In presenting this thesis in partial fulfilment of the requirements for an advanced degree at the University of British Columbia, I agree that the Library shall make it freely available for reference and study. I further agree that permission for extensive copying of this thesis for scholarly purposes may be granted by the head of my department or by his or her representatives. It is understood that copying or publication of this thesis for financial gain shall not be allowed without my written permission.
ABSTRACT

There has been much discussion of the merits and limitations of area licencing, i.e., a fishery management tool which restricts fishermen to certain geographic areas, in the British Columbia, Canada, salmon fishery. To date there has been little formal evaluation of the implications of this policy tool for salmon fishery management. In the reports by Pearse (1982), Sinclair (1978) and Fleet Rationalization Committee (1982) some insights on the subject are provided, but an evaluation in terms of specific criteria is lacking.

This study evaluates five area licence configurations in the context of the B.C. salmon fishery. They are assessed based on evaluative criteria that cover the following subject areas: management operations; socio-economic effects; biological effectiveness; and economic efficiency. Each of these broad subjects are factored into specific elements, in which the emphasis is on the nature of the fishery and the resource.

From the analysis it was found that the area licence configurations that factored the coast into two large harvest areas or the configuration that alienated small area(s) as test area(s) are most appropriate for the fishery. These configurations facilitated the attainment of management operations, socio-economic and biological goals, but not the economic efficiency goals. The other configurations, in particular those that factor the coast into a number of smaller harvest areas, result in exacerbating the problems with all criteria except economic efficiency and some biological factors.
The appropriate area configurations for the B.C. salmon fishery would be the configurations that factors the coast into two large harvest areas; or the configuration where two or three small harvest areas are alienated from the existing harvest area. There are three fundamental reasons for this: (1) they are least disruptive (i.e., minimum impact on present harvest patterns, least politically sensitive, and minimum distributional effects); (2) they offer greatest flexibility to address political, economic, biological and social uncertainties; and (3) these area configurations provide the greatest ease of implementation and incremental adjustment of the status quo. Acceptance of these configurations will depend on the time horizon and the objectives of the decision makers.
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This study is dedicated to those who despite their abilities have not achieved their goals. To these people I wish them the best in life and recommend to them the works of Og Mandino, in particular the book entitled "The Choice."
CHAPTER 1 - INTRODUCTION

1.1 Background and Rationale

Area licensing is a fisheries management tool which restricts fishermen to certain geographic areas. This study is concerned with the implications of alternative area configurations for the B.C. commercial salmon fishery.

Pearse (1982) in the "Royal Commission on the Pacific Fisheries—Final Report" recommended, that an area licensing scheme (three areas) be adopted in the B.C. Salmon Fisheries. Contrary to this recommendation, Sinclair (1978) and The Fleet Rationalization Committee's (1982) recommended that area licensing not be adopted for the salmon fisheries. Within the fisheries management and commercial fishing communities, there are a number of individuals advocating area licensing (Ellis 1981, Christy 1982 and MacDonald 1982). In these and other reports, there is no shortage of ideas and statement of possibilities. However, there is a lack of assessment of the implications of specific area licence configurations for specific fisheries (i.e., a particular fishery in a specific geographic area). Hence, if an area licence configuration is to be adopted in the B.C. salmon fishery, it is important for the decision makers to be informed of the possible consequences to make an informed decision.

1.2 Purpose of Study

The study evaluates five area licensing configurations. The evaluation addresses a number of issues identified in the works of
Pearse (1982); The Fleet Rationalization Committee (1982); Sinclair (1978); MacDonald (1982); Ellis (1982); Christy (1984); and through discussions with fishermen, fisheries managers and fish processors. These issues fall into one of the following subjects: (1) Management Operations; (2) Socio-Economic Effects; (3) Biological Effectiveness; and (4) Economic Efficiency. Upon assessing the area configurations, the area configuration(s) most appropriate for the B.C. salmon fishery will be identified.

1.3 **Scope of Study**

The objectives of this study are as follows:

1. To identify alternative area licensing configurations for the B.C. commercial salmon fishery.

2. To assess the implications (management operation; socio-economic effects; biological effectiveness and economic efficiency) of five area configurations in the context of the B.C. salmon fishery.

3. Upon assessing the configurations, they are ranked and the configuration that would be appropriate for the B.C. salmon fishery is identified.

The following constraints are assumed in the study:

1. The restrictions on an "A" licence can be fixed or not fixed. In this study it will be assumed that the restriction will be fixed unless otherwise stated: fixed is defined as restrictions that run for life.
2. Though non-salmon fisheries are important in understanding the dynamics of the salmon fishery, this analysis focuses on the consequences of area licencing on the commercial salmon fleet, independent of other fisheries.

3. Whether the status quo or an area licence configuration should be maintained or adopted is not assessed in this study.

4. Harvest regulations and policies are the same as the status quo unless otherwise stated in the text. For example, the escapement targets are the same.

5. Though Native Indian food fishing and the sport fishing sectors could have a major bearing on the acceptability of the different area configurations, these two factors are not addressed in this study.

1.4 Format of Study

This study is presented in six chapters. In chapter one, the purpose, rationale and scope of the study are defined.

Chapter two is devoted to a discussion of the theory of fisheries management. Fisheries management is defined; the different forms of intervention are identified; the objectives of fisheries management and problems and issues in the B.C. salmon fishery are discussed. Implicitly and explicitly, the theory of fisheries management is applied in the development of the evaluative framework, and in determining the appropriate area licence configuration in the B.C. salmon fishery.
In chapter three, the quantitative and qualitative analytical techniques, as well as the nature of the data that are used in this study are described. This chapter also covers the details of the evaluative framework used in this study.

In chapter four, the results of the quantitative analysis are provided. This includes a description of the results and discussions of the results and limitations of the analyses.

In chapter five, the area licence configurations are assessed and ranked, applying the forementioned evaluative framework. An explanation for the ranking is provided.

Chapter six provides the summary of the findings; statement of the limitations of the study; and concluding remarks.
CHAPTER 2: BACKGROUND - FISHERIES MANAGEMENT

2.1 Introduction

The purpose of this section is to provide background information or a brief discussion on: area licensing as a limited entry tool; theory of fisheries management; and description of the B.C. fishery. First, area licensing is defined and identifying the type of limited entry policy tool it is. Second, there is a brief discussion of the theory of fisheries management identifying the model adopted in this report when framing the evaluative criteria and identifying the appropriate area licence configuration for the B.C. salmon fishery. Third, a description of the B.C. salmon fishery focusing on the financial status of the industry; and other problems and issues.

2.2 Area Licensing: A Definition

Based on the description and discussions by Sinclair (1978), Ellis (1982), The Fleet Rationalization Committee (1982), MacDonald (1982) and Pearse (1982), area licensing can be defined as: a management tool which restricts fishermen to certain geographic areas. This definition is similar to the "Territorial Use Rights" (TURFs) concept introduced by Christy (1982). However, the two concepts differ in that TURFs is a broad fisheries management policy tool and area licensing is management tool specific to the B.C. fishery. This is not to say that the latter can not be applied in other areas.

Area licensing can be viewed as a limited entry policy tool. Ginter and Rettig (1978, p. 158) have discussed and defined limited
Like the more common techniques, such as time and area closures, limited entry is intended to retard the growth of fishing effort by controlling the number of fishermen, vessels, or units of gear that have legitimate access to certain fish resources. Hence, limited entry is an alternative way of limiting effort; however, effort limitation does not necessarily imply entry limitation.

... Limited entry refers to any fishery management tool which controls, restricts, or limits the entry of new fishermen, vessel or gear into a fishery.

Based on the forementioned, and the classification of fisheries management tools (Weitzman 1974, Pearse 1980), area licensing can be classed as a quantity mechanism, that effects the input into the fishery, i.e., harvest capacity. However, it is unlike other management tools for it restricts entry via a spatial mechanism.

2.3 Fisheries Management: Definition and Approach

In the fisheries management literature there are numerous definition of fisheries management. In lieu of describing and/or quoting all the different perspectives, fisheries management can be summed up as "the endeavour to address or achieve, management operation, socio-economic, biological and economic efficiency goals, given the problem environment and issue context for a given fishery."

Thus to design an appropriate fishery management plan, these objectives as well as all other facets of the fishery and resource should be considered. This approach is labelled as the integrated/holistic approach (McHugh 1978) and is aptly described by Nickel and Sinclair (1977, pp. xvii-xviii).
"... The successful management of a fishery requires an understanding of the physical methods of fishing as well as the socio-economic effects of government regulations, marketing, welfare assistance and other elements related to the fishery."

It is this management perspective and approach that is used in this study, to develop an evaluative criteria, and to identify an appropriate area licence configuration for the B.C. salmon fishery.

2.4 Problems and Issues in the B.C. Salmon Fishery

The purpose of this section is to identify the problems and issues in the B.C. salmon fishery. This is presented from a theoretical and practical perspective.

Gordon (1954) and Scott (1955) argue, the underlying factor which leads to economic and biological problems in most fisheries, is the common property nature of the resource. The theoretical tenet of this perspective is: in the absence of some form of property rights, the behavior of the harvesters are such that the fish stocks will be at risk of being over-harvested and there will be excess capital and labour invested in the fishery. The outcome of this behavior is often called "bioeconomic equilibrium" (Anderson 1977, Crutchfield 1977, Scott and Nehrer 1981). Figure 1 shows that in an "open access" fishery the revenue generated equals the cost of harvesting the resource.

A number of different definitions of common property can be found in the literature. Maloney and Pearse (1975) and Crutchfield and Zellner (1962) forward two different perspectives. Maloney and Pearse
Figure 1 - Basic economic perspective of the relationship between cost, revenue and economic rent (modified Anderson 1977 p.31)

TC: Total cost of harvesting resource
TR: Revenue of fish based on Shaefer production model
A: Area where profit exists - Economic Rent
B: Area where there is no profit, hence economic rent is dissipated
B-E: Point where total cost of harvesting equal the total revenue
(1975) state that excess capital and labour in the harvest sector results in over-harvest of stock and the dissipation of economic rent. Crutchfield and Zellner (1962) state that a truly common property fishery is where there is open access.

Adapting the definition forwarded by Crutchfield and Zellner (1962) it can be argued that some of the common property characteristics of the B.C. salmon fishery have been eliminated, through the "Davis Plan," established in 1969. This limited entry program has constrained access.

The economic woes of the salmon fishery cannot be solely attributed to the common property nature of the resource. There are social, political and economic factors outside of the common property nature of the resource that have contributed to the state the industry is in. The following is a brief list of these factors:

1. Vessels with smaller tonnages were "cannibalized" for the licences and combined to construct larger and more effective vessels (Fraser 1979). For the seine fleet this is often carried out due to financial advantage a fishermen could realize because of the graduated bonus on their catches.

2. Older vessels were upgraded for more powerful and luxurious harvest units. This could be considered capital and horsepower stuffing (Scott and Nehrer 1981), but such investments were often made for ego reasons (i.e., keeping up with the "Jones Syndrom."

3. Individuals invested in vessel/licences to realize capital gains and/or capital depreciation benefits.
4. Harvesters invested in vessel/licences based on the implicit and explicit manner in which the resource was allocated by the fisheries management agency.

Pearse (1982, 1981), identified and described the problems in the salmon fishery. Aside from the procedural and decision making problems and issues, they can be grouped under the following subject areas: (1) Management Operations; (2) Socio-economic Effects; (3) Biological; and (4) Economic Efficiency.

Pearse (1981) in the discussion of "Licensing and Regulating Fleet Development" identified over-capacity, over-capitalization, low incomes and financial instability as major problems in the industry. For example, Tables 1 and 2 show: the low net income of fishermen; and the relative importance of fuel cost, capital cost, and unemployment insurance benefits in their financial structure.

Due to the financial status of harvesters, the structure of the harvest sector (e.g., mobility of the fleet) and the decision making process, political pressure can result in a situation where stocks are placed at risk of being over-harvested. This latter problem is important due to the competing demands placed on the resource by the various user groups in the harvest sector.

