Inventory Types									Product Type[1]	Comments
						Habitat Type								
				Fish	Habitat	Lake	Stream	W/shed	Ripar- ian	Resource Use	Mgmt			
		MELP												invertebrate transplants into or within BC
	Lake Rehab. Records Data Base	MELP	A	Y	N	N	N	N	N	N	Y	H		summary of chemical lake rehabilitation activities in BC
	Habitat Dioxin Data	DFO	A	Y	N	Y	Y	N	N	N	Y	E		data base for evaluating the level of dioxin/furan contamination in freshwater fish
	Lake Enrichment Program	DFO	A	Y	Y	Y	N	N	N	N	Y	E/H		Program to enhance the production of natural stocks of sockeye salmon; data on 25 remote lakes over the length of the B.C. coast.

1. E = electronic; H = hardcopy

APPENDIX 3.2

Completed Questionnaires for Major

Province-Wide Inventories

FOREST RESOURCES INVENTORY COMMITTIEE
STATUS OF FOREST RESOURCES INVENTORIES
QUESTIONNAIRE

1.   INVENTORY NAME: Stream Information Summary

2.   AGENCY DEVELOPING INVENTORY/CONTACT PERSON (BRANCH):

Department of Fisheries and Oceans Habitat Management Division Contact: Kathy Pontus

3.   INVENTORY TYPE

LEGAL/ADMIN
RESOURCE STATUS
RESOURCE MANAGEMENT/MONITORING
SOCIO ECONOMIC
OTHER

4.   WHAT DATA DO YOU COLLECT?

- stream location
- gradient
- obstructions
- flow
- fish distribution

- escapements
- life history timing
- enhancement and management activities
- land use, water use and water quality activities
- fish production, potential constraints and general comments

5.   SCALE OF DATA COLLECTED (PLEASE DO 1 SHEET/SCALE)

OVERVIEW

MANAGEMENT   WHAT IS THE NUMERIC SCALE? 1:50,000

OPERATIONS

6. DESCRIBE YOUR DATA, INVENTORY, COVERAGE AND THE ADEQUACY
    OF THE COVERAGE?

This inventory was intended to provide a snapshot of the fish and fish habitat data available for a stream. The data was collected from federal and provincial fisheries staff, local residents and a variety of literature sources. A first pass at collection has been completed for all D.F.O. subdistricts in B.C., the east Kootenays and approximately half the Yukon River drainage. Coverage in some central areas of B.C. is poor and escapement data is out of date. There are currently over 4700 streams in the database.

7. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT?

The principal users are D.F.O. habitat and enforcement staff. Other internal users include planning, enhancement and research. External users include M.O.E.L.P. Fish and Wildlife, M.O.F., forest companies, municipalities, private consultants, native councils, environmental groups, B.C. Hydro and the general public.

8. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

D.F.O. staff use the data for initial screenings of habitat referrals or for selecting streams for enhancement, restoration and management. External users find it useful for general review of an area and planning and protection activities.

9. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

HARD COPY   REPORTS   MAPS   OTHER
ELECTRONIC   SPATIAL   NONSPATIAL

10. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS? (CIRCLE CHOICE)

REPORTS   MAPS   TABLE   OTHER
ELECTRONIC or HARD COPY   D.F.O. Subdistrict catalogues

11. ARE YOUR CLIENTS CHARGED FOR THIS PRODUCT? WHAT IS THE CHARGE?

Clients currently are not charged for hard copy reports or digital data. Copies of full size 1:50.000 NTS maps with hand-drafted data are available at the cost of reproduction $6 - $10 per mapsheet.

12. DO YOU HAVE INVENTORY METHODS AND STANDARDS DOCUMENTED?

Information requirements are outlined in the Stream Information System SIS user manual and SIS Mapping Requirements.

13. DESCRIBE ANY SHORTCOMINGS, PROBLEMS OR ISSUES ASSOCIATED
     WITH THIS INVENTORY. (Attach additional sheets if required to address this
     question.)

The first objective of the Habitat Inventory program was to organize and summarize existing fish and fish habitat data in a computer data base. Beginning in 1985, contracts to collect data were let simultaneously around the province. The objective of the program was to get as much existing fish and fish habitat information in the data base as quickly as possible. The first pass at data collection for the B.C. D.F.O. subdistricts was completed in 1990. Since that time court decisions such as that

reached for the Old Man Dam have increased the department's jurisdiction to north and eastern B.C. Major B.C. watersheds still to be completed include the Columbia and Peace.

The push to complete the province and the variety of contractors involved has had an
effect on the density and quality of the information collected. Limited budgets
stretched over large areas has left data gaps in some central regions of the province
and information is often referenced as existing without further comment or detail.
Coverage of provincial species throughout the province is also poor and information is of varying age with some streams being reviewed as recently as 1990 while others
were last looked at in 1985. Currently there is no update strategy.

With the near completion of the first pass at data collection for the D.F.O. Pacific region, the existing products (data base and hard copy maps) need to be evaluated for
completeness of coverage, level of detail, suitability for resource management purposes, format and platform.
Currently, the data base and associated hard copy
maps are separate entitles making it difficult to complete and keep track of updates.
Efforts are under way to bring the hard copy maps into a digital environmental that
can be linked to the existing textual data base.

DFO/HELP

Fish Habitat Inventory & Information Program

Habitat Data & Information systems survey

Stream INFORMATION Summary System   (SISS)

The following is a summary from the survey results on fisheries habitat data and information systems. The summary has incorporated comments from DFO Habitat Management Division, Salmonid Enhancement Program, Science Sector, fisheries environmental consultants, and community colleges. Although survey questions focused on the Stream Information Summary system and the Stream Survey System, respondents were encouraged to identify broader information and system needs.

1. updates must be conducted on a regular basis

SISS must have current information if it is to assist decision making. In some locations SISS is five years out of date and is not used for this reason. There must be a strategy for updating. Several methods were identified including forwarding hardcopy updates to a central data entry area and updating capability in Subdistrict Offices. People must be made aware of benefits of continually updating and must be supported and encouraged to do so. SISS maps show historical use, not current use at former levels of abundance.

2. Information must be complete.

SISS is incomplete for many of the categories of information such as gradient. The level of completeness also varies depending on the Subdistrict and the presence or absence of salmon. There
are many additional information sources that must be tapped such as consultant reports, Fishery Officer narratives and personal knowledge. Some users noted that they depend on personal files
instead of SISS because SISS is incomplete and out of date.
There is a great deal of personal knowledge regarding fish habitat information that must be incorporated into SISS. More emphasis must be given to collecting and reporting information for non
anadromous fish species.

3. There must be greater geographical coverage of information.

A first pass SISS information has been completed for OFO
Subdistricts, the East Kootenays, and parts of the Yukon. SISS is not "complete" for most of eastern and northern B.C. and the Yukon. There is also a need to include all stream" in SISS regardless of

fish presence to assist habitat referrals and other applications.

4. Information must be credible.

Escapement data are full of inaccuracies and habitat
races to process and analyze the data).

 descriptions are qualitative. In some cases fish distribution data are not accurate. SISS information must he reported in greater detail for flow, fish distribution, spawning and rearing areas and escapement. Escapement, in particular, must be reported using the best source or information such as from counting fences. Greater commitment must be given to conducting rigorous, quantitative assessments using well documented, standardized procedures. There must be complete referencing, all information must be verified and the methods used must be reported.

5. The system must be user friendly and made available for use in a PC environment.
There is a need to make available "extractable data sets," updating capability by, for example, dbase IV, printing via local printer. System speed and access must be appropriate if it is to be used. Users would like to be able to quickly call up printer ready maps.

6. The watershed coding system must be made more user friendly.
Include a table of contents of watershed codes and stream name by page number in Stream Information Summary catalogues.. All streams should be included as separate entries. To facilitate locating individual streams a "stream network tree," should be created for each Subdistrict.