2.4 Summary

Area licensing is a limited entry management tool that restricts entry into a fishery through spatially restricting vessels. If it is to be adopted in the B.C. salmon fishery, an integrated/holistic fisheries management approach, taking into account the problems and issues in the industry, should be adopted.
Table 1 - 1982 Fishing Income of Salmon Vessels Per Vessel Average
(Department of Fisheries and Oceans 1983).*

<table>
<thead>
<tr>
<th></th>
<th>High 25%</th>
<th>Medium 50%</th>
<th>Low 25%</th>
<th>All SP Vessels</th>
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<td><strong>Salmon</strong></td>
<td></td>
<td></td>
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<tr>
<td>Gillnet Gross Income</td>
<td>$54,779</td>
<td>$24,128</td>
<td>$8,326</td>
<td>$27,461</td>
</tr>
<tr>
<td>Net</td>
<td>18,323</td>
<td>8,158</td>
<td>376</td>
<td>8,616</td>
</tr>
<tr>
<td>Tax (loss)</td>
<td>12,657</td>
<td>6,201</td>
<td>(1,126)</td>
<td>5,888</td>
</tr>
<tr>
<td><strong>Seine</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross</td>
<td>237,937</td>
<td>97,557</td>
<td>39,641</td>
<td>117,348</td>
</tr>
<tr>
<td>Net</td>
<td>52,809</td>
<td>21,321</td>
<td>812</td>
<td>24,436</td>
</tr>
<tr>
<td>Tax</td>
<td>548</td>
<td>(13,159)</td>
<td>(9,286)</td>
<td>(9,137)</td>
</tr>
<tr>
<td><strong>Troll</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Gross</td>
<td>76,699</td>
<td>37,631</td>
<td>15,728</td>
<td>42,103</td>
</tr>
<tr>
<td>Net</td>
<td>26,161</td>
<td>13,475</td>
<td>1,041</td>
<td>15,079</td>
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<td>Tax</td>
<td>15,648</td>
<td>8,738</td>
<td>13,685</td>
<td>7,558</td>
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<td><strong>Combination Salmon</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gross</td>
<td>60,956</td>
<td>29,599</td>
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<td>Net</td>
<td>26,039</td>
<td>9,788</td>
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<td>19,369</td>
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<td><strong>Combination Licences</strong></td>
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<td><strong>Troll/Herring</strong></td>
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<tr>
<td>Gross</td>
<td>133,308</td>
<td>64,979</td>
<td>28,663</td>
<td>72,602</td>
</tr>
<tr>
<td>Net</td>
<td>44,710</td>
<td>19,400</td>
<td>4,719</td>
<td>21,930</td>
</tr>
<tr>
<td>Tax</td>
<td>27,833</td>
<td>13,006</td>
<td>1,066</td>
<td>13,883</td>
</tr>
<tr>
<td><strong>Gillnet/Troll/Salmon + Herring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross</td>
<td>90,840</td>
<td>46,899</td>
<td>16,984</td>
<td>47,618</td>
</tr>
<tr>
<td>Net</td>
<td>36,667</td>
<td>17,185</td>
<td>(1,343)</td>
<td>16,006</td>
</tr>
<tr>
<td>Tax</td>
<td>31,502</td>
<td>13,196</td>
<td>3,580</td>
<td>12,708</td>
</tr>
<tr>
<td><strong>Seine/Salmon/Herring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross</td>
<td>211,584</td>
<td>115,354</td>
<td>56,963</td>
<td>125,048</td>
</tr>
<tr>
<td>Net</td>
<td>96,990</td>
<td>24,220</td>
<td>10,492</td>
<td>34,450</td>
</tr>
<tr>
<td>Tax</td>
<td>35,942</td>
<td>2,420</td>
<td>(15,082)</td>
<td>(6,799)</td>
</tr>
</tbody>
</table>

Gross Income = Landing value plus bonus except for the seine, the gross income assumes that shares in payment of fuel etc. is computed in.

Net Income = Gross income minus expenses (e.g., operating costs, shares, capital cost).

Taxable Income = Net income minus shares paid to shareholders. Capital cost allowance and if applicable. No fishing expense.

(#) = Number of respondents for each cell.

Limitation of Data = The data is limited due to the following factors: (1) the sample size of some of the cells is small from a statistical point-of-view; (2) the sample may not be a true representation of the industry for the respondents were selected from the files of an accounting firm; and (3) the categorization of the groups as High, Medium and Low does not reflect the economic nature of the fish harvest sector.

*This data is a compression of the data in the above referenced report.
Table 2 - Vessel Income and Expenses. Average % Value of total income and expense for Each Gear Group (Department of Fisheries and Oceans 1983).*

<table>
<thead>
<tr>
<th>Gear Group</th>
<th>High 25%</th>
<th>Medium 50%</th>
<th>Low 25%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Troll</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel Costs</td>
<td>17</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>U.I.C. Income</td>
<td>13</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Interest</td>
<td>20</td>
<td>12</td>
<td>31</td>
</tr>
<tr>
<td><strong>Troll/Herring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>7</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>U.I.C.</td>
<td>7</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>Interest</td>
<td>13</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td><strong>Gillnet/Salmon</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>8</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>U.I.C.</td>
<td>7</td>
<td>21</td>
<td>9</td>
</tr>
<tr>
<td>Interest</td>
<td>11</td>
<td>8</td>
<td>18</td>
</tr>
<tr>
<td><strong>Gillnet/Herring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>6</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>U.I.C.</td>
<td>8</td>
<td>32</td>
<td>9</td>
</tr>
<tr>
<td>Interest</td>
<td>4</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td><strong>Troll/Gillnet/Salmon</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>10</td>
<td>16</td>
<td>17</td>
</tr>
<tr>
<td>U.I.C.</td>
<td>8</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Interest</td>
<td>10</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td><strong>Troll/Gillnet/Herring</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>7</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>U.I.C.</td>
<td>5</td>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>Interest</td>
<td>7</td>
<td>5</td>
<td>22</td>
</tr>
<tr>
<td><strong>Seine (unincorporated)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td></td>
<td>34</td>
<td></td>
</tr>
<tr>
<td><strong>Seine (incorporated)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>6</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Interest</td>
<td>10</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td><strong>Seine/Salmon/Herring (unincorporated)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td><strong>Seine/Salmon/Herring etc. (incorporated)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fuel</td>
<td>4</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Interest</td>
<td>18</td>
<td>31</td>
<td>41</td>
</tr>
</tbody>
</table>

*These ratio figures are as per the data in the report on the 1982 fishermens income.

(#) = Number of respondents per cell.
(C) = Cost(s).
(I) = Income.
CHAPTER 3: METHODS AND DATA

3.1 Evaluative Framework

In this study five area licence configurations are assessed, applying an evaluative framework which focuses on four broad subject areas: management operations; socio-economic (distributional) effects; biological effectiveness; and economic efficiency. The criteria under these categories are based on those developed by Fox (1977), Cicin-Sain (1978), Crutchfield (1979), Scott (1979), Clawson (1980), Ingram (1980), Anderson (1980), Bishop et al. (1980), Langdon (1982), Pearse (1981, 1982), Stokes (1982). The four subject areas are divided into sub-criteria based on the above works, the nature of the resource, the structure of the fishery, and the nature of the existing management system in the industry.

3.1.1 Management Operations

A. **Implementability** - a concern of decision makers and fisheries managers is the ease with which a plan can be implemented. The following is a list of factors that should be taken into account, to ensure that the management plan can be easily implemented (Anderson 1980).

1. A plan should be **simple**: uncertainties will be greater if it is too complex; there may be a greater need for more institutions to administer it; decision makers and the affected groups (i.e., fishermen and processors) may have difficulty conceptualizing its short-term and long-term consequences.
2. A plan should be socially and politically acceptable. If the plan is opposed by different actors (i.e., different user groups such as fishermen and processors), it may be difficult to implement for there will be resistance to its adoption.

B. **Management Flexibility** - a plan should be flexible so that adjustments to unexpected events can be made. The following is a list of factors that should be considered concerning the flexibility of a management plan:

1. Salmon stocks display temporal (i.e., within and between season) and spatial (i.e., area distribution) variability in abundance; yet our measurement and predictive capabilities are limited. The management plan should be designed with some flexibility, so that in-season restrictions (e.g., halt or reduce fishing effort by time, area or species and by gear usage) and between season adjustments (e.g., reduction in harvest capacity, modification in the distribution of harvest effort or changes in allocation by gear or area of allowable catch) can be adopted with minimum disruption of harvest activities.

2. The initial plan should be chosen to ensure that future management options are not foreclosed. That is, the initial plan generally determines what future management options are possible. The management plan should be designed so it can be modified to complement any future changes in fisheries management objectives (Walters 1975).
3.1.2 Socio-Economic Effects

A. Distributional Effects - The distribution of benefits and costs is of concern to decision makers and harvesters. The issue is whether the distributional consequences are contrary to "the perceived norm" and if so who will benefit and who will bear the costs. The norm is very difficult to define for there are many interest groups involved.

This issue is complicated by the fact that the catch by the different user groups has varied over time. This variability can be attributed to the following: catchability of species by different user groups and different gear types; change in catch capacity by different gear types and user group; change in the abundance of the different stocks; and changes in regulations over time and space.

When addressing this subject, the following should be considered:

1. Harvesters should have the opportunity to ensure that catches result in equitable distribution of revenue from the fisheries so that fishermen in each gear groups under area licensing have the opportunity to realize catches that are close to the provincial average catch (i.e., the average catch per vessel given the total catch in the B.C. salmon fishery). This is important for the harvesters' mobility will be restricted if area licensing is introduced. Under the status quo situation fleet mobility tends to equalize catches over time and space.

2. Related to the forementioned factor is the access the harvesters will have to the surplus production from salmon
enhancement projects. Under the present management system, the increased production from enhancement project can be accessed by most fishermen, subject to licence restrictions and the species enhanced. Area licensing could pose a problem, by restricting fleet mobility, for specific fleets could be foreclosed from harvesting the additional production.

3. As indicated in the financial profile of the harvest sector (Table 1), Unemployment Insurance Benefits are important to the fishermen's income: this income range from 5% to 48% of gross income. Area licensing could pose problems if it leads to shorter fishing seasons affecting fishermen's eligibility for the benefits.

4. Another factor that could result in distribution effects is strikes. Depending on the timing of the runs (i.e., peak abundance of the returning stocks); the area licence configuration; and timing of the strikes, the fishermen's gross revenue could be effected. Since some fishermen would be more dependent upon specific runs, within specific areas, they are more vulnerable to labour disputes. Presently fishermen can offset industry strikes by fishing other runs throughout the coast.

B. Employment Effects - Decision makers and some fishermen's associations are concerned about the potential for the displacement of fishermen if area licensing is introduced. When addressing this
subject, the extent to which fishermen will be displaced should be considered.

3.1.3 Biological Effectiveness

A. Attain Biological Goals - The maintenance of the stocks is critical to the health of the fishery. The key factors to be considered are:

1. Stocks should be maintained at a sustainable level by ensuring that harvest levels are such that the escapement is realized to maintain populations (Fisheries and Marine Services, 1976).
2. Mixed stock fishing should be avoided to minimize the harvest of multiple stocks simultaneously. This can lead to major management problems (Dickie and Kerr 1982; Healey 1982; and Ledbetter and Hilborn 1981).
3. Stocks deemed to be at low productive levels should be enhanced.
4. Fleet concentration which could increase the risk of overfishing should be avoided.

3.1.4 Economic Efficiency

A. Vessel and fleet efficiency - efficient utilization of fish resources has been advocated by fisheries managers, economists and others (Anderson 1980; Scott 1979; Crutchfield 1979).

This is attained when the economic rent is maximized or when the
positive difference in revenue and cost is the greatest. Given the biological production, the objective is to maximize long-term outputs and minimize long-term inputs in the fishery.

There are a number of definitions of "the efficient" utilization of fish resources. The definitions differ due to assumptions made about: (1) time horizons; (2) discount rates; and (3) competing goals. The underlying argument of most fisheries economists and managers, is that for fisheries to be optimally managed, the cost of harvesting the resource should not exceed the revenue generated.

Factors influencing output or production revenue can be broken down into the following components:

1. Production of salmon (volume by species);
2. Market value of the product, which is a function of product quality and market demand; and
3. Efficiency of the processing sector, hence their ability (or willingness) to pay a specific ex-vessel price.

Harvest cost, can be factored as follows:

1. Fixed costs (i.e., costs incurred whether or not the individual fishes) includes: costs of capital; vessel maintenance and annual fees (e.g., insurance, licence, and moorage).
2. Variable costs (i.e., cost incurred to harvest fish) includes: equipment, fuel, and others.

A management plan should be designed to increase the efficiency of the vessel/fleet, hence the output/input ratio should be enhanced.
3.1.5 Summary of Evaluative Criteria

Given the nature of the B.C. salmon fishery and the forementioned factors, the evaluative framework to be used in this analysis can be stated as follows:

Management Operations
A. Implementability
   1. Will area licensing result in management plans that are unnecessarily complex?
   2. Will area licensing result in plans that are likely to be social and politically unacceptable?

B. Management Flexibility
   1. Will area licensing reduce management flexibility with regards to in-season and between season adjustments?
   2. Will area licensing foreclose future management options and make it difficult to adopt changes in management objective?

Socio-Economic Effects
A. Distributional Effects
   1. Under area licencing will different gear groups have the opportunity to realize catches that are approximately the provincial average catch by each gear group?
   2. Under area licensing, will harvesters have equal access to production from salmon enhancement development?
3. Will area licensing make it more-or-less difficult for a fisherman to be eligible for Unemployment Insurance Benefits?

4. Will area licensing result in major differences in the economic impact of a strike in the fishing industry?

B. Effects on Employment
   1. Will fishermen be displaced under area licensing?

Biological Effectiveness
   1. Will area licensing result in sufficient escapement to sustain stock levels?
   2. Will area licensing minimize the harvest of multiple stocks?
   3. Will area licensing facilitate or inhibit enhancement of stocks that are at low productive levels?
   4. Will area licensing reduce fleet concentration?

Economic Efficiency
   1. Will area licensing result in a reduction in fleet/harvest costs?

3.2 Methods and Data

3.2.1 Quantitative Analysis

In the quantitative analysis two data sources were used. Most of the analysis is based on the Department of Fisheries and Oceans Catch

3.2.1.1 Nature of Data

A. Sales Slips

The Department of Fisheries and Ocean Catch Statistics, in particular fish sales slips were the primary data source. The individual sales slips are stored in computer files, in the following manner: (1) date of sales; (2) the period when the fish was harvested; (3) the statistical area where the fish was harvested is divided into 30 statistical areas and several sub-areas (see Figure 2); (4) vessel code number; (5) the species harvested; (6) the number of pieces (fish) sold; (7) the weight and value of catch by weight, by species and gear used.

The data is not completely accurate, but is the best information available. Some limitations of the data are:

1. Not all the catches are recorded since some catches enter the market through nonconventional channels;

2. Catch are sold to some fish buyers using false identification numbers;

3. In some cases, fishermen may have harvested their catch in more than one area, but only one area is recorded on the sales slip; and

4. Some species, though harvested using one gear type are delivered as being harvested using another gear type.
Figure 2 - Fishing Statistical Areas of the B.C. Coast
(Department of Fisheries and Ocean, 1983).
B. S.E.P. Enhancement Data

The Geographic Working Group (1980) generated data on the manageable enhancement potential for B.C. stream systems, for the Salmon Enhancement Program Planning. The data presents the stock enhancement potential for salmon systems and for various regions on the coast (e.g., North Coast; Central Coast, Northwest Vancouver Island; Southwest Vancouver Island; Johnstone Strait, Georgia Strait; Fraser River; and Juan de Fuca Strait).

3.2.2 Area Licence Configurations

In this study five area configurations or schemes are assessed (Figure 3). NorthA-SouthA (Figure 4); NorthB-SouthB-WestB (Figure 5); S.E.P. (Figure 6); Small Areas-Part of Coast (Figure 7) and Small Area - Whole Coast (Figure 2).

These configurations are not a comprehensive list of all the possible area licence schemes. However, they were selected assuming that they would be representative of the range of the possible configurations, schemes ranging from small to large areas.

The NorthA-SouthA configuration was selected, because many fishermen, with whom this subject was discussed, preferred it, and this configuration is an incremental change from the present situation.

The NorthB-SouthB-WestB configuration was selected because the troll fleet under the above configuration would be exposed to a three area harvest system and the net fleet would not. This is the case for
Figure 3 - Proposed Area licensing configurations

A. NorthA/SouthA configuration for all gear types
   - NorthA -- statistical areas (SAs) 1-8, 30 2 west and 2 east
   - SouthA -- SAs 9-29

B. NorthB-SouthB-WestB configuration for all gear types
   - North B -- SAs 1-8, 30 2 west and east
   - South B -- SAs 9-18, 28 and 29
   - West B -- SAs 19-27

C. S.E.P. configuration
   - North Coast -- SAs 1-5, 2 west and 2 east
   - Central Coast -- SAs 6-10 and 30
   - N.W. Vancouver Island -- SAs 25-27
   - S.W. Vancouver Island -- SAs 21-24
   - Johnstone Straits -- SAs 11-13
   - Georgia Straits -- SAs 14-18
   - Fraser -- SAs 29 (all subareas) & 28
   - Juan de Fuca -- SAs 20 & 19

D. Small Area-Part of The Coast Configuration
   - River-Smith Inlet -- SAs 9 and 10
   - Barkley Sound -- SA 23
   - Nass River -- SAs 3x-3y
   - Rest of the Coast -- All areas except the above

E. Small Area-Whole Coast Configuration
   - All statistic areas are harvest areas.
Figure 4 - NorthA-SouthA Area Licence Configuration (Department of Fisheries and Oceans, 1983).
Figure 5 - NorthB-SouthB-WestB Area Licence Configuration (Department of Fisheries and Oceans, 1983).
Figure 6 - S.E.P. Area Licence Configuration
(Department of Fisheries and Oceans, 1983).
Figure 7 - Small Area-Part of the Coast Configuration (Department of Fisheries and Oceans, 1983).
an inside-outside A licensing management plan exists.

The S.E.P. area configuration was selected because these areas have been defined by the Salmon Enhancement Planning Group, Department of Fisheries and Oceans, as functional and practical management and planning boundaries.

The Small Area-Whole Coast configuration was selected because it represents a case that is least like the present situation.

The Small Area-Part of the Coast configuration as considered for it was one of the configurations fishermen preferred, for it is similar to the status quo. Also, it can be viewed as a configuration that allows for an experimental situation.

3.2.3 Fleet Mobility Analysis

To determine the mobility trends for the different gear types under each area licence configuration (the exception being the Small Area-Whole Coast configuration), the following analysis was conducted:

1. The total number of vessels that harvested fish in an area was determined and the number of boats defined as harvesting 100% and 80% - 100% of their catch from a harvest area, for each gear type under the each configuration was determined.

2. The number of vessels determined at step two was divided by the total number of boats that engaged in the fishery, to generate a percentage value. This was done for each gear type for the area licence configurations.
For the above analysis the 1971-1980 sales slip data was used. However, it must be pointed out the mobility of the fleet may have changed since this period. These changes could be due to factors such as:

1. The timing and the length of fisheries openings;
2. The economics of the harvest sector—to maximize catch the harvester may have select fisheries with a potential for a high catch-per-unit effort; and
3. The physical mobility (i.e., power) of the vessels.

The results of this analysis will be used to assess the following criteria: (1) implementation; (2) management flexibility; (3) access to the resource; (4) biological effectiveness; and (5) economic efficiency.

3.2.4 Catch Variability Analysis

The fish sales slip data for the 1971-1981 period was used to determine the variability in catch, within each area, for the area licence configurations. The numeric indicator computed in this analysis is the coefficient of variation which is indicator of the degree of variability. The larger the index value the greater the variability in catch during the 1971-1981 period.

The coefficient of variation was determined in the following manner:

1. The ex-vessel value of the catch for each gear group in each harvest area under the different area configuration was determined.
2. The ex-vessel value, for each gear group in each harvest area, under the different area configuration was computed.

3. The standard deviation was calculated for the revenue for each gear group in each harvest area under the different area configurations.

4. The standard deviation value was then divided by the ex-vessel value to give the coefficient of variation, for each gear group in each harvest area under the different area configurations.

It should be noted that the coefficient of variation describes the degree of variability in the catch, but no confidence limits have been assigned.

The results of the catch variability analysis will be used to assess the following criteria: (1) management implementation; (2) management flexibility; (3) harvesters' access to the resource (4) biological effectiveness; and (5) economic efficiency.

3.2.5 Run Timing Overlap Analysis

The 1971-1981 Department of Fisheries and Oceans Sales Slip data was analyzed to determine the overlap in the timing of the runs in any two harvest areas under the different area licence configurations.

In this analysis a numeric value was computed, and the value ranged from 0 to 1.0. This value represents the potential catch an individual could realize by fishing in any two harvest areas for the area licence configurations. For all area configurations, except Small Area-Whole Coast, the degree of variability was computed for all possible harvest
areas. Using past catch data, in particular the timing of the catch for both areas, the degree of run timing segregation was computed. With this information, the percent of the possible maximum catch from both areas was computed. The percentage value takes into account that 100% of catch from both areas may not be realized due to physical and biological constraints.

To compute the run timing overlap indicator, the 1971 - 1981 catch statistics was used in the following manner:

1. For each gear group within each harvest area, under each area licence configuration, the value of the catch and the timing of the catches was determined.

2. For each gear group the value of the catch during the overlap period (when fishery in both places was opened) was determined for all two harvest area combinations (e.g., NorthB-SouthB, SouthB-WestB and NorthB-WestB for the NorthB-SouthB-WestB area licence configuration).

3. The value of the catch generated for all harvest area combinations was computed, for each gear group, under the area licence configurations.

4. If there was overlap in run timing (opening of the two fisheries) it was assumed the fleet would be in the area that generated the greatest catch for any of the area combinations. Thus, to determine the overlap indicator, this latter mentioned value was added to the value of the catch during the non-overlap period, and divided by the total values of catches
from both harvest areas, for each gear group, under the area licence configurations.

The results of this analysis will be used to determine the degree to which fishermen could benefit if they leased or purchased a second licence/vessel. This will be used to ascertain the potential effects, in terms of economic efficiency and of the displacement of fishermen, under the different area configurations.

3.2.6 Loss of Income Due to Labour Disputes

To compute income losses due to labour disputes the catch statistics for the 1971-1981 period were used. For each gear type in each area under the different area licence configurations the revenue loss due to hypothetical strikes was computed. Potent revenue losses due to strikes was computed in the following manner:

1. The weekly catches by gear and harvest area, under the different area licence configurations was computed using D.F.O. catch statistics.

2. The loss of revenue during a two week period of greatest potential loss was identified. This value was then divided by the total value of the catch to determine the percent loss in revenue.

3. Revenue loss for a hypothetical early strike (e.g., early to mid-July) and late strike (e.g., early to mid-August) was calculated. These periods were selected based on experience.

The results of this analysis will be used to assess the area configurations, in terms of loss of income due to a two week strike.
3.2.7 **Salmon Enhancement Potential**

In this analysis the salmon enhancement potential data produced by the Geographic Working Group (D.F.O., 1982) was used. These data provides salmon enhancement potential figures for each region of the coast. The salmon enhancement production figures are given by species, and figures used where those identified as manageable programs (i.e., this takes into account technical, biological and financial aspects of the projects). This information is important for it identifies the spatial distribution of salmon enhancement opportunities. Under the different area licence configurations some harvester may not have access to future enhancement production.

In this analysis the salmon enhancement potential for each area under the different area licence configurations was computed. The information generated for each area included: the production of each species; and the species mix.

The results of the salmon enhancement potential analysis will be used to assess how the harvesters' access to production from enhancement projects could be constrained under the different area configurations.

3.2.8 **Other Supporting Sources for Thesis**

3.2.8.1 **Introduction**

The purpose of this section is to briefly describe the non-quantitative information sources, and subjective approach used in the evaluation.
3.2.8.2 Other Sources

When assessing and comparing the different area configurations the following information and perspectives were used:

1. The author's knowledge of the industry through thirteen years of experience as an owner/operator of a salmon fishing vessel; and

2. Information generated through discussion with representatives of fishermen's organizations, processors and fishermen.

When evaluating and comparing the different configurations, in the non-quantifiable areas, the judgement of the author was applied. This subjective assessment was based on his understanding of the industry, as well as his assessment of the perspective of others involved in it.

3.2.8.3 Limitations of the Qualitative Approach

The technique employed in the qualitative approach is limited by the following factors:

1. The majority of the people this subject was discussed were based in Vancouver;

2. The people that the author held discussions with have varying interests in the industry, and since the beginning of this study (1982) there has been considerable change in the problem environment;

3. The author, though he endeavoured to be objective, has bias due to his investment in the industry and his long term objectives as an actor in it.
CHAPTER 4 - RESULTS OF DATA ANALYSIS

4.1 Fleet Mobility

The purpose of this section is to present the results of the fleet mobility analysis describing the mobility trends for each gear group under each area configuration.