7. There is a large and varied need for maps of different scales and for different applications.
Maps must he available at scale. dependent on the application and level of detail required. GIS could be used to address these needs. SISS maps are sometimes too cluttered. Topographical and cadastrasl information should not be presented with fisheries data. Individuals must have the capacity to customize SISS maps and base maps for presentation in reports and meetings. The following types of maps were reported as being required in addition to SISS maps; forest cover, slope stability, landsat imagery, soils, riparian vegetation, wildlife, water licenses,, point source discharge sites' points where water quality data have been collected, land use, wetlands, special areas such as green strips, flood plains, and
habitat classification (see below).

8. Greater emphasis must be made on training.
Users need to be skilled in the usage of SISS. Workshops and
technical support should be provided for this purpose.
9. SIS its supportive must be
The existence   and its supportive infrastructure must be publicized to promote use by all users   potential users of the system.

10. The publication of SISS hardcopy catalogues should continue.

SISS catalogues were used more frequently than by access to SISS by vax and telephone request. However, direct access via the vax was hindered by lack of access, being user unfriendly, and slow system response time. Catalogues provide an effective means to record updated information and enable quick reference to DFO Subdistrict 1:50,000 maps.

11. Other information requirements includes

productive capability -   SISS does not address sources of production limitations

escapement data -   must be updated regularly; methods standardized and reported; enhanced stock counts must be reported separately from wild stocks; historic trends; better interpretations of escapement data by people with an understanding of the system; more reliable information such as from counting fences should be included.

historical environmental data -   such as past harvesting, and flood events

fish distribution -   non-anadromous fish distribution, spawning habitat distinguished from rearing habitat.

biophysical information -automatic recording station data to evaluate flow and temperature variations in key tributaries; spawning substrates by size, quality, and area; stream gradient profile, hydrological information (flows'), water quality, fish tissue, sediment quality, point discharge sites, waste management permits, and spill information

forest cover   -
riparian vegetation
landuse -   a complete listing of all landuses is needed.

soils and slope stability -
fish kills -   there should be a linkage to the DFO fish kill database

wetlands -
special areas - protected areas, green, belts, habitat compensation areas, restrictive covenants, parks

tides -   tide tables

climate -

air photo and satellite imagery - reference numbers for aerial photographs and satellite imagery should be included

water licences -

lake information - provincial lake data base

habitat classification - fish forestry guidelines classification system, slope failure potential

interpreted information - interpretations of biological and physical studies should be reported

cadastral information - roads, railroads etc.

administrative boundaries -

FISHERIES INVENTORY TASK FORCE

STATUS OF FISHERIES INVENTORIES

QUESTIONNAIRE/ INFORMATION TEMPLATE

1. INVENTORY NAME

Salmon Escapement Data Base and Reporting System (SEDS)

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON (BRANCH)

DFO, Biological Services Branch, Pacific Biological Station

3. INVENTORY TYPE; WHAT TYPES OF DATA ARE COLLECTED?

Biological
Fish Invertebrates Aquatic plants

Physical Habitat
Lakes Streams Foreshore Riparian

Water
Quality Quantity

Resource Use
Effort Catch

4. OBJECTIVES OF THE INVENTORY.

5. DESCRIBE THE DATA COLLECTED BY TYPE. ATTACH DATA FORMS IF AVAILABLE.

Number of fish by species, run timing

6. DESCRIBE INVENTORY METHODS AND STANDARDS. ARE THESE DOCUMENTED?

See Fishery Officer inventory document.

7. SCALE OF DATA COLLECTED

OVERVIEW   WHAT IS THE NUMERIC SCALE? 1:
MANAGEMENT
OPERATIONS

8. COVERAGE AND THE ADEQUACY OF THE COVERAGE?

Not adequate; restricted to selected known salmon-bearing streams.

9. WHAT ARE THE APPROXIMATE COSTS OF THIS INVENTORY (PER LAKE OR STREAM, OR TOTAL PER NUMBER OF LAKES).

10. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODOCT?

1) Fisheries Branch, DFO
2) SEP
3) Habitat Management Division, DFO
4) Pacific Salmon Allocation Resource Committee
5) Pacific Biological Station

11. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS: (CIRCLE CHOICE)

REPORTS MAPS TABLES OTHER
(ELECTRONIC OR HARD COPY hard copy

12. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

13. HOW IS THE DATA INTERPRETED BY/FOR CLIENTS?

Habitat inventory, stock assessment.

14. WHAT MODELS ARE USED FOR DECISION MAKING ?

15. HOW IS THE INVENTORY STORED? (CIRCLE CEOICE)

HARD COPY - REPORTS MAPS OTHER
ELECTRONIC - SPATIAL NONSPATIAL

16. DO YOU CONSIDER THE INVENTORY ADEQUATE? DESCRIBE ANY STRENGTHS, SHORTCOMINGS, PROBLEMS OR ISSUES ASSOCIATED WITE THIS INVENTORY.

Errors in interpretation can lead to management measures which cause serious social and economic disruption or over-fishing. In either case, the long term benefits from the resource are severely compromised. Fisheries

management can also become vulnerable to lobbying if stock assessments are uncertain or lack credibility. The current Fishery Officer escapement record is in many cases a
severe impediment to effectively fulfilling our mandate.

ESTABLISEMENT OF REGIONAL ESCAPEMENT MONITORING STANDARDS

Regardless of the production and harvest management systems used, spawning escapement data collected for stock assessment purposes should be of known accuracy and precision and comparable from one year to the next. At a minimum, the escapement data must serve as a defensible index of the true escapement level.

In some streams more detailed data will need to be collected.
This is particularly true in streams where coded wire tag recovery data are being used to scale ocean catches or to estimate ocean exploitation rates. In streams such as these, accurate escapement data to the whole stream will need to be known to some level of precision.

To meet these requirements the following Regional standards need to be applied to all systems and all species:

1. Stocks and/or streams for escapement enumeration should be selected based on their importance to fishery management, stock assessment, SEP assessment and habitat protection;

2. Based on the above selections, the stocks/streams should be prioritized in order of importance; these priorities will determine the number and intensity of visits in any season,
depending on budget limitations;

3. Selected stocks/streams will be surveyed annually using a pre-defined method and schedule;

4. Survey methods used must be scientifically sound and fully documented;

5. A validation system (species ID, verify counts) may need to be instituted for some streams; and,

6. For some stocks/streams, it may be necessary to collect biological information along with the escapement counts (this would include age composition information, sex ratios and tag incidence, as well as insuring that there are sufficient resources to process and analyze the data).

FISHERIES INVENTORY TASK FORCE
STATUS OF FISHERIES INVENTORIFS

QUESTIONNAIRE/INFORMATION TEMPLATE

1. INVENTORY NAME Winter Limnological Surveys

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON (BRANCH)

Regions 5, 3, 7

3. INVENTORY TYPE; WHAT TYPES OF DATA ARE COLLECTED?

Biological
Fish Invertebrates Aquatic plants
Physical Habitat
Lakes Streams Foreshore Riparian
Water
Quality Quantity
Resource Use
Effort Catch

4. OBJECTIVES OF THE INVENTORY.

Quick check of water quality (O2) at time of lowest values (late February early March) to determine capability to support fish. If O2 looks OK, then lake has fish in it or could have fish production through stocking.

5. DESCRIBE THE DATA COLLECTED BY TYPE. ATTACH DATA FORMS IF AVAILA8LE.

O2/temp at 1 m intervals to bottom or 10 m.
PH, TDS, conductivity, snow depth, ice depth.

6. DESCRIBE INVENTORY METHODS AND STANDARDS. ARE THESE DOCUMENTED?

Report in preparation.
Could be standardized by Victoria.