4.1.1 Gillnet

A. NorthA-SouthA Configuration

Under the NorthA-SouthA area licence configuration, the percentage of the gillnet fleets that were stationary (i.e., 100% of the catch from a single area) ranged from 29% (347 vessels) in 1980 to 61% (722 vessels) in 1971 for the NorthA fleet, and 68% (1177 vessels) in 1978 to 83% (2225 vessels) in 1971 for the SouthA fleet (Figure 8). The mobility of the SouthA fleet was less variable: In 1979, 76% (933 vessels) and in 1980, 73% (941 vessels) of the SouthA fleet was stationary. The SouthA fleet was more stationary than the NorthA fleet: this difference ranged from a high of 45% in 1980 and a low of 15% in 1977 (Figure 8).

When a stationary vessel is defined as any vessel that harvests 80% or more of its catch from a single area, the mobility trends for the two fleets are similar to the above (Figure 8), but the percent of the fleets that were stationary, is greater: 83% (910 vessels) in 1979 and 62% (789 vessels) in 1980 for the NorthA fleet, and 84% (1032 vessels) in 1980 for the SouthA fleet.
Figure 8 - Percent of the Gillnet Fleet that was Stationary Under the Large Area Configurations (1970-70, 1977-80)

- 80-100% catch single area
- 100% catch single area

<table>
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<tbody>
<tr>
<td>1970</td>
<td></td>
<td>50%</td>
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<tr>
<td>1971</td>
<td></td>
<td>40%</td>
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<tr>
<td>1977</td>
<td></td>
<td>30%</td>
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<tr>
<td>1978</td>
<td></td>
<td>20%</td>
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<tr>
<td>1979</td>
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<td>10%</td>
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<td>1980</td>
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<td>0%</td>
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</table>

- 80-100% catch single area
- 100% catch single area

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</thead>
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<tr>
<td>1970</td>
<td></td>
<td>20%</td>
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<tr>
<td>1971</td>
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<td>10%</td>
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<tr>
<td>1977</td>
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<tr>
<td>1978</td>
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<td>50%</td>
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<tr>
<td>1979</td>
<td></td>
<td>40%</td>
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<tr>
<td>1980</td>
<td></td>
<td>30%</td>
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</tbody>
</table>
vessels) in 1979 and 86% (1102 vessels) in 1980 for the SouthA fleet.

B. NorthB-SouthB-WestB Configuration

Under the NorthB-SouthB-WestB area configurations, there was no substantial change in the mobility of the SouthB fleet, during the 1977-1980 period: the percentage of the fleet that was stationary ranged from 53% in 1978 to 60% in 1979 (Figure 8). The mobility of the WestB fleet decreased during this period; the percentage of the fleet that was stationary increased from 14% (1977) to 37% (1980) (Figure 8). The mobility of the NorthB fleet increased during the 1977-1980 period: the percentage of stationary vessel decreased from 52% (1977) to 27% (1980) (Figure 8).

When a stationary vessel was defined as any vessel that harvested 80% or more of the revenue in a single area, the mobility trends are similar to the above, but the number of vessels and the percentage of the vessels that are stationary is greater (Figure 8). In 1980 the NorthB fleet was more mobile than the WestB fleet and the WestB fleet more mobile than the SouthB fleet (Figure 8).

C. S.E.P. Area Configuration

Under the S.E.P. area configuration the mobility of the North Coast fleet increased during the 1977-1980 period (Figure 9): the percent of the fleet that was stationary ranged from 57% in 1977 (total number of vessels was 793) to 15% in 1980 (total number of vessels was 751). The values are greater if a stationary vessel is defined as "a
Figure 9 - Percent of the Gillnet Fleet That Was Stationary Under the S.E.P. Area Configuration - (1977-80)

- NORTH - NORTH COAST
- CENTRAL - CENTRAL COAST
- NW ISLD - NORTHWEST VANCOUVER ISLAND
- SW ISLD - SOUTHWEST VANCOUVER ISLAND
- JOHN ST - JOHNSTONE STRAITS
- GEO ST - GEORGIA STRAITS
- FRASER - FRASER RIVER
- J DE F - JUAN DE FUCA STRAITS

80-100% catch single area
100% catch single area
vessel that harvested 80%-100% of the revenue from a single area" - 90% of the fleet in 1977, and 46% of the fleet, in 1980, were stationary.

The Central Coast fleet mobility pattern remained relatively stable during the 1977-1980 period (Figure 9). The percent of the fleet that was stationary ranged from a high of 31% (128 vessels) in 1979 and a low of 13% (144 vessels) in 1978.

For the same period, the Southwest Vancouver Island fleet displayed a decline in mobility: 6% of the fleet was stationary (11 vessels) in 1977 and 22% (77 vessels) of the fleet was stationary in 1980 (Figure 9).

The mobility of the Johnstone Strait fleet decreased during the same period (Figure 9). There was an increase in stationary vessels: 14% (43 vessels) in 1978 and 41% (73 vessels) in 1980.

The mobility of the Fraser River fleet was relatively stable in this period (Figure 9). The percent of the fleet that was stationary ranged from 50% (1995 vessels) in 1978 to 68% (394 vessels) in 1979.

The mobility of the gillnet fleets in the following areas; Juan de Fuca Strait; North West Vancouver Island and Georgia Strait, declined during the 1977-1980 period (Figure 9). This information must be carefully interpreted for the number of vessels that are stationary is so low that the percentage change could over represent the mobility trend.

When the stationary vessel is defined as any vessel that harvested 80%-100% of its catch in a single area, the mobility trends of these fleets are similar to the above, but the over all mobility of the fleets was less (Figure 9).
D. Small Area-Whole Coast and Small Area-/Part of the Coast

Configurations

Under the Small Area-Whole Coast and Small Area-Part of the coast configuration, which includes Rivers-Smith Inlet, Nass River, and Barkley Sound, the total number of vessels that depend on these fisheries for the majority of their catch varied over time (Table 3). The majority of the vessels that engaged in these fisheries had small dependencies on them: Relative to the total number of vessels that harvested fish in these areas, the number of vessel that depended on them (i.e., 80% - 100% and 50% - 100%) of gross income is small (Table 3).

In 1980, 1412 gillnet vessels engaged in the Rivers-Smith Inlet fisheries, but only 9 vessels harvest the majority of their catch from this area. Hence, when interpreting the data one should bear in mind the low gillnet catch levels.

4.1.2 Seine

A. NorthA-SouthA Configuration

Under the NorthA-SouthA area configuration the mobility of the NorthA and SouthA fleet was relatively stable: the stationary component of the fleet ranged from 21% (83 vessels) in 1978 to 37% (122 vessels) in 1980 for the SouthA, and 8% (17 vessels) in 1979 to 18% (22 vessels) in 1978 for the NorthA (Figure 10). The NorthA fleet was more mobile
Figure 10 - Percent of the Seine Fleet that was Stationary Under the NorthA-SouthA and NorthB-SouthB-WestB Area Configurations - (1970-71 & 1977-80)
Table 3 - Number of Vessels in the Small Areas at Different Levels of Dependence for Good and Bad Years - Gillnet*

<table>
<thead>
<tr>
<th></th>
<th>Bad Year</th>
<th>Good Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50% - 100% (Year)</td>
<td>80% - 100% (Year)</td>
</tr>
</tbody>
</table>

*Note: This table indentifies the number of gillnet vessels that were dependent on the fisheries at two levels of dependence: 50% - 100% of their catch from a single area; and 80% - 100% of their catch from a single area. Also, two ranges were identified: years when the number of vessel were small and large.
than the SouthA fleet.

Relative to the gillnet fleet the seine fleet was more mobile. For example, in 1980 the ratio of percent stationary gillnet to percent stationary seine was 1:4 for the NorthA fleet and 1:2 for the SouthA fleet.

B. NorthB-SouthB-WestB Configuration

Under the NorthB-SouthB-WestB configuration, the mobility of the fleets were relatively stable in the 1977-1980 period (Figure 10). The percent of the fleet that was stationary ranged from 5% (NorthB fleet in 1977) to 21% (WestB fleet in 1978), with the figures for the other areas for this period falling within this range. Relative to the gillnet fleet the seine fleet was more mobile.

When a stationary vessel was defined as any vessel that harvested 80%-100% of its revenue in a single area, the percent of the fleets that was stationary was greater (Figure 10). The mobility trend was similar to that described above. However, relative to the gillnet fleet, the seine fleet was more mobile.

C. SEP and Small Areas Configuration

Under the SEP and small area configuration, there were few stationary vessels. Due to the small number of stationary seine vessels in each area, no analysis was conducted. If percentage values were assigned the information could deceptively over or understate the case.
4.1.3 Troll

A. NorthB-SouthB-WestB

For the 1977-1980 period the mobility of the troll fleet declined under this configuration. For the SouthB fleet the proportion of stationary vessels increased from 70% (338 vessels) in 1977 to 80% (468 vessels) in 1980 (Figure 11). The mobility of the WestB fleet varied over this period: the proportion of stationary vessels ranged from a low of 55% (828 vessels) in 1979 to a high of 66% (864 vessels) in 1980.

When a stationary vessels are defined as vessels that harvested 80%-100% of their gross revenue in a single area, the fleets were fairly stationary during the 1977-1980 period. The proportion of the fleet that was stationary range from a low of 79% (1980) for the NorthB fleet to a high of 89% (1980) for the SouthB fleet - the other figures were within this range.

The troll fleet is not as mobile as the other gear groups based on the mobility pattern of the fleets under the NorthB-SouthB-WestB area licence configuration. The mobility trends for troll fleet was not analyzed for the S.E.P. and small area configurations due to the nature of the troll fisheries.

However, there is a substantial movement within specific areas. The fleet that work the West Coast Vancouver Island area, for example, move within this area fairly extensively and the same can be said of fleets in other areas.
Figure 11 - Percent of the Troll Fleet that was Stationary Under the NorthB-SouthB-WestB Area Configuration (1977-1980)
4.2 Variability of Catch

Based on an analysis of the 1971-1981 catch statistics, the variability in catch by gear and by area increased as the coast was disaggregated into smaller fishing areas. With a reduction in the areal extent of the fishing areas, the variability in value of catch (or revenue) increases (Tables 4-7). There are a number of exceptions to this trend. There are some areas that are small in areal extent, but the coefficient of variability is less than for some of the areas that are large.

Within specific area licence configurations, the coefficient of variability for specific gear types varies from sub area to sub area. For example, under the SEP configuration, the variability in catch of the gillnet fleet ranged from 0.334 in Fraser River to 1.158 in Georgia Strait (Table 6). A similar range exists for other gear types, and under different area licence configurations.

Generally, the net fleets displayed greater variability than the troll fleet, under the different area licence configurations (Tables 4-7). However, as the coast is disaggregated into smaller harvest areas, e.g., moving from the NorthA-SouthA configuration to the Small Area-Whole Coast configuration, there are some areas where the variability in the catches by troll fleet was greater than the net fleet.

Within the net fleets, the variability in the catch for the gillnet fleet was greater than the seine fleet under the NorthA-SouthA and NorthB-SouthB-WestB area licence configurations (Table 5). However,
Table 4 - Variability in Catch by Gear Type and by Area, Under the NorthA-SouthA Area Licence Configuration. The Values are Coefficient of Variation (1971-1980).1

<table>
<thead>
<tr>
<th>Gear Type</th>
<th>NorthA</th>
<th>SouthA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gillnet</td>
<td>0.350</td>
<td>0.391</td>
</tr>
<tr>
<td>Seine</td>
<td>0.329</td>
<td>0.338</td>
</tr>
<tr>
<td>Troll</td>
<td>0.144</td>
<td>0.317</td>
</tr>
</tbody>
</table>

Table 5 - Variability in Catch by Gear Type and by Area, Under the NorthB-SouthB-WestB Area Licence Configuration. The Values are Coefficient of Variation (1971-1980).

<table>
<thead>
<tr>
<th>Gear Type</th>
<th>North</th>
<th>South</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gillnet</td>
<td>0.350</td>
<td>0.380</td>
<td>0.443</td>
</tr>
<tr>
<td>Seine</td>
<td>0.329</td>
<td>0.415</td>
<td>0.400</td>
</tr>
<tr>
<td>Troll</td>
<td>0.146</td>
<td>0.098</td>
<td>0.152</td>
</tr>
</tbody>
</table>

1The coefficient of variation is a numeric indicator of variability. Confidence limits are not provided, hence significant differences must be qualitative assessed. Please note that this footnote applies to Tables 4-7.
Table 6 - Variability in Catch by Gear Type and by Area Under the SEP Area Licence Configuration. The Values are Coefficient of Variation (1971-1980).

<table>
<thead>
<tr>
<th>Gear Type</th>
<th>North Coast</th>
<th>Central Coast</th>
<th>NW Van. Island</th>
<th>SW Van. Island</th>
<th>Johnstone Strait</th>
<th>Georgia Strait</th>
<th>Fraser River</th>
<th>Juan de Fuca</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gillnet</td>
<td>0.360</td>
<td>0.589</td>
<td>0.992</td>
<td>0.385</td>
<td>0.420</td>
<td>1.158</td>
<td>0.334</td>
<td>0.570</td>
</tr>
<tr>
<td>Seine</td>
<td>0.390</td>
<td>0.387</td>
<td>0.858</td>
<td>0.581</td>
<td>0.502</td>
<td>0.445</td>
<td>-</td>
<td>0.533</td>
</tr>
<tr>
<td>Troll</td>
<td>0.177</td>
<td>0.187</td>
<td>0.281</td>
<td>0.168</td>
<td>0.270</td>
<td>0.204</td>
<td>0.606</td>
<td>0.456</td>
</tr>
</tbody>
</table>

Table 7 - Variability in Catch by Gear Type and by Area Under the Small Areas Area Licence Configuration. The Values are Coefficient of Variation (1971-1981).

<table>
<thead>
<tr>
<th>Gear Type</th>
<th>Rivers-Smith Inlet</th>
<th>Barkley Sound</th>
<th>Nass River</th>
<th>Rest of the Coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gillnet</td>
<td>0.881</td>
<td>0.392</td>
<td>0.569</td>
<td>0.318</td>
</tr>
<tr>
<td>Seine</td>
<td>1.207</td>
<td>0.677</td>
<td>0.870</td>
<td>0.126</td>
</tr>
<tr>
<td>Troll</td>
<td>0.514</td>
<td>0.518</td>
<td>0.279</td>
<td>0.126</td>
</tr>
</tbody>
</table>
under the NorthB-SouthB-WestB scheme, the variability in the seine catch was greater than for the gillnet fleet. The exception is the SouthB area under the NorthB-SouthB-WestB area licence configuration.

Under the S.E.P. and Small Area licence configurations, there is no particular trend in variability in catches for the gillnet and seine fleet. Depending on the area, the variability of catch for the seine fleet was greater than for the gillnet fleet (Table 6). Under the Small Area-Whole Coast licence configuration, the variability of the seine catch was greater than the gillnet catch (Table 7). The exception being that the gillnet catch was more variable than the seine for the larger areas.

These trends in variability of catch by gear and by area, and the difference in the value of catch by time, gear and area, under different area licence configurations can be due to a number of factors. The number of vessels for each gear group in each harvest area, and difference in biological production and species mix in the areas could contribute to variability in catches.

4.3 Run Timing Overlap

As the coast is disaggregated into smaller fishing areas, moving from NorthA-SouthA to Small Areas-Whole Coast area licence configurations, the overlap in the timing of the runs is reduced. Thus, the percent of the potential harvest from both areas could be greater as the areal extent of the area licence configurations is reduced. Table 8 to 15 show, the increase in the percent of potential catch for vessels
licenced for two areas, under the different area configurations.

The purpose of this section is to describe such trends for each
gear group under each area configuration.

A. NorthA-SouthA Configuration

Under this configuration the percent of the potential catch for a
vessel licenced for two areas are: Gillnet 64%, Seine 74% and Troll 76%
(Table 8).

B. NorthB-SouthB-WestB Configuration

Under this configuration the potential catch for a vessel with a
licence for two areas is not substantially greater than under the
NorthA-SouthA configuration. This is the case for the seine and troll
fleets. For the gillnet fleet licenced for the NorthB-WestB (84%) and
SouthB-WestB (80%) licence combinations, the potential catches are
greater than under the NorthA-SouthA area licence configuration (64%)
(Table 8).

C. S.E.P. Configuration

Under the S.E.P. area licence configuration the potential catch
for vessels licenced for two areas displayed a wide range in percent
values: Gillnet ranged from 64% to 99% with mean of 86%; Seine 61% -
99% with mean of 84%; and Troll 60% - 100% with a mean of 82% (Table
9). These values are the summary of all the possible licence
combination under this configuration in Tables 10-12.

Relative to the NorthA-SouthA and NorthB-SouthB-WestB
configurations the percent of potential catch for vessels licenced for two areas is greater under the S.E.P. configuration. If the mean value under the S.E.P. configuration is compared to the values under the NorthA-SouthA and NorthB-SouthB-WestB, the forementioned values are greater. However, some of the values for the licence combination under the S.E.P. configuration are less than under the forementioned configurations (Table 10-12 and Table 8).

D. Small Area-Part of the Coast/Whole Coast Configuration

Under these configurations the value of potential catch for vessels licenced for two areas ranged from: 64% to 91% with a mean value of 81% for gillnet; 75% to 99% with a mean of 89% for seine; and 60% to 99% with a mean of 89% for troll (Table 9). These figures are the summary of the values in Tables 13 to 15.

The potential catch figures are similar to that under the S.E.P. area configuration. However, it should be noted that for the small area-whole coast configuration, all the possible two licence combinations were not analyzed. Also, the degree of overlap varies over time. Though the supporting data are not provided, one can logically argue that in some years the stock strength and species mix of the harvests in the different areas varies over time. Hence, this could affect the extent of the contribution of catches from the two areas to the overall catch from both. Depending on the biological factors, the degree of overlap could be strong or weak.
Table 8 - Percent of Potential Catch for Vessels Licenced for Two Areas under NorthA-SouthA and NorthB-SouthB-WestB (1971-1980).*

<table>
<thead>
<tr>
<th>Area Licence Configuration</th>
<th>Gillnet</th>
<th>Seine</th>
<th>Troll</th>
</tr>
</thead>
<tbody>
<tr>
<td>NorthA-SouthA Licence combination</td>
<td>64%</td>
<td>74%</td>
<td>76%</td>
</tr>
<tr>
<td>NorthB-SouthB Licence combination</td>
<td>61%</td>
<td>73%</td>
<td>61%</td>
</tr>
<tr>
<td>NorthB-WestB Licence combination</td>
<td>84%</td>
<td>76%</td>
<td>71%</td>
</tr>
<tr>
<td>SouthB-WestB Licence combination</td>
<td>80%</td>
<td>74%</td>
<td>76%</td>
</tr>
</tbody>
</table>

*The percent figure connotes the degree of overlap in the timing of the runs. If the figure is 100% this means that there is no overlap in the timing of the runs. Hence, if a fisherman has a licence for both harvest areas, under a specific area configuration, they will be able to harvest 100% of the potential catch from both areas. If the figure is 50%, this means that 50% of the runs overlap in the timing of the runs. Thus, the fishermen with licences for two harvest areas, will be able to only harvest 50% of the potential catch from both areas. This note applies to Tables 8 to 15.
Table 9 - Percent of Potential Catch for Vessels Licensed for Two Areas Under the SEP and Small Area Configurations (1971-1980).

<table>
<thead>
<tr>
<th>Area Licence Configuration</th>
<th>Percent Range</th>
<th>Mean Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gillnet - Two Licences</td>
<td>64% - 99%</td>
<td>86%</td>
</tr>
<tr>
<td>Seine - Two Licences</td>
<td>61% - 99%</td>
<td>84%</td>
</tr>
<tr>
<td>Troll - Two Licences</td>
<td>60% - 100%</td>
<td>82%</td>
</tr>
<tr>
<td><strong>Small Area - Part of the Coast</strong> (e.g., River-Smith, Barkley, Nass and Rest of the Coast)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gillnet - Two Licences</td>
<td>64% - 91%</td>
<td>81%</td>
</tr>
<tr>
<td>Seine - Two Licences</td>
<td>75% - 99%</td>
<td>99%</td>
</tr>
<tr>
<td>Troll - Two Licence</td>
<td>66% - 99%</td>
<td>89%</td>
</tr>
<tr>
<td>Area</td>
<td>North Coast</td>
<td>Central Coast</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
<td>---------------</td>
</tr>
<tr>
<td>North Coast</td>
<td>50%</td>
<td>64%</td>
</tr>
<tr>
<td>Central Coast</td>
<td>50%</td>
<td>99%</td>
</tr>
<tr>
<td>NW Vancouver Island</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>SW Vancouver Island</td>
<td>50%</td>
<td>73%</td>
</tr>
<tr>
<td>Johnstone Strait</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>Georgia Strait</td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Fraser River</td>
<td></td>
<td>50%</td>
</tr>
<tr>
<td>Juan de Fuca</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 11 - Potential Catches for Vessels Licenced for two Areas Under SEP Area Licence Configurations - Seine (1971-1980).

<table>
<thead>
<tr>
<th></th>
<th>North Coast</th>
<th>Central Coast</th>
<th>NW Van. Island</th>
<th>SW Van. Island</th>
<th>Johnstone Strait</th>
<th>Georgia Strait</th>
<th>Fraser River</th>
<th>Juan de Fuca</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Coast</td>
<td>50%</td>
<td>63%</td>
<td>0%</td>
<td>74%</td>
<td>80%</td>
<td>94%</td>
<td>0%</td>
<td>81%</td>
</tr>
<tr>
<td>Central Coast</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>79%</td>
<td>78%</td>
<td>95%</td>
<td>0%</td>
<td>77%</td>
</tr>
<tr>
<td>NW Vancouver Island</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>SW Vancouver Island</td>
<td>50%</td>
<td>89%</td>
<td>95%</td>
<td>0%</td>
<td>0%</td>
<td>91%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Johnstone Strait</td>
<td>50%</td>
<td>98%</td>
<td>0%</td>
<td>78%</td>
<td>0%</td>
<td>78%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Georgia Strait</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
<td>93%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraser River</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juan de Fuca</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 12 - Potential Catches for Vessels Licenced for two Areas Under SEP Area Licence Configurations - Troll (1971-1980).

<table>
<thead>
<tr>
<th></th>
<th>North Coast</th>
<th>Central Coast</th>
<th>NW Van. Island</th>
<th>SW Van. Island</th>
<th>Johnstone Strait</th>
<th>Georgia Strait</th>
<th>Fraser River</th>
<th>Juan de Fuca</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Coast</td>
<td>50%</td>
<td>60%</td>
<td>61%</td>
<td>70%</td>
<td>80%</td>
<td>82%</td>
<td>0%</td>
<td>99%</td>
</tr>
<tr>
<td>Central Coast</td>
<td>50%</td>
<td>60%</td>
<td>77%</td>
<td>75%</td>
<td>79%</td>
<td>0%</td>
<td>99%</td>
<td></td>
</tr>
<tr>
<td>NW Vancouver Island</td>
<td>50%</td>
<td>70%</td>
<td>80%</td>
<td>84%</td>
<td>0%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW Vancouver Island</td>
<td>50%</td>
<td>90%</td>
<td>89%</td>
<td>0%</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Johnstone Strait</td>
<td>50%</td>
<td>70%</td>
<td>0%</td>
<td>96%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Georgia Strait</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
<td>96%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraser River</td>
<td>50%</td>
<td>50%</td>
<td>0%</td>
<td>96%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Juan de Fuca</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Rivers-Smith Inlet</th>
<th>Barkley Sound</th>
<th>Nass River</th>
<th>Rest of the Coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers-Smith Inlet</td>
<td>50%</td>
<td>76%</td>
<td>64%</td>
<td>90%</td>
</tr>
<tr>
<td>Barkley Sound</td>
<td>50%</td>
<td>72%</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>Nass River</td>
<td>50%</td>
<td>91%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rest of the Coast</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 14 - Potential Catches for Vessels Licenced for Two Areas Under Small Area Configuration - Seine (1971-1980).