7. SCALE OF DATA COLLECTED

OVERVIEW   WHAT IS THE NUMERIC SCALE? 1:100,000
MANAGEMENT
OPERATIONS

8. COVERAGE AND THE ADEQUACY OF THE COVERAGE?

We have about 800 samples on 500 lakes.

9. WHAT ARE THE APPROXIMATE COSTS OF THIS INVENTORY (PER LAKE OR STREAM, OR TOTAL PER NUMBER OF LAKES).

$60-80 per lake for helicopter time.
35 lakes per day for staff of two to three.

10. WHO ARE YOUR CLIENTS, THE DSERS OF THIS PRODUCT?

Fisheries staff, Habitat Protection, Forestry.

11. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS: (CIRCLE CHOICE)

REPORTS MAPS TABLES OTHER
ELECTRONIC OR HARD COPY hard copy

12. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

Protection and Recreational development and Planning for future inventory.

13. HOW IS THE DATA INTERPRETED BY/FOR CLIENTS?
Not

14. WHAT MODELS ARE USED FOR DECISION MAKING ?

Winter kill risk values determined on mean O2 at various strata. Report in preparation.

15. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

HARD COPY REPORTS MAPS OTHER
ELECTRONIC - SPATIAL NONSPATIAL

16. DO YOU CONSIDER THE INVENTORY ADEQUATE? DESCRIBE ANY STRENGTHS, SHORTCOMINGS, PROBLEMS OR ISSUES ASSOCIATED WITH THIS INVENTORY.

- very useful!! for planning.

- problem with unnamed lakes location.
- variability in O2 readings from year to year.
- no relationship established yet between winter measurements.
Of TDS, PH and summer values.

FOREST RESOURCES INVENTORY COMMITTEE

STATUS OF FOREST RES0URCES INVENTORIES

QUESTIONNAIRE

1. INVENTORY NAME

Biophysical Lake Inventory

2. AGENCY DEVELOPING INVENTORY/CONTACT PERS0N (BRANCH)

Ministry of Environment, Lands & Parks
Fisheries Branch
Contact: J.A. Balkwill

3. INVENTORY TYPE
- LEGAL/ADMIN
RESOURCE STATUS yes
RESOURCE MANAGEMENT/MONITORING yes
S0CIO-ECONOMIC
OTHER

4. WHAT DATA DO YOU COLLECT?

Basic bathymetric data; fisheries species presence/size/condition/relative numbers; water chemistry; surrounding land usage; inlet/outlet spawning and rearing potential; misc. related observations including access details, terrain features, existing recreational facilities.

5. SCALE OF DATA COLLECTED (PLEABE DO 1 SHEET/SCALE)

OVERVIEW   WHAT IS THE NUMERIC SCALE? 1:
MANAGEMENT ves   Scale varies with size of lake
OPERATIONS

6. DESCRIBE YOUR DATA, INVENTORY, COVERAGE AND THE ADEQUACY OF THE COVERAGE?

This inventory would be described as detailed, single pass, reconnaissance. Fieldwork is always involved. About 3,000 out of 25-30,000 lakes in the province have been surveyed, mostly in the south. Coverage is adequate in a few areas (e.g. Okanagan)) but generally totally inadequate, especially in the north, and frequently out of date even where it does exist.

7. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT?

Principal users are ministry regional fisheries and habitat staff. Other internal users are Water Quality Branch, Environmental Protection and Parks. External users include Ministry of Agriculture and Fisheries, Department of Fisheries and Oceans, B.C. Hydro,, RCMP,, native tribes, consulting firms and the general public.

8. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY??
Regional fisheries staff use the data to identify and manage wild fish stocks, to determine stocking levels for hatchery fish, and to identify rehabilitation possibilities. Habitat staff use it in planning and referral processes. The general public are recreational users of the lake bathymetry and fish data.

9. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

HARD COPY - REPORTS MAPS   OTHER
ELECTRONIC - SPATIAL NONSPATIAL

10. WHAT PRODUCT(8) IS SUPPLIED TO CLIENTS: (CIRCLE CHOICE)

REPORTS MAPS TABLE OTHER
ELECTRONIC OR HARD COPY hard copy

11. ARE YOUR CLIENTS CHARGED FOR THIS PRODUCT? "EAT IB TEZ CHARGE?

Government users receive existing data free of charge. Private users and contractors get free reports but are charged for bathymetric maps at rates set by MAPS BC (currently
S3.25+taxes+$1.00 handling).

12. DO YOU have INVENTORY METHODS AND STANDARDS DOCUMENTED?

The current methodology is described in detail in a draft manual that will be published in 1992. The manual was tested by internal regional staff in 1991. Feedback from the exercise
will be complete by the end of November.

13. DESCRIBE ANY SHORTCOMINGS, PROBLEMS OR ISSUES ASSOCIATED WITH THIS INVENTORY.
(Attach additional sheets if required to address this question.)

Detailed reconnaissance inventory meets only some of the requirements of fisheries and habitat managers, the primary clients. There is an immediate need for a companion product that focuses on the quick identification of high value, sensitive and threatened wild fish stocks and habitats.
The existing detailed product also needs to be re-examined to see if it includes all the variables needed for today's applications. For example, past management has dealt exclusively with game species; rare and endangered non-game species must now be considered. As well, management models continue to be developed and revised -- most importantly for defining productive capacity and habitat sensitivity -- and the inventory must provide the data needed by those models.

Access to existing data is a major shortcoming. The present hardcopy lake reports and accompanying bathymetric maps are expensive and time consuming to produce and distribute and do not, in themselves, meet many of the needs that the data could be put to. Quality control is difficult to maintain because most of the current inventory projects are contracted out from regional offices, often focus only on immediate, narrow objectives, and are not controlled by experienced inventory staff.

A computerized database management system is presently under development and will be in place by April 1, 1992. This will permit a greatly expanded suite of analyses, interpretations
and reports as well as quicker updating and more effective control of data quality. The major problem in making this system operational will the time and cost to complete existing
data entry.

The major problem with this inventory as already mentioned, however, is coverage -- rather, lack of coverage. First pass inventory has barely begun in the northern two-thirds of the
province.

FOREST RESOURCES INVENTORY COMMITTEE
STATUS OF FOREST RESOURCES INVENTORIES

QUESTIONNAIRE

1. INVENTORY NAME BIOPHYSICAL STREAM SURVEYS

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON ((BRANCH))

MINISTRY OF ENVIRONMENT,
 LANDS AND PARKS FISHERIES BRANCH
CONTACT: R.S.. HAWTHORN

3. INVENTORY TYPE

- LEGAL/ADMIN
- RESOURCE STATUS YES
- RESOURCE HANAGEMENT/MONITORING YES
- SOCIO ECONOMIC
- OTHER

4. WHAT DATA DO YOU COLLECT?

- Basic stream channel physical properties (widths, depths, gradient, debris,
discharge, bank Properties, bed composition, confinement, etc.).
- Obstructions to fish passage, cover, Crown closure.
- Fish presence, some detail on age/length/condition of fish.
- Water properties, (oxygen, temperature, conductivity, pH, etc.).
- Land/water use, management concerns, etc.

5. SCALE OF DATA COLLECTED (PLEASE DO 1 SHEET/SCALE)

OVERVIEW
MANAGEMENT~   WHAT IS THE NUMERIC SCALE? 1: 50.000 (approx.)
OPERATIONS

6. DESCRIBE YOUR DATA, INVENTORY, COVERAGE AND THE ADEQUACY OF THE COVERAGE?

Data describes survey at 2 levels: (a) describes a length (reach) of streams; ((b) describes stream features at a
particular site where ground measurements taken Approximately 20% of B.C. covered in mid-1970's - early 1980's
in systematic fashion since then surveys only on a project-specific or opportunistic basis.