<table>
<thead>
<tr>
<th></th>
<th>Rivers-Smith Inlet</th>
<th>Barkley Sound</th>
<th>Nass River</th>
<th>Rest of the Coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers-Smith Inlet</td>
<td>50%</td>
<td>90%</td>
<td>93%</td>
<td>99%</td>
</tr>
<tr>
<td>Barkley Sound</td>
<td>50%</td>
<td>77%</td>
<td>95%</td>
<td></td>
</tr>
<tr>
<td>Nass River</td>
<td>50%</td>
<td>90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rest of the Coast</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Rivers-Smith Inlet</th>
<th>Barkley Sound</th>
<th>Nass River</th>
<th>Rest of the Coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rivers-Smith Inlet</td>
<td>50%</td>
<td>96%</td>
<td>66%</td>
<td>99%</td>
</tr>
<tr>
<td>Barkley Sound</td>
<td>50%</td>
<td>96%</td>
<td>75%</td>
<td></td>
</tr>
<tr>
<td>Nass River</td>
<td>50%</td>
<td>99%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rest of the Coast</td>
<td>50%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When interpreting this data it is important to take into account, the following. First, where harvest areas are large, the potential harvests may overstate the true conditions. Under such area licence configurations, fishermen may fish within specific areas in each harvest area. For example, there are fishermen that may fish the Skeena and the Fraser Rivers. The degree of overlap is small under the NorthA-SouthA and NorthB-SouthB-WestB area configurations. The overlap is overstated and the potential catches for double licencing could be understated.

Second, the analysis does not take into account the logistics of travel between two harvest areas. This could have a major effect on the harvest levels.

Third, extent of overlap could change due to enhancement projects. The enhancement of specific stocks could be such that the contribution of a second area to gross revenue could be effected.

4.4 Possible Loss of Revenue Due to Labour Disputes

The potential loss in gross revenue, due to a two week strike, increases as the coast is disaggregated into smaller harvest areas (Table 16). The percentage loss in gross revenue in some of the areas is greater under the area licence configurations with smaller harvest areas (e.g., Small Area and S.E.P. configurations) than the area licence configurations with large harvest areas (e.g., NorthA-SouthA and NorthB-SouthB-WestB area licence configurations). The relative difference in percentage loss in gross revenue, between the least and the most affected fleet, also increases as the coast is disaggregated.
into smaller harvest areas (Table 16).

Depending on the timing of the strike - early season, i.e., 21-22 weeks (mid-July) or late season, i.e., 24-25 weeks (mid August) - the different fleets will be effected unequally. If a strike takes place in the early season, the fleets in the NorthA Region (e.g., harvest areas within the NorthA harvest area) will be more adversely affected than the fleet in the SouthA Region (e.g., harvest areas in the SouthA area) This can be attributed to the timing of the runs. The majority of the runs in the Northern Region peak before the runs in the Southern Region, the exception being the early sockeye runs in Barkley Sound, and Rivers and Smiths Inlet in the Southern Region.

With a late strike, the fleets in the areas that have late runs (or if the catch is dominated by later runs), will be affected more than the previously mentioned areas. These areas are primarily in the Southern Region and the Central Coast. The effect for the fleets in the S.W. Vancouver Island and N.W. Vancouver Island areas may not be as great, for the bulk of the fleet catch is from the early sockeye fisheries and fall chum fisheries.

Generally, the percent loss in gross revenue increases, as the coast is disaggregated into smaller harvest areas (Table 17). The percentage loss varies, with a high of 46% for the gillnet fleet under the Small Area licence configuration; 82% for the seine under the S.E.P. configuration; and 37% for the troll under the S.E.P. The loss in gross revenues due to a two week strike depends on: the timing of the strike; the gear type; and the area within the licence
Table 16 - Loss of Revenue Due to a Two Week Strike During Periods of Greatest Abundance, for Each Gear Group and for Each Area - Percent of Gross Revenue (1971-1980).

<table>
<thead>
<tr>
<th>Area Licence Configurations</th>
<th>Gillnet Week</th>
<th>Seine Week</th>
<th>Troll Week</th>
</tr>
</thead>
<tbody>
<tr>
<td>NorthA-SouthA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NorthA</td>
<td>30% (20-21)</td>
<td>37% (21-22)</td>
<td>17% (21-22)</td>
</tr>
<tr>
<td>SouthA</td>
<td>21 (22-23)</td>
<td>29 (24-25)</td>
<td>20 (23-24)</td>
</tr>
<tr>
<td>NorthB-SouthB-WestB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NorthB</td>
<td>30 (20-21)</td>
<td>37 (21-22)</td>
<td>17 (21-22)</td>
</tr>
<tr>
<td>SouthB</td>
<td>22 (23-24)</td>
<td>31 (24-25)</td>
<td>19 (24-25)</td>
</tr>
<tr>
<td>WestB</td>
<td>12 (28-29)</td>
<td>28 (25-26)</td>
<td>21 (23-24)</td>
</tr>
<tr>
<td>SEP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Coast</td>
<td>40 (20-21)</td>
<td>41 (21-22)</td>
<td>18 (21-22)</td>
</tr>
<tr>
<td>Central Coast</td>
<td>23 (19-20)</td>
<td>38 (20-21)</td>
<td>20 (23-24)</td>
</tr>
<tr>
<td>NW Vancouver Island</td>
<td>15 (18-19)</td>
<td>82 (32-33)</td>
<td>32 (23-24)</td>
</tr>
<tr>
<td>SW Vancouver Island</td>
<td>25 (19-20)</td>
<td>33 (20-21)</td>
<td>17 (22-23)</td>
</tr>
<tr>
<td>Johnstone Strait</td>
<td>20 (21-22)</td>
<td>32 (24-25)</td>
<td>24 (24-25)</td>
</tr>
<tr>
<td>Georgia Strait</td>
<td>26 (24-25)</td>
<td>45 (24-25)</td>
<td>15 (18-19)</td>
</tr>
<tr>
<td>Fraser River</td>
<td>29 (23-24)</td>
<td>-</td>
<td>37 (24-25)</td>
</tr>
<tr>
<td>Juan de Fuca</td>
<td>27 (24-25)</td>
<td>48 (24-25)</td>
<td>33 (24-25)</td>
</tr>
<tr>
<td>Small Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivers-Smith Inlet</td>
<td>46 (18-19)</td>
<td>77 (19-20)</td>
<td>21 (23-24)</td>
</tr>
<tr>
<td>Barkley Sound</td>
<td>29 (18-19)</td>
<td>41 (20-21)</td>
<td>15 (24-25)</td>
</tr>
<tr>
<td>Nass River</td>
<td>32 (23-24)</td>
<td>49 (21-22)</td>
<td>25 (26-27)</td>
</tr>
<tr>
<td>Rest of Coast</td>
<td>26 (22-23)</td>
<td>28 (24-25)</td>
<td>20 (23-24)</td>
</tr>
</tbody>
</table>

1 The percent values have been rounded off to nearest whole number.
Table 17 - Loss of Revenue Due to a Two Week Strike During Early and Late Season in Percent of Gross Revenue (1971-1980).*

<table>
<thead>
<tr>
<th>Area Licence Configuration</th>
<th>Early Season, 21-22 Week</th>
<th>Late Season, 24-25 Week</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gillnet</td>
<td>Seine</td>
</tr>
<tr>
<td>NorthA-SouthA</td>
<td>(1:2)</td>
<td>(1:3)</td>
</tr>
<tr>
<td>NorthA</td>
<td>29%</td>
<td>37%</td>
</tr>
<tr>
<td>SouthA</td>
<td>15%</td>
<td>12%</td>
</tr>
<tr>
<td>NorthB-SouthB-WestB</td>
<td>(1:6)</td>
<td>(1:4)</td>
</tr>
<tr>
<td>NorthB</td>
<td>29%</td>
<td>37%</td>
</tr>
<tr>
<td>SouthB</td>
<td>16%</td>
<td>13%</td>
</tr>
<tr>
<td>WestB</td>
<td>5%</td>
<td>9%</td>
</tr>
<tr>
<td>SEP</td>
<td>(1:34)</td>
<td>(1:41)</td>
</tr>
<tr>
<td>North Coast</td>
<td>36%</td>
<td>41%</td>
</tr>
<tr>
<td>Central Coast</td>
<td>22%</td>
<td>34%</td>
</tr>
<tr>
<td>NW Vancouver Island</td>
<td>2%</td>
<td>-</td>
</tr>
<tr>
<td>SW Vancouver Island</td>
<td>13%</td>
<td>22%</td>
</tr>
<tr>
<td>John Strait</td>
<td>20%</td>
<td>12%</td>
</tr>
<tr>
<td>Geog. Strait</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>Fraser River</td>
<td>13%</td>
<td>-</td>
</tr>
<tr>
<td>Juan de Fuca</td>
<td>8%</td>
<td>5%</td>
</tr>
<tr>
<td>Small Areas</td>
<td>(1:7)</td>
<td>(1:2.5)</td>
</tr>
<tr>
<td>Rivers-Smith</td>
<td>13%</td>
<td>16%</td>
</tr>
<tr>
<td>Barkley</td>
<td>4%</td>
<td>21%</td>
</tr>
<tr>
<td>Nass</td>
<td>22%</td>
<td>49%</td>
</tr>
<tr>
<td>Rest of Coast</td>
<td>23%</td>
<td>19%</td>
</tr>
</tbody>
</table>

*The ratio is the comparison between the area with least loss in revenue and the area with the greatest loss in revenue. Also, the percentage figures have been rounded off to the newest whole number.
configuration. When a strike takes place it is important, for the timing of period of greatest abundance of stocks varies in the different areas. If the harvest area is large in geographic extent, the potential loss in revenue is not as great as it would if the harvest areas are smaller (e.g., S.E.P. and Small Areas, area licences configurations). Generally, the larger areas have a greater diversity in the number of stocks: The major exception being Johnstone Strait which is an area where many bypassing stocks are harvested. Also, the fleet in the NorthA Region, is heavily dependent on a single run, the Skeena River sockeye. Thus, if a strike takes place in these areas, there will be greater losses than in the other large areas.

Gear type is an important factor to take into account when assessing potential loss in revenues. That is, the net and troll fleet generally fish for different species and the availability of the species varies.

The results of this analysis must be tempered by the following:

1. The losses are averages for the 1971-81 period, but during particular years the harvest levels may be greater or less than the average. That is, there is variability in abundance (refer to Section 4.2).

2. Due to averaging, the potential effects of a strike during period of high abundance of specific runs, e.g., Adams River Sockeye, is not demonstrated. For example, if a two week strike takes place from the second or first week in August, the fleets in Johnston Strait, Juan de Fuca Strait and West Coast of Vancouver Island will be affected under the
NorthA-SouthA configuration. Under the NorthA-SouthA area licence configuration, the pure trollers and seine fleet will be adversely affected, but the gillnet fleet may not, for they will be able to access the stocks in the Gulf of Georgia (i.e., mouth of the Fraser River).

3. The data does not take into account changes in management regulations and structural changes in the fleet (i.e., composition of the fleet); and the development of fisheries through stock enhancement.

4.5 *Salmon Enhancement Opportunities*

The enhancement potential for salmon and the species mix of the enhancement opportunities varies for each region under different area licensing configurations.

Under the NorthA-SouthA configuration, the enhancement potential for all species is greater in the SouthA harvest area. The enhancement potential of the higher valued species (e.g., chinook and sockeye) is also greater in the SouthA region (Table 18).

Under the NorthB-SouthB-WestB configuration, the difference in enhancement potential between the different regions is reduced. However, the enhancement potential of the higher valued species is greatest in the SouthB region (Table 18).