7. WHO ARE YOUR CLIENTS, TEE USERS OF THIS PRODUCT?

Prime requesters/ users are Regional Fisheries and Habitat staff. Other main
users are consulting companies and lately Native groups.

8. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

Regional Fisheries staff use it to define possible areas to perform management tasks such as fish stocking or
rehabilitation projects. Habitat staff Utilize data in decision-making process of handling referrals.

9. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

        HARD COPY   -   REPORTS   MAPS OTHER   DATA CARDS
        ELECTRONIC -   SPATIAL NONSPATIAL

10. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS? (CIRCLE CHOICE)

        REPORTS   MAPS   TABLES   (OTHER COPIES OF CARDS
        ELECTRONIC OR HARD COPY

11. ARE YOUR CLIENTS CHARGED FOR THIS PRODUCT? WHAT IS THE
CHARGE?

Not currently.

12. DO YOU HAVE INVENTORY METHODS AND STANDARDS DOCUMENTED?

"Stream Survey Field Guide" published in 1989 details methods of collection, etc.
A "Stream Survey Manual" describing surveys in general currently in second draft,(13. DESCRIBE A~'Y
SHORTCOMMINGS, PROBLEMS OP. ISSUES ASSOCIATED
WITH THIS INVENTORY. (Attach additional sheets if required to address this question.)

13. The original intent of this inventory was to cover the entire province in a systematic fashion. That intent needs
to be re-examined. Detailed stream survey inventory complements the overview-level Stream Information
Summary System (SISS) which is described elsewhere. A more effective and realistic approach may be to first
survey the province at the SISS level, and to do detailed inventory only in high value/problem areas. If this were
the case, should the detailed inventories follow a standard format or should they be "problem focussed"?

In either case, the existing product needs to be reviewed to ensure that it includes all the variables needed for
today's applications. For example, past fisheries management has dealt almost exclusively with game species; rare
and endangered non-game species must now be considered. Additionally, management models continue to be
developed and revised - most importantly for defining productive capacity and habitat sensitivity - and the inventory
product must provide the data needed by these models.

Poor access to existing data is a also a major shortcoming. The inventory currently exists only as 25,000+
hardcopy data cards and 300+ maps. For the most part, only one copy of each data card exists and it must be
photocopied for others to use the information. The development of a computerized georeferenced database is
essential but has not yet begun.

FISHERIES INVENTORY TASK FORCE

STATUS OF FISHERIES INVENTORIES

QUESTIONNAIRE/INFORMATION TEMPLATE

1. INVENTORY NAME

Habitat Management Plans for the Fraser River Basin

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON (BRANCH)

Fraser River Task Force, DFO

3. INVENTORY TYPE; WHAT TYPES OF DATA ARE COLLECTED?

Biological
FISH Invertebrates Aquatic plants
PHYSICAL   Habitat
Lakes Streams   Foreshore Riparian
WATER
Quality Quantity , Resource Us Effort Catch

4. OBJECTIVES OF THE INVENTORY.

This is not an inventory per se but a compilation of existing
Inventories is a major component of the plans in:

- documenting salmonid use and status of stream habitat for
each salmon watershed;
- identifying other resource users in the watershed and interactions with fisheries; and,

- identifying restoration and enhancement opportunities.

5. DESCRIBE THE DATA COLLECTED BY TYPE. ATTACH DATA FORMS IF
AVAILABLE.

Forestry - Rate of Cut - Landsat
Agriculture - ~ of watershed, ~ of stream length
Water Quality - Naquadat, Seam, Waste permits
Water Use - Hydat, Water licences
Mining - Minfile
Biophysical - Geology, soils, terrain, biogeoclimatic zones
Fisheries - SISS

6. DESCRIBE INVENTORY METHODS AND STANDARDS. ARE THESE DOCUMENTED??

Vary with database. In general, could use a lot of improvement.

7. SCALE OF DATA COLLECTED

OVERVIEW WHAT IS THE NUMERIC SCALE? 1:50.000 / 1:250,000 MANAGEMENT
MANAGEMENT
OPERATIONS

8. COVERAGE AND THE ADEQUACY OF THE COVERAGE?

Need data on a watershed basis -- not usually available. Coverage is often inadequate for Fraser River sub-basins.

9. WHAT ARE THE APPROXIMATE COSTS OF THIS INVENTORY (PER LAKE
STREAM, OR TOTAL PER NUMBER OF LAKES).

N/A

10. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT?

Stakeholders in the Fraser River basin. Overall objective to
develop an environmentally sustainable development plan for the Fraser River basin.

11. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS: (CIRCLE CHOICE)

REPORTS MAPS TABLES OTHER
ELECTRONIC OR HARD COPY
Working towards GIS

12. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

13. HOW IS THE DATA INTERPRETED BY/FOR CLIENTS?
- Developing models to determine production goals for salmon;
- Developing sensitivity indices for streams.

14. WHAT MODELS ARE USED FOR DECISION MAKING ?

15. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

HARD COPY - REPORTS MAPS OTHER
ELECTRONIC SPATIAL NONSPATIAL
Not standardized as yet.

16. DO YOU CONSIDER THE INVENTORY ADEQUATE? DESCRIBE ANY STRENGTHS, SHORTCOMINGS
PROBLEMS OR ISSUES ASSOCIATED WITH THIS INVENTORY.

Shortcomings with fisheries database (SISS):

- not spatially linked (need GIS);
- does not include detailed stream survey data (reaches);
- no mechanism for updating;
- not adequate for assessment of habitat/productivity;
- digital map bases not available, i.e. need enhancement,
restructuring, etc.;
- no lake information.

Common problems with other data bases:
-cannot be easily sorted into watersheds; - problems of data quality, reliability;
- difficulty of access;
-data not included in electronic database.

Significant improvement is required in most databases to be useful for management decisions. Optimum use should be made of
GIS technology.

FISHERIES INVENTORY TASK FORCE

STATUS OF FISHERIES INVENTORIES

QUESTIONNAIRE/INFORMATION TEMPLATE

1. INVENTORY NAME

Small Lakes Index Management (SLIM)

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON (Branch)

Ministry of Environment, Lands and Parks
Fisheries Branch
D. Tredger 387-9588

3. INVENTORY TYPE; WHAT TYPES OF DATA ARE COLLECTED?

Biological
Fish Invertebrates Aquatic plants
Physical Habitat
Lakes Streams Foreshore Riparian
Water
Quality Quantity
Resource Use
-Effort CATCH

4. OBJECTIVES OF THE INVENTORY.

To monitor trends in angler effort, catch per unit effort and size and age of fish in small lake sport fisheries.
Standardized procedures allow consistent comparisons across regions and
years.

5. DESCRIBE THE DATA COLLECTED BY TYPE. ATTACH DATA FORMS IF
AVAILABLE

Angler effort - collected by index angler activity counts made from the air on 20 predetermined dates and times. The number of boats and shore anglers actively engaged in fishing are counted. Dates and times are chosen to cover a high use (midday weekend) period. Flightlines and timing are consistent over regions and years. Flightline specific data forms are provided to flight contractors.

Catch per unit effort and fish sampling - creel surveys are conducted on high use weekend days. Anglers are asked the numbers of fish kept and released, and hours fished. Angler caught fish are measured, and scale samples are taken.

6. DESCRIBE INVENTORY METHODS AND STANDARDS. ARE THESE DOCUMENTED?

Methods and standards are documented on the attached forms and instructions. See data form and instruction package (attachment 1).

7. SCALE OF DATA COLLECTED
OVERVIEW X WHAT IS THE NUMERIC SCALE? 1:
MANAGEMENT X
OPERATIONS

Two levels include single year counts to provide an estimate of angler use, and multi-year data to determine trends.