Under the S.E.P. configuration, the difference in enhancement potential is reduced. However, in certain regions, there is greater enhancement potential for the following reasons:
Table 18 - Enhancement Opportunities in Different Areas Under Various Area Licence Configurations - Production in the Number of Piece in Thousands.*

<table>
<thead>
<tr>
<th>Areas</th>
<th>Chinook</th>
<th>Sockeye</th>
<th>Pink Even Year</th>
<th>Pink Odd Year</th>
<th>Chum</th>
<th>Coho</th>
</tr>
</thead>
<tbody>
<tr>
<td>NorthA-SouthA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NorthA</td>
<td>294</td>
<td>23</td>
<td>3,645</td>
<td>1,060</td>
<td>2,168</td>
<td>650</td>
</tr>
<tr>
<td>SouthA</td>
<td>2,470</td>
<td>8,937</td>
<td>4,460</td>
<td>3,984</td>
<td>6,732</td>
<td>1,831</td>
</tr>
<tr>
<td>NorthB-SouthB-WestB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NorthB</td>
<td>294</td>
<td>23</td>
<td>3,645</td>
<td>1,060</td>
<td>2,168</td>
<td>650</td>
</tr>
<tr>
<td>SouthB</td>
<td>1,740</td>
<td>8,699</td>
<td>4,110</td>
<td>3,984</td>
<td>2,616</td>
<td>1,138</td>
</tr>
<tr>
<td>WestB</td>
<td>730</td>
<td>237</td>
<td>350</td>
<td>-</td>
<td>2,348</td>
<td>693</td>
</tr>
<tr>
<td>SEP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Coast</td>
<td>240</td>
<td>176</td>
<td>956</td>
<td>60</td>
<td>841</td>
<td>515</td>
</tr>
<tr>
<td>Central Coast</td>
<td>61</td>
<td>179</td>
<td>2,689</td>
<td>1,000</td>
<td>1,727</td>
<td>155</td>
</tr>
<tr>
<td>NW Vancouver Island</td>
<td>440</td>
<td>-</td>
<td>350</td>
<td>-</td>
<td>1,157</td>
<td>379</td>
</tr>
<tr>
<td>SW Vancouver Island</td>
<td>290</td>
<td>237</td>
<td>-</td>
<td>-</td>
<td>1,191</td>
<td>315</td>
</tr>
<tr>
<td>Johnstone Strait</td>
<td>520</td>
<td>170</td>
<td>4,110</td>
<td>3,589</td>
<td>1,484</td>
<td>447</td>
</tr>
<tr>
<td>Georgia Strait</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>57</td>
<td>64</td>
<td>68</td>
</tr>
<tr>
<td>Fraser River</td>
<td>1,139</td>
<td>8,227</td>
<td>-</td>
<td>338</td>
<td>668</td>
<td>1,138</td>
</tr>
<tr>
<td>Juan de Fuca</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*The figures presented in this table are based on the data in the Summary Report on Manageable Enhancement Opportunities, by the Enhancement Opportunities Sub-Committee, Salmon Enhancement Program, Department of Fisheries and Oceans, Pacific Region (Geographic Working Group, 1982).
1. The Fraser River has a substantially greater enhancement potential for the higher valued species (e.g., chinook, sockeye and coho) than all other regions;
2. The enhancement of even and odd year pinks is substantially greater in Johnstone Strait; and
3. In Juan de Fuca Strait, the enhancement opportunities are not as great as the other regions.

Though the analysis was not conducted for the Small Area-Whole Coast configuration, but based on the trend with the other configurations it can be argued that the distribution of enhancement opportunities under this configuration are unequal. As the coast is disaggregated into smaller harvest areas the distribution of enhancement opportunities become unequal.

Summary

In the above section the result of the data analysis was provided. The information on fleet mobility, running timing over lap, variability of catch, loss of revenue due to strikes; and salmon enhancement opportunities will be used in chapter five to evaluate and compare the five area licence configurations. This quantitative information will be used to complement, wherever possible, the qualitative assessment, in the next chapter.
CHAPTER 5 - EVALUATION OF AREA LICENCE CONFIGURATIONS

5.1 Introduction

In this chapter the five area configurations will be assessed and ranked, applying the evaluative criteria in chapter two, in terms of four broad subject areas: management operations, socio-economic effects, biological effectiveness, and economic efficiency. The evaluation and ranking makes use of the quantitative information generated in chapter four and other supporting information.

The result of this section should be interpreted acknowledging the assumptions stated in this study and that the reader's values and perceptions may differ from that of the author's.

5.2 Management Operations

The purpose of this section is to assess the five area licence configurations addressing the following subject areas: implementability of plans; and flexibility of the plan.

5.2.1 Implementability

The purpose of this section is to evaluate the five area licence configurations in terms of whether they will result in management plans that are complex, and their social and political acceptability. Socio-economic factors could affect the social and political acceptability of the management plans, but this will not be addressed in this section.
NorthA-SouthA and Small Area-Part of the Coast Configurations

These area licence configurations will not result in more complex management system than the other schemes for the following reasons. First, they are similar to the status quo. It will not be necessary to introduce other management tool(s), and existing regulatory mechanisms will be compatible with these configurations. Under the NorthA-SouthA configuration an inter-harvest area allocation system will not be necessary for existing regulatory mechanism (e.g., time, gear, area and species-harvest-regulations) could be adopted to minimize inter-area harvest problems.

The Small Area-Part of the Coast configuration will not pose any major complexities, for existing policy and regulatory mechanisms will be sufficient to address management problems. If problems do arise it will not be a major issue, for the harvesters will elect to fish in the harvest areas that are smaller in geographic extent, knowing the circumstances they would be exposed to. Also, the number of harvesters affected under this configuration is less than other configurations, thus it will be more acceptable.

The NorthA-SouthA and the Small Area-Part of the Coast area configurations will be more readily accepted than the other schemes for the following reasons. First, these area licence configurations will be least disruptive of fishermen's current harvest patterns. As indicated in chapter four (section 4.1), these configuration will have the least impact on the mobility of the fleets.

Second, these area licence configurations will have less uncertainty associated with them. They are closer to the status quo
than the other area configurations, hence it will be easier for the user
groups to conceptualize the short- and long-term consequences of these
schemes. Under the other schemes the economic, distributional and
biological ramifications of the management plans could be difficult to
conceptualize, and other policy tools and regulations may be necessary.
Thus, there will be greater uncertainty and risk associated with them.

Third, the segregation of a few statistical areas (e.g., Barkley
Sound, Rivers-Smith Inlet and Nass River) will not result in the
withdrawal of a large percentage of the catch from the provincial total
(see Table 19). A large area of the coast will be available to the
fleets that do not elect to fish in the small harvest areas. Thus they
will have maximum flexibility to adjust their harvest strategies. Also,
the fishermen that elect the small areas assume the risks associated
with: strikes, enhancement opportunities, biological vagaries, and
variability in value of species. The fishermen that choose the large
area will not be subject to new risks, for this area approximates the
status quo.

NorthB-SouthB-WestB

This area licence configuration will result in a management plan
that is more complex than under the previous configurations. First, it
may be necessary to introduce a program to allocate the allowable
catches by gear group and by area. Also, changes in existing harvest
regulations may be necessary. This is the case because of the diversion
of stocks through Johnstone Strait versus Juan de Fuca Strait
(International Pacific Salmon Fisheries Commission, 1984), will result
Table 19 - Catch Contribution of Small Areas to Larger Areas.*

<table>
<thead>
<tr>
<th></th>
<th>NorthA-SouthA</th>
<th>NorthB-SouthB-WestB</th>
<th>S.E.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NorthA SouthA</td>
<td>NorthB SouthB WestB</td>
<td>North Coast Central Coast All B.C.</td>
</tr>
<tr>
<td>Rivers-Smith Inlets</td>
<td>1%</td>
<td>3%</td>
<td>4% 1%</td>
</tr>
<tr>
<td>Nass River</td>
<td>25%</td>
<td>25%</td>
<td>39% 12%</td>
</tr>
<tr>
<td>Barkley Sound</td>
<td>10%</td>
<td>20%</td>
<td>5%</td>
</tr>
<tr>
<td>N.W. Vancouver Island</td>
<td>12%</td>
<td>24%</td>
<td>6%</td>
</tr>
</tbody>
</table>

*Note: The percentage values were calculated using average value of catch for the gillnet-seine catches for the 1979-1980 period. This table identifies the percent of the catch each of the small areas (e.g., Nass River) contribute to the B.C. salmon fishery and to the harvest areas under the different area configurations.
in fishermen having different opportunities of access to the surplus production.

These changes (e.g., permit the net fisheries to take place in areas that were traditionally closed to them and allow the seine fleet in areas that were exclusively fished by the gillnet fleet) and other policy tools will increase the uncertainties. The result will be gear conflicts and biological problems (e.g., increased mixed stock fishery, hence increased risk of over harvesting stocks).

Second, the information requirements will be greater under this configuration. If an area-gear allocation scheme, accurate in-season and pre-season information on the strength of the runs, will be necessary, to ensure that area-gear allocations are not exceeded and harvest areas are not over, or under-subscribed.

This configuration will not be as readily accepted as the NorthA-SouthA and Small Area-Part of the Coast configurations, because of the following:

First, the NorthB-SouthB-WestB area configuration will restrict the mobility of the fleets, more than the latter schemes (see Chapter 4, Section 4.1). The fleets will be restricted in their North-South movement, and movement between the Inside waters (e.g., Fraser River and Johnstone Strait) and the West Coast of Vancouver Island.

Second, the level of uncertainty will be greater because the coast will be factored into smaller harvest areas. The uncertainty will be related to the biological variability in each area (see Chapter 4, Section 4.2); the distribution of the fleet between the different
harvest areas; and complexity for other management tools and regulations will be necessary for an orderly harvest of the resources. Also, there is the risk of some harvest areas being over-subscribed and other areas under-subscribed: an area is under-subscribed if the average catch is greater than the provincial catch average for the gear group.

**S.E.P. and Small Area-Whole Coast Configurations**

These configurations, relative to the above configurations will result in more complex management plans. This will be the case for the following reasons. First, these schemes are considerably different from the status quo. Due to the nature of the resource and existing harvest/gear regulations, it will be necessary to introduce other management tools and other harvest/gear regulations. For example, an allocation system will be necessary to address inter-area (transboundary) problems and problems related to the allocation of the resource by gear group and by area. To achieve this it will be necessary to change the harvest and gear regulations. These problems are greater under the S.E.P. and Small Area-Whole Coast configurations for the coast will be factored into a more harvest areas.

Second, related to the above there will be a greater need for different institutional arrangements. A system must be established to manage the transboundary problems. It will be necessary to establish a mechanism where the fishermen from each harvest area can communicate and work effectively with each other and with fisheries managers to draw up management plans.
Third, with an allocation system, the "gauntlet" nature of the fisheries, and the variability in catches, the information needs will be greater. An accurate predicative mechanism will be needed for pre-season and in-season management, to ensure that stocks are not over-harvested and to ensure that each gear group in each harvest area will realize their share of the catches. Thus, under these schemes, the fishery management plan will be more complex than other schemes. With the other configurations the biological information is not as critical, for the coast is not factored into small harvest areas.

The S.E.P. and Small Area-Whole Coast configurations will not be as readily accepted as the previously mentioned schemes, for the following reasons. First, a larger percent of the harvesters' fishing pattern will be adversely affected. As indicated in Chapter 4 (Section 4.1) the mobility of the fleets will be constrained as the coast is disaggregated into smaller harvest areas.

Second, these schemes are considerably different from the status quo; biological variability will be greater (see Chapter 4, Section 4.2); and other management tools or harvest regulations will be necessary. Fishermen will not readily accept these configurations for they will have greater difficulty conceptualizing the short- and long-term consequences of the management plans. Thus, relative to the other configurations the fishermen will perceive that these schemes will result in greater risk and uncertainty.
Summary

In terms of the implementation criteria, the area configurations can be ranked, in decreasing level of acceptability as follows:

1. NorthA-SouthA and Small Area-Part of the Coast;
2. NorthB-SouthB-WestB;
3. S.E.P.; and
4. Small Area-Whole Coast.

5.2.2 Flexibility

The purpose of this section is to evaluate and rank the area licence configurations, based on whether they are amenable to change when unexpected biological and/or economic events occur, and whether they foreclose management options. Before evaluating the area licence configurations a brief discussion of the factors, that highlight the need for flexibility, will be provided.

Most salmon fishermen make in-season adjustments in response to variability in abundance of salmon. That is, depending on their catch-per-unit-effort in one area relative to others, harvesters make decisions on where they will fish at a particular time during the season. Adjustment in harvest strategy was exemplified by harvesters' response to the 1983 prediction for a above average returns, for the Skeena River sockeye runs. Due to the closure of the Fraser River (i.e., Fraser River was closed for the early July fisheries) and restrictions on the Rivers-Smith Inlets sockeye fishery, many harvesters targetted on the Skeena run. When this run did not materialize, the
harvesters focused their efforts on the Central Coast chum runs and the Fraser River sockeye runs. This problem is an example of variability of catch by fleet in different areas (see Chapter 4, Section 4.2).

The runs that return to the Fraser River pose a special problem because of the annual variability in abundance and areal variability due to the diversion of stock through Johnstone Strait, e.g., the diversion of sockeye runs through Johnstone Strait ranged from 27% to 83%, during the 1978-1983 period (International Pacific Salmon Fisheries Commission, 1984).

Year-to-year variations of relative abundance of stocks in different geographic areas is another factor that should be considered. That is, in some years some areas will have high abundance, where other areas will experience low abundance, and the following years the trends could be reversed. Depending on the distribution of fishing effort, as well as the ability to predict the strength of runs (plus whether area harvesting rights are permanent or whether choices are made annually) a reduction in the harvesters' flexibility to adjust to abundance levels could pose major distributional and economic problems.