8. COVERAGE AND THE ADEQUACY OF THE COVERAGE?

The number of SLIM lakes varies annually. Approximately 500 lakes have adequate estimates of effort for 1 year or more. These lakes are concentrated in the southern interior of the province (attachment 2). Regions 1,2,6 and 7 have not been included in the program because of logistical and budgetary considerations. Lesser quality data has been collected early in the program, and more recently by using MOF Fire Patrol flights. A complete listing of lakes by region is available.

9. WHAT ARE THE APPROXIMATE COSTS OF THE INVENTORY (PER LAKE OR
STREAM, OR TOTAL PER NUMBER OF LAKES).

Aerial flight costs per lake vary with size, location and concentration of lakes on each flightline. Cost per lake in 1989 and 1990 averaged $114/lake. See attachment 3.

Weekend creel surveys cost approximately $400 per lake per weekend.
Again these vary.

10. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT, AND WHAT DO
THEY USE IT FOR?

Main clients are regional fisheries managers. Information used to estimate effort, catch per effort and quality (fish size) on small lake fisheries. Used to manage fishery to meet lake specific objectives.

Effort by itself used to value the resource (importance of fishery) and as a component in wild stock management (exploitation).

Other users include Headquarters Sections to evaluate programs (fish culture, HCF, wild stock status, etc.). Anyone interested in resource values will use the data.

11. WHAT PRODUCT (s) IS SUPPLIED TO CLIENTS (CIRCLE CHOICE))

REPORTS MAPS TABLES   OTHER
ELECTRONIC OR HARD COPY

Access to database for regional use.

12. HOW IS THE DATA INTERPRETED BY/FOR CLIENTS? WHAT MODELS ARE USED?

Angler effort is estimated from a regression of mean SLIM boat
count vs total boat hours (see attachment 4).

The SLIM Index for trend analysis is also calculated. Mean boat count, catch per effort and fish size/age statistics are calculated (see attachment 5). All calculations are done by the HQ SLIM coordinator.

Time series of fishery statistics are viewed graphically to determine success of management relative to goals (see attachment
6).

13. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)
HARD COPY - REPORTS MAPS   OTHER
ELECTRONIC - SPATIAL NONSPATIAL

Database stored in DBASE on Fisheries Branch LAN. Subsets available in some regions. Lakes have watershed codes and lake sequence numbers assigned but have not yet been linked to the database.

14. DO YOU CONSIDER THE INVENTORY ADEQUATE? DESCRIBE ANY STRENGTHS, SHORTCOMINGS, PROBLEMS OR ISSUES ASSOCIATED WITH THIS INVENTORY.

This inventory provides broadly comparable estimates of some variables useful in managing small lake fisheries. It provides the capability to collect standard data on a large number of lakes at a reasonable cost on a per lake basis.

The program was not really designed to estimate angler effort. It was designed to provide and index of sufficient sample size to compare effort over a time series. The regression relating angler activity to the SLIM index appears to work rather well.

Coverage of areas with logistical and cost related problems is lacking. Problems include coastal areas where season length may be considerably longer, and weather for flying is relatively poor. Other areas do not have a concentration of lakes that would provide the benefits of low unit cost. The latter consideration relates more to strict SLIM type objectives rather than single year estimates of angler effort.

FISHERIES INVENTORY TASK FORCE

STATUS OF FISHERIES INVENTORIES

QUESTIONNAIRE/INFORMATION TEMPLATE

1. INVENTORY NAME Steelhead Harvest Analysis

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON (BRANCH)

Fisheries Branch - Ministry of Environment, Lands and Parks

3. INVENTORY TYPE; WHAT TYPES OF DATA ARE COLLECTED?

Biological
Fish Invertebrates Aquatic plants
Physical Habitat
Lakes Streams Foreshore Riparian Water
Quality Quantity
Resource Use
Effort Catch
Other

4. OBJECTIVES OF THE INVENTORY.

To obtain trend information on angling effort and catch success for steelhead province wide.

5. DESCRIBE THE DATA COLLECTED BY TYPE. ATTACH DATA FORMS IF AVAILABLE.

See attached.

6. DESCRIBE INVENTORY METHODS AND STANDARDS. ARE THESE DOCUMENTED?

Yes. A postcard questionnaire survey of a sample of anglers who purchased steelhead licenses in B.C. This is an annual survey.

7. SCALE OF DATA COLLECTED

OVERVIEW WHAT IS THE NUMERIC SCALE? 1:
MANAGEMENT
OPERATIONS

8. COVERAGE AND THE ADEQUACY OF THE COVERAGE?

Mailout is to 100% of non-resident Canadians and non-Canadian; 60% of B.C. residents who bought steelhead licenses. Response rate is about 55%/about 30% of license holders. Non-residents are sampled at a high rate to ensure a statistically adequate response.

9. WHAT ARE THE APPROXIMATE COSTS OF THIS INVENTORY (PER LAKE OR STREAM, OR TOTAL PER NUMBER OF LAKES).

-$60/stream

10. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT?

Regional fisheries biologists and the public.

11. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS: (CIRCLE CHOICE)

REPORTS MAPS TABLES OTHER
ELECTRONIC OR HARD COPY

12. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

Monitor trends in angling success for steelhead, angling days and catch and release. Also, shows effects of regulation changes on angler behavior. General public uses it to plan fishing trips. Journalists use it to raise issues and discuss angling opportunities.

13. HOW IS THE DATA INTERPRETED BY/FOR CLIENTS?

Standard mathematical procedures are used to extrapolate from reported values to estimate data on a stream by stream basis for all steelhead anglers.

14. WHAT MODELS ARE USED FOR DECISION MAKING ?

15. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

HARD COPY REPORTS MAPS OTHER
SPATIAL NONSPATIAL
DBase Stream by stream

16. DO YOU CONSIDER THE INVENTORY ADEQUATE? DESCRIBE ANY STRENGTHS, SHORTCOMINGS, PROBLEMS OR Issues ASSOCIATED WITH THIS INVENTORY.

Studies and comparisons to on-site creel census data indicate a positive response bias. The questionnaire likely produces inflated estimates of steelhead catch and angler days. Few anglers maintain permanent records so they rely on memory to fill out the questionnaire. The likelihood that the most active and successful anglers are the keenest to return the questionnaire could also be a factor leading to an overestimate.

Care must be taken in interpretation of the data and trends for caught and released wild fish. Catch and release regulations can make it appear as though numbers of fish have increased dramatically in some streams when actually the same fish can be caught repeatedly.

Poor angling conditions can make it appear as though runs have decreased. It is important to link weather, flow conditions, regulation changes, etc. to interpretation of results. Other factors influencing the behavior of anglers or other resource users can be important as well. However, we now have 25 consecutive years of data which regional fisheries managers find useful.

FISHERIES INVENTORY TASK FORCE
STATUS OF FISHERIES INVENTORIES

QUESTIONNAIRE/INFORMATION TEMPLATE

1. INVENTORY NAME
Stream Inventory
- Stock Monitoring
- Stock Assessment
- Impact Assessment
-Determination of Fisheries Flow Requirements

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON (BRANCH)

Fisheries Branch - Ministry of Environment, Lands and Parks Contact: Ronald A. Ptolemy, SMU,
Conservation Section, 387
9582.

3. INVENTORY TYPE; WHAT TYPES OF DATA ARE COLLECTED?

Biological
 FISH Invertebrates Aquatic plants
Physical HABITAT
    Lakes Streams Foreshore Riparian
Water
        Quality, Quantity
          temperature;   suspended sediment;
        T. alkalinity   depth/velocity distribution
        conductivity
        pH nitrogen/phosphorus profile
Resource Use
Effort Catch
Other
special analysis dependent on suspected
quality problems (e.g. dissolved 02, ammonia)

4. OBJECTIVES OF THE INVENTORY.

1. Resource status
2. Resource management (wild stocks)
3. Resource management/monitoring
4. Determine carrying capability
5. Determine sustainable use
6. Determine resource rarity/limitations
7. Determine hatchery stocking rate
8. Mitigation/compensation

5. DESCRIBE THE DATA COLLECTED BY TYPE. ATTACH DATA FORMS IF AVAILABLE.

1. Fish abundance/species composition
 - length frequency - capture form
2. Habitat description
 - see form
 - air photo interpretation
- deLeouw habitat unit description of multiple units = reach
-Ryan thermograph records; WSC spot temperatures
- freeze-core gravel sampling

- water quality sampling by reach or system
3. Steam transect
- partial/whole stream wide depth/velocity distribution transect (see form)

6. DESCRIBE INVENTORY METHODS AND STANDARDS. ARE THESE DOCUMENTED?
As above:
1. Yes; standard fisheries manuals/software
2. Yes; deLeeuw document and others
3. Yes; IFIM approach/manuals

7. SCALE OF DATA COLLECTED

WHAT IS THE NUMERIC SCALE? 1:

OVERVIEW 1:250,000 (species distribution; 1st cut estimates of capability)

MANAGEMENT1:20,000 - 50,000   (detailed reach description, cover, reach water quality)

OPERATIONS 1:1000 - 1:20,000   (detailed inventory/ecological studies)

8. COVERAGE AND THE ADEQUACY OF THE COVERAGE?

At all scales:
- inadequate
- overview available for Skeena and Thompson steelhead
- data is often relevant to single points
- data gaps are large
- virtually no overlap in data of similar quality
- coverage limited to selected Skeena tribs (-700 sites), Kootenay region (15 streams); Interior (Kamloops; N = 50 streams) South Coast (N = 200 streams)

9. WHAT ARE THE APPROXIMATE COSTS OF THIS INVENTORY (PER LAKE OR STREAM, OR TOTAL PER NUMBER OF LAKES).

        a)   -700 - 1000 dollars per stream sample site involving
population density surveys and detailed habitat description.

        b)   -10,000 - 30,000 dollars per stream system dependent on
drainage size

10. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT?

- research and management biologists (inhouse Fisheries staff)
- habitat management staff (DFO, MOELP)
- Native groups
- public interest groups (e.g. Bilston-Metchosin Watershed Society)

11. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS: (CIRCLE CHOICE)

OTHER MAPS TABLES OTHER
ELECTRONIC or HARD COPY; hard copy

12. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

- use information to better manage fish/habitat resource
- use information to protect what is left of a limited resource
- use information to determine 'safe' exploitation while sustaining longterm abundance of stocks
- modify Fisheries regulations/stocking strategies
- determine mitigation/compensation in resource conflicts (e.g. B.C. Hydro, MOTH)

13. HOW IS THE DATA INTERPRETED BY/FOR CLIENTS?

By:
- qualified (RPBio) biologist/ecologist
- fish abundance is rated using standard habitat suitability
curves, physical data, known experimental results (Re. physiology)
- aid of physical sciences specialist hydrology, geography)

14. WHAT MODELS ARE USED FOR DECISION MAKING ?

See objectives answers for question #4.
1. Fish densities rated against model predictions (e.g. T. alk model) integrating fish size and competing species
abundance/size overlap; territory-size model.
2. Habitat suitability curves.
3. Growth-temperature model(s); smolt age model - growth
season length.
4. Sediment - fisheries interaction model (% egg-fry survival;
fish food production).
5. Egg number/' - fish size model.
6. Usable space vs. stream size, flow stage model.
7. Species distribution, stream size; water yield; stream
order model.
8. Channel form - stream sinuosity model Re. Hab. Improv.
Structure Placement.

15. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

HARD COPY - REPORTS MAPS OTHER graphs
ELECTRONIC - SPATIAL NONSPATIAL
VAX files by data type

16. DO YOU CONSIDER THE INVENTORY ADEQUATE? DESCRIBE ANY STRENGTHS, SHORTCOMINGS, PROBLEMS OR ISSUES ASSOCIATED WITH THIS
INVENTORY.

- Inventories are largely incomplete Re. hydraulic suitability of sample sites done by outside agencies/consultants.
- Need simplification of physical habitat description (fewer parameters).
- Need precision of measurement/repeatability.
- Need better diagnostic power.
- Inventory of large rivers is problematic due to insufficient reach sampling Re. 'cover' attributes (e.g. frequency of habitat types/LWD structures)
- Need regionalized flow regime/temperature/water quality to
resolve 'overview' scale problems.

- Current inventories often do not qualify results of habitat descriptions with specific flow stages at time of survey. -Some investigations have not clearly separated all
groups/size classes using 'mix-~software or scale analysis this leads to highly questionable results (e.g. mixing population density estimates - for separate age groups).
- Habitat suitability curves are not available or verified for
most native species in B.C. (both salmonids/non-salmonids).
- Digitized blueline atlas has yet to be made user-friendly Re.
analysis of stream order - segments lengths.

FISHERIES INVENTORY TASK FORCE

STATUS OF FISHERIES INVENTORIES

QUESTIONNAIRE/INFORMATION TEMPLATE

1. INVENTORY NAME: F.A.I.U. (Victoria) Habitat Capability

Inventory

2. AGENCY DEVELOPING INVENTORY/CONTACT PERSON (BRANCH)
Fisheries Branch Vancouver Island Region

J.C. Wightman Anadromous Streams Biologist

3. INVENTORY TYPE; WHAT TYPES OF DATA ARE COLLECTED?
Biological
FISH Invertebrates Aquatic plants
Physical Habitat
Lakes Streams Foreshore Riparian
Water
Quality Quantity: Water survey of Canada stream flow records; -water quality is derived from steam specific sampling. All inventory of streams now includes water sampling (parameters same as those requested by R. Ptolemy).

Resource Use
- effort Catch Steelhead Harvest Analysis __ _ ,

4. OBJECTIVES OF THE INVENTORY.

Determine watershed and/or reach specific habitat capability.

5. DESCRIBE THE DATA Collected BY TYPE. ATTACH DATA FORMS IF AVAILABLE.

Generally use F.A.I.U. Habitat/Fish SamDlina Site field form supported by Stream Transect field form for determining useable area by species. Length frequency forms are used for recording
all fish data.

6. DESCRIBE INVENTORY METHODS AND STANDARDS. ARE THESE DOCuMENTED?

Currently favour F.A.I.U. approach for most inventories however there are examples of non-standard inventories such as the Mainland Coast report (copy given to Gary Norris).

7. SCALE OF DATA COLLECTED

OVERVIEW 1:50,000 WHAT IS THE NUMERIC SCALE? 1:50,000
MANAGEMENT 1:50,OOO)
) would probably use 1:20,000 scale maps if
OPERATIONS 1:50,000   ) available

8. COVERAGE AND THE ADEQUACY OF THE COVERAGE?

Very little inventory on most Mainland Coast streams (Loughborough Inlet to Smith Inlet). A similar situation exists for the West Coast of Vancouver Island--particularly for small to medium sized streams.

9. WHAT ARE THE APPROXIMATE COSTS OF THIS INVENTORY (PER LAKE OR STREAM, OR TOTAL PER NUMBER OF LAKES).10. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT?

This can be done for lakes more simply/accurately than for streams--for streams the costs are very sensitive to access limitations (i.e. use of aircraft) and intensity of the inventories (i.e. reconnaissance level vs. habitat capability).

10. WHO ARE YOUR CLIENTS, THE USERS OF THIS PRODUCT?

Other resource agencies (Ministry of Transportation and Highways et al; Ministry of Forests; Department of Fisheries and Oceans; Ministry of Agriculture, Fisheries and Food; Ministry of Tourism; Ministry of Environment, Lands and Parks, etc.); also various Native Bands/Tribal Councils.

11. WHAT PRODUCT(S) IS SUPPLIED TO CLIENTS: (CIRCLE CHOICE)

REPORTS MAPS TABLE ~ OTHER all but not new data
ELECTRONIC OR HARD COPY ~ hard copy

12. WHAT DO YOUR CLIENTS DO WITH THIS INVENTORY?

Used for assisting in resource development decisions; habitat protection planning; enhancement/restoration; proposing regulations (from public groups).

13. HOW IS THE DATA INTERPRETED BY/FOR CLIENTS?

We are not directly responsible for ensuring the '§ clients" interpret our data as we would like. We are always prepared to

14. WHAT MODELS ARE USED FOR DECISION MAKING ?

This question leaves a lot to be desired!! We use various habitat capability models (Slaney parr model; Drainage Area/M.A.D.; Alkalinity/Specific Conductance model) for deriving estimates of wild smolt production from watersheds.

15. HOW IS THE INVENTORY STORED? (CIRCLE CHOICE)

HARD COPY - REPORTS NAPS OTHER
ELECTRONIC - SPATIAL NONSPATIAL

D Base, Lotus/Excel, Harvard Graphics

16. DO YOU CONSIDER THE INVENTORY ADEQUATE? DESCRIBE ANY STRENGTHS, SHORTCOMINGS, PROBLEMS OR ISSUES ASSOCIATED WITH THIS INVENTORY.

Overall, the existing inventory is not adequate due to incomplete regional coverage and the fact that much of the inventory information is now dated. We also do not have enough hydrology and water quality data for many of our streams, which is increasingly necessary for production modeling. We would like to have an improved capability to expeditiously access the more remote watersheds, which means more helicopter funds to collect the necessary data for decision-making. And as always, we desperately need more "arms and legs" to do the grunt work!

APPENDIX 3.3 Summary of Other Inventories

Habitat Inventory Program
Agency: DFO, Habitat Management Division
Inventory Type: biophysical, stream
Data Types: fish; fish habitat; riparian; watershed; management
Level of Detail: overview
Period: single pass, mid-1980's; currently inactive
Data Storage: hard copy
Comments: father of SISS; coverage restricted to east coast of Vancouver Island

Salmonid Habitat Inventory Program
Agency: DFO/MELP (Fisheries Branch)
Inventory Type: biophysical, stream
Data Types: fish; fish habitat; riparian; watershed; management
Level of Detail: overview
Period: single pass, mid-1980's; currently inactive
Data Storage: hard copy
Comments: available length of stream in different categories for fish production; 5 major and 35 minor river basins on Vancouver Island and mainland coast; used to screen SEP projects

Coho Initiative
Agency: DFO
Inventory Type: biophysical, stream
Data Types: fish; fish habitat; riparian; watershed; harvest/use; management
Level of Detail: overview
Period: on-going since early 1990's
Data Storage: currently hard copy
Comments: program to protect small streams for wild coho in Georgia Strait; set-back zoning at land use planning level

National Sportfishing Survey
Agency: DFO (Recreational Fisheries Division)/MELP (Fisheries Branch)
Inventory Type: resource use
Data Types: fish; harvest (by species); angler days; angler satisfaction; economics
Level of Detail: overview
Period: conducted at five year intervals since 1975
Data Storage: electronic for statistical data; hard copy report published
Comments: all federal, provincial and territorial governments participate; provides basic information on the British Columbia freshwater sport fishery as well as contributing to understanding of national sport fishery

Licence Sales Data Base
Agency: MELP, Fisheries Branch
Inventory Type: management
Data Type: management
Level of Detail: overview
Period: on-going since early 1990's
Data Storage: electronic; hard copy
Comments: angling licence trend analyses for licence design and fee structure

BC 16's
Agency: DFO, Habitat Management Division
Inventory Type: biophysical
Data Type: fish
Level of Detail: reconnaissance
Period: on-going since at least early 1950's for some streams
Data Storage: hard copy
Comments: Fishery Officer narratives on spawning escapements; coverage restricted to selected known salmon-bearing streams; Pacific Biological Station restricted in ability to direct data collection

Museum Collections
Agency: Royal British Columbia Museum; others (universities, etc.)
Inventory Type: biophysical
Data Type: fish; aquatic invertebrates
Level of Detail: reconnaissance
Period: on-going since 1940's
Data Storage: preserved specimens in reference collections; data from research collections incorporated into scientific publication, popularized literature, exhibits, teaching programs, demonstrations; computerization on-going
Comments: emphasis on selected taxa collected in Columbia River basin; only a few representatives from elsewhere in the province

Stream Catalogues
Agency: DFO, Pacific Biological Station
Inventory Type: biophysical
Data Type: fish habitat
Level of Detail: reconnaissance
Period: summary of Fishery Officer narratives from early 1950's (if available) to date of publishing (mid to late 1970's)
Data Storage: hard copy; reports
Comments: Fishery Officer narratives on salmon spawning habitat; coverage restricted to selected known salmon-bearing streams

Conservation Data Centre
Agency: MELP, Wildlife Branch
Inventory Type: biophysical, lake/stream
Data Type: fish; fish habitat; riparian
Level of Detail: reconnaissance
Period: on-going since early 1990's
Data Storage: reports, maps (1:50 000), tables; both hard copy and electronic
Comments: largely summary data system; rare and vulnerable taxa only; coverage currently inadequate due to recent start-up; will need two years to approach completion; areas lacking coverage will be more adequately surveyed in the near future

SEP Assessment and Planning
Agency: DFO
Inventory Type: biophysical
Data Type: fish; fish habitat
Level of Detail: reconnaissance
Period: currently inactive
Data Storage: hard copy
Comments: carcass counts, biophysical surveys; enhancement opportunities

Angling Guide Management System
Agency: MELP, Fisheries Branch
Inventory Type: resource use
Data Type: fish; harvest (by species; by resident, non-resident and alien guided anglers; by classified and unclassified waters)
Level of Detail: reconnaissance
Period: on-going since early 1990's
Data Storage: hard copy reports; summaries and yearly
Comments: province-wide coverage with few omissions due to start-up; further development work in the near future

SPORT
Agency: DFO, Recreational Fisheries Division
Inventory Type: resource use
Data Type: harvest
Level of Detail: reconnaissance
Period: on-going since 1990
Data Storage: electronic
Comments: sample angler survey of Tidal Sport Fishing Licences

Commercial Salmon Catch Spreadsheet Program (CSCSP)
Agency: DFO, Biological Sciences Branch
Inventory Type: resource use
Data Type: fish, harvest
Level of Detail: reconnaissance
Period: on-going
Data Storage: electronic
Comments: stock assessment information on fishing effort and gear type; summary of sales slip data from 1952 to present

Commercial Catch Statistics System
Agency: DFO, Biological Sciences Branch
Inventory Type: resource use
Data Type: fish, harvest
Level of Detail: reconnaissance
Period: on-going
Data Storage: electronic; contains on-line data or on-line summary data to early 1980's
Comments: commercial sales slips

Native Food Fishery Data Base
Agency: DFO
Inventory Type: resource use
Data Type: fish; harvest
Level of Detail: reconnaissance
Period: on-going since 1951
Data Storage: electronic
Comments: band name, location, no.of permits, gear types, species, no.of fish; used to produce Indian Food Fishery annual report; does not contain, but should, detailed Fraser River Division catch data

Vancouver Island Lakes Questionnaire
Agency: MELP, Fish and Wildlife, Nanaimo, BC
Inventory Type: resource use
Data Type: fish; harvest
Level of Detail: reconnaissance
Period: 1986 and 1989 angling seasons
Data Storage: hard copy
Comments: angler questionnaires for angler effort and catch on Vancouver Island lakes; done for 1986 and 1989 angling seasons

Juvenile Salmonid Abundance
Agency: DFO/MELP
Inventory Type: management
Data Type: fish, economics
Level of Detail: reconnaissance
Period: on-going
Data Storage: electronic
Comments: evaluation of SEP production and net benefits

Finclip Recovery Data Base and Reporting System (FRDRS)
Agency: DFO
Inventory Type: management
Data Type: fish; harvest
Level of Detail: reconnaissance
Period: on-going
Data Storage: electronic
Comments: commercial troll and net reports, hatchery escapements; designed to evaluate success of hatchery production

Conservation Goals Data Base for Salmon
Agency: DFO
Inventory Type: management
Data Type: fish, harvest
Level of Detail: reconnaissance
Period: on-going
Data Storage: electronic
Comments: data base for establishing conservation goals for each species of salmon; salmon escapements, locations of Indian Reserves and Native fishery data; Fraser River basin done, Skeena/Nass basins in progress; Barkley Sound planned

SEP Assessment Data Base
Agency: DFO/MELP
Inventory Type: management
Data Type: fish
Level of Detail: reconnaissance
Period:
Data Storage: electronic
Comments: evaluation of SEP production and net benefits

Mark Recovery Program
Agency: DFO (Pacific Biological Station)/MELP
Inventory Type: management
Data Type: fish
Level of Detail: reconnaissance
Period: on-going since 1970
Data Storage: electronic
Comments: coded wire tag recovery data

Sport Spot Closures
Agency: DFO, Recreational Fisheries Division
Inventory Type: management
Data Type: fish; management
Level of Detail: reconnaissance
Period: on-going
Data Storage: electronic
Comments: list of closure areas, boundaries, gear and species prohibitions, etc.

Research
Agency: DFO
Inventory Type: biophysical, fish/lake/stream
Data Type: fish; fish habitat; riparian; watershed; harvest
Level of Detail: intensive
Period: on-going
Data Storage: hard copy
Comments: research on habitat sensitivity, impact assessment and population dynamics; establishment of conservation goals for salmon; mostly conducted by Pacific Biological Station

Research
Agency: MELP, Fisheries Branch (Research Section, UBC, Vancouver, BC)
Inventory Type: biophysical, fish/lake/stream
Data Type: fish; fish habitat; management strategies
Level of Detail: intensive
Period: on-going
Data Storage: various
Comments: research on population dynamics; enhancement strategies, techniques and opportunities; etc.; various locations but level of activity does not meet current information needs

Escapement/Spawning Counts/Surveys
Agency: DFO/MELP (Fisheries Branch)
Inventory Type: biophysical, fish
Data Type: numbers of fish
Level of Detail: intensive
Period: on-going
Data Storage: various
Comments: coverage restricted to important or problem fisheries

Index Netting/Fishing
Agency: DFO/MELP (Fisheries Branch)
Inventory Type: biophysical, fish
Data Type: fish (age/size)
Level of Detail: intensive
Period: on-going
Data Storage: various
Comments: collection of sport fish samples for age/growth studies, etc.; coverage restricted to important or problem fisheries

Kokanee Echosounding
Agency: MELP, Fisheries Branch
Inventory Type: biophysical, fish
Data Type: numbers of fish
Level of Detail: intensive
Period: on-going since 1985
Data Storage: electronic and hard copy
Comments: methodology not yet well-established but under development; coverage restricted to 4 large lakes in BC (Okanagan, Kootenay, Arrow and Quesnel)

Urban Streams
Agency: DFO, Habitat Conservation Unit
Inventory Type: management
Data Type: fish; fish habitat; riparian; watershed; management
Level of Detail: intensive
Period: new program; just starting
Data Storage: hard copy
Comments: inventory for mitigating urban impact on fish, fish habitat and production

Fish Forestry Interaction Program
Agency: MELP, Fisheries Branch/MOF
Inventory Type: biophysical, stream
Data Type: fish; fish habitat; riparian; watershed; management
Level of Detail: intensive
Period: on-going since 1980
Data Storage: hard copy reports
Comments: region-specific studies on mass wasting and effects on fish habitat on Queen Charlotte Islands; information may be transferable to other areas of the province

North Thompson Coho Index Program
Agency: DFO/MELP/Shuswap Nation Tribal Council
Inventory Type: biophysical, stream
Data Type: fish
Level of Detail: intensive
Period: new program; not yet started; proposal written, needs funding; will cover 6 years from start-up
Data Storage: hard copy
Comments: coho keystream program North Thompson River tributaries; assessment of smolt carrying capacity; development of alternative escapement enumeration methodology

Nechako River Physical Data
Agency: DFO/MELP/Alcan
Inventory Type: biophysical, stream
Data Type: fish; fish habitat; riparian
Level of Detail: intensive
Period: on-going since 1986
Data Storage: electronic
Comments: application of physical data to a monitoring/remedial measures pilot testing/applied research program; air/ water temperatures, precipitation, discharge

Snorkel Surveys
Agency: MELP, Fisheries Branch
Inventory Type: biophysical, fish
Data Type: numbers of fish
Level of Detail: intensive
Period: on-going
Data Storage: various
Comments: estimates of fish abundance for comparison with production capability estimates; coverage restricted to important or problem fisheries

Creel Surveys
Agency: MELP, Fisheries Branch and BC Parks
Inventory Type: resource use
Data Type: fish (presence; age/size); harvest (by species and location); effort
Level of Detail: intensive
Period: on-going
Data Storage: various
Comments: coverage restricted to important or problem fisheries; BC Parks voluntary and not yet province-wide

Referral System
Agency: DFO/MELP
Inventory Type: management
Data Type: fish; fish habitat; riparian; watershed; harvest; management
Level of Detail: intensive
Period: on-going since 1989
Data Storage: electronic
Comments: information regarding development proposals that may impact fish or fish habitat (eg. logging, mining, urban development, etc.)

Foreshore Referrals Program
Agency: DFO
Inventory Type: management
Data Type: fish; fish habitat; riparian; watershed; management
Level of Detail: intensive
Period: on-going
Data Storage: hard copy
Comments: designed to assist in the evaluation of coastal/estuarine referrals; procedure for conducting on-site habitat description and assessment

BC Sportfishing Regulations
Agency: MELP, Fisheries Branch
Inventory Type: biophysical, fish; resource use
Data Type: fish
Level of Detail: intensive
Period: on-going
Data Storage: hard copy; data base under development
Comments: province-wide summary of sportfishing regulations and individual lake/stream management strategies

Release Records Data Base
Agency: MELP, Fisheries Branch
Inventory Type: biophysical, fish
Data Type: fish (by location, species and numbers)
Level of Detail: intensive
Period: on-going since start of stocking program in BC
Data Storage: electronic
Comments: complete summary of fish stockings by Provincial hatchery system

Transplant
Agency: DFO/MELP (Fisheries Branch)
Inventory Type: biophysical, fish
Data Type: fish (by location, species and numbers)
Level of Detail: intensive
Period: on-going
Data Storage: hard copy
Comments: outlines history of number and type of fish or aquatic invertebrate transplants into or within BC

Lake Rehabilitation Records Data Base
Agency: MELP, Fisheries Branch
Inventory Type: biophysical, fish/lake
Data Type: fish; management
Level of Detail: intensive
Period: on-going
Data Storage: hard copy
Comments: summary of chemical lake rehabilitation activities in BC

Habitat Dioxin Data
Agency: DFO, Habitat Management Division, Water Quality Unit
Inventory Type: management
Data Type: fish
Level of Detail: intensive
Period: on-going since 1988
Data Storage: electronic
Comments: data base for evaluating the level of dioxin/furan contamination in freshwater fish