These problems are compounded by variability in species mix of catches in various harvest areas and variability in the ex-vessel value of the fish, i.e, the value of salmon harvested by each gear type and by area has varied within season, inter-regionally, and between season.

The possible effects of the five area licence configurations against this criteria will be assessed as follows. The degree to which management flexibility will be restricted, will be assessed by
addressing: the mobility of the fleet; the variability in catches; and diversity in stocks in each harvest area. To assess the potential in terms of the foreclosure of future management options, the focus will be on the degree of complexity of the management plan. A complex management system will result in a fishery that will have greater inertia, for fishermen will make investment to adjust to the structure.

NorthA-SouthA and Small Area-Part of the Coast

These area licence configurations offer the greatest flexibility, to address inseason and season-to-season management issues. A number of factors enhance the flexibility of these configurations. First, the harvest areas are large enough to provide diversity in runs. This will enable fishery managers to impose time, area and/or gear restrictions, for fishermen will have the flexibility to harvest other runs. Also, a large percent of the fleets are stationary (i.e., not mobile to relative to the status quo situation), thus fishermen will be able to make adjustment in their harvest strategies within the harvest areas under these schemes (see Chapter 4, Section 4.1).

Second, the Small Area-Part of the Coast configuration is similar to the status quo, hence maximum management flexibility will be maintained. The small harvest areas alienated from the whole coast will not pose a major management problem, for the harvester will be given the option to elect to fish in these small areas or the large harvest area. In the large harvest area the diversity in runs will be such that fishermen have alternative of runs they can fish if harvest restrictions are placed on some stocks.
Third, the problems related to the diversion of Fraser River stocks through Johnstone Strait or Juan de Fuca Strait will not pose any major problem. The fishermen can move within the SouthA harvest area to adjust to the variability in abundance in this area. Thus, fisheries managers will have the flexibility to make adjustments to manage the different stocks.

Fourth, the Department of Fisheries and Oceans will have greater flexibility in their choice of sites or stocks to enhance. This will be the case because unlike the other area configurations, where the mobility of the fleet will be restricted and the areal extent of the harvest areas smaller, fishermen will be able to access the production from enhancement projects. Thus, there will be less political pressure to pursue enhancement projects on a regional basis to accommodate the distribution of the fleet.

In terms of foreclosure of future management options, these configurations will offer greater flexibility relative to others. Under the NorthA-SouthA and Small Area-Part of the Coast configurations, the initial plan will not be institutionally and structurally complex. Thus, it will be easier to change or withdrawal the initial plans and/or change them.

First, in terms of withdrawing the initial plan, these configurations do not pose a major problems, for the harvesters will not be induced to invest capital in the industry. For example, double licensing will be minimized for the advantages of doing so are not great (see Chapter 4, Section 4.2).
Second, if the desired end is to further disaggregate the coast into smaller harvest areas, these configurations offer the greatest flexibility. The contribution of small areas to the total catches in the harvest areas, under these configurations, is small relative to the other configurations (Table 3). Thus, if the coast is to be factored into smaller harvest area there will be less opposition from fishermen under these configurations than under the others.

Third, in terms of long-term changes in area, time and gear regulations these area configurations offer the greatest flexibility. Under these configurations, fishermen have a number of options to access surplus production. Thus, this condition offers the fisheries managers greater flexibility to make changes in the harvest regulations.

**NorthB-SouthB-WestB**

This area configuration will not offer as much in-season flexibility as the NorthA-SouthA and the Small Area-Part of the Coast configurations, for the following reasons. First, other than the NorthB harvest area (it is the same as the NorthA harvest area), the harvest areas under this configuration are smaller than under the NorthA-SouthA configuration. This means that the fishermen will have less runs to harvest, which could restrict the degree to which area, time and species regulations can be changed. This will be the case for fishermen in the SouthB and WestB harvest areas have less options.

Second, under this configuration the fishermen will be unable to move between the West Coast of Vancouver Island region and the Fraser
River-Johnstone Straight region. Thus, management flexibility to deal with the diversion of Fraser River stocks through Juan de Fuca Strait and Johnstone Strait will be reduced.

Third, with the restriction in the mobility of the fleet, and the disaggregation of the coast into smaller harvest areas, management flexibility in terms of sites or stocks to enhance will be reduced. There will be greater pressure to pursue enhancement project on a regional basis to accommodate fleet distribution in lieu of the most feasible projects.

In terms of the foreclosure of future management options, this configuration offers less flexibility relative to the NorthA-SouthA and Small Area-Part of the Coast configurations, for the following reasons. First, this configuration will result in a management plan that is much more complex, e.g., the allowable catch will be allocated amongst the gear types in each area and by area. Also, more harvesters will invest in a second licence because the advantages of this strategy will be greater (see Chapter 4, Section 4.2). These structural and industry changes means that it will be more difficult to withdraw the management plan or to change the initial plan.

Second, except in the NorthB harvest area, it will be difficult to alienate small areas from the harvest areas under this configuration. The small areas will contribute more to the total catches in the harvest areas under the NorthB-SouthB-WestB, configuration than under the previously mentioned configurations. This will reduce management flexibility in the withdrawal of the initial plan or to change the plan.
Third, expect the NorthB harvest area, the harvest areas under this configuration are smaller in geographic extent, thus the diversity in stocks will be less relative to the NorthB-SouthB and Small Area-Part of the Coast configurations. Fishermen will have less options if harvest restrictions are imposed. Thus, fisheries managers may lose some flexibility in terms of making long-term regulatory changes.

S.E.P. and Small Area-Whole Coast

These area configuration offer the least flexibility in relation to in-season and season-to-season management for the following reasons. First, under these configurations the diversity in runs is small: this situation is greater under the Small Area configuration than the S.E.P. configuration. This could restrict fisheries managers in introducing harvest restrictions, for the fishermen will not have very many options in the runs they can harvest.

Second, because the coast is factored into a number of small harvest areas that are limited in geographic extent, fishermen will not have the flexibility to respond to temporal and spatial variability in abundance. This is a major problem in terms of the variability in the rate of diversion of Fraser River stocks through Johnstone Strait and Juan de Fuca Strait. Thus, management flexibility will be reduced to address problems related to stock abundance, for fishermen will strongly oppose any harvest restrictions.

Third, because the coast will be factored into small harvest areas, flexibility in terms of sites or stocks to enhance will be
reduced. There will be greater pressure placed on management to enhance stocks on a regional basis in lieu of the best opportunities. This will be the case for these configurations restrict the mobility of the fishermen. Thus, the enhancement project must be adjusted to accommodate the distribution of fleet.

In terms of the foreclosure of future management options, these configurations offer less flexibility than the others for the following reasons. First these configurations will result in a more complex management system. The harvesters will respond to such situations by investing in the industry to maximize their returns, e.g., purchase and/or lease a second vessel/licence (see Chapter 5, Section 5.4). The number of fishermen that will be involved in such behavior will be greater under these configurations than under the others, for the advantage of doing so will be greater (see Chapter 4, Section 4.2). This means that it will be more difficult to withdraw or change the initial plan.

Second, under the S.E.P. and Small Area-Whole Coast configurations the harvest areas are smaller in geographic extent, than under the other configurations. Thus, the diversity in runs will be less under these configurations. Flexibility in terms of long-term changes in time, gear and area restriction will be less. It will be difficult to make such change, for the fishermen's mobility will be restricted, hence, their flexibility to adjust to changes in the regulations will be reduced. Thus, the harvesters will pressure to prevent changes.
Third, it will be difficult to alienate small areas from the harvest area under the S.E.P. configuration. This is the case for the small areas will contribute a large percent of the total catch in the harvest areas, under this configuration. This means that management flexibility will be reduced if the small areas is the desired end, for fishermen will strongly oppose the removal of fishing areas from the harvest areas. Under the S.E.P. configuration this problem is greater for the geographic extent of the harvest areas is smaller than the other area licence configurations.

Summary

In terms of management flexibility, the area licence configurations can be ranked in decreasing order as follow:

1. NorthA-SouthA and Small Area-Part of the Coast;
2. NorthB-SouthB-WestB;
3. S.E.P.;
4. Small Area-Whole Coast.

It may be important to maintain flexibility so that the initial plan can be adjusted to unexpected biological, economic or social events or to meet future objectives.

5.3 Socio-Economic Effects

The purpose of this section is to assess the distributional and employment effects of the different area licence configurations.

The focus of the distributional effects are as follows: effect
on the harvesters' access to the resource; effect on the harvesters' access to enhancement production; effect on fishermen's eligibility for unemployment insurance benefits; and economic effects due to strikes (labour disputes). The focus of the employment effect criteria is whether the area configurations will displace fishermen.

5.3.1 **Distributional Effects**

In this section the five area licence configurations will be assessed and ranked. This section is presented as follows. First, the assessment of the effects on harvesters' access to the resource is presented. This is followed by the assessment of the harvesters' access to production from enhancement projects. The following section focuses on the effects of the configurations on fishermen's eligibility for unemployment insurance benefits. In the final section the effects of labour disputes under the different configurations are presented.

The effect the configurations will have in terms of the harvesters' access to the resource to realize catches that approximates the provincial catch average by gear group will be assessed in the following manner. First it will be assumed that the fleet will be distributed among the harvest areas, under the different configurations, such that the theoretical provincial catch average will be realized. Then, the information on fleet mobility and variability in catch will be used to determine how the area configurations will effect whether this catch level could be realized. Also, in this analysis factors such as existing harvest regulations and ability to predict stock strength will
be taken into account.

The effect on the different area licence configuration in relation to the harvesters' access to production from salmon enhancement projects will be assessed as follows. The information on the distribution of enhanced opportunities, and the mobility of the fleet will be taken into account to determine the access of the different gear group in the harvest areas under the different area configurations.

To determine the effects of the configurations on the fishermens' eligibility for unemployment benefits the following information was used. The Department of Fisheries and Oceans catch statistics was used to determine the number of weeks of fishing the different gear groups would realize in each harvest area under the different configurations.

To determine the economic effects of the configurations due to labour disputes the information generated in Chapter 4 (Section 4.4) was used. Information on the revenue losses by gear group and by area under the different configurations is provided.

The focus of the employment criteria is to assess the configurations in terms of their effect on the displacement of fishermen. The information on the number of fishermen displaced due to double licensing or leasing of second licence is used to determine this.

A. **Effect on Harvesters' Access to Resources**

The purpose of this section is to assess the different configurations and rank them in terms of their effect on fishermens access to the resources.
NorthA-SouthA and Small Area-Part of the Coast

These area configurations will have the least effect on harvesters realizing a fair access to the resource (e.g., realize catches that approximate the provincial catch average for their gear group). First, assuming that the vessels will be distributed between the harvest areas such that the different gear groups will have the opportunity to realize catches that approximate the provincial catch average, there will be no problems in attaining such catches. However, there may be a perceptual problem, for the troll fleet will be subjected to a three area system, under the NorthA-SouthA configuration: this will be due to the inside-outside A-licensing regulations, whereas the net fleet will have two harvest areas to select from. The troll fleet in the SouthA harvest area may not realize the provincial catch average due to the diversion of Fraser River stocks through Johnstone Strait and Juan de Fuca Strait. If a large percentage of these stock migrate through Johnstone Strait, the troll fleet in the outside area of the SouthA harvest area may not have access to the Fraser River stocks.

Second, under the Small Area-Part of the Coast configuration, there will be no major distributional problems. The majority of the fishermen will be in the harvest area outside of the small harvest areas. The fishermen will be able to adjust to variability in stock abundance over space and time, for they have alternatives.

Third, the gillnet and troll vessels that are capable of functionally operating as a combination vessel (i.e., capable of using two types of gear) will have greater access to the resource. The seine
vessels, the inside troll fleet and other single gear vessels, will have less access to the resource.

NorthB-SouthB-WestB

Under this configuration, the distributional effects will be greater than under the above configurations, for the following is a list of reasons. First, the seine and the troll fleets in the SouthB and the WestB harvest areas may not realize the provincial catch average. If a large percent of the Fraser River runs are diverted through Johnstone Strait, the seine, gillnet and troll fleet in the WestB harvest area will not be able to access the fish. However, if the stocks are diverted through Juan de Fuca Strait, the seine fleet in the SouthB area will not realize their provincial catch average. This will be the case, for they are not permitted to harvest the stocks near the mouth of the Fraser River. The gillnet and troll fleet in the SouthB harvest area will have access to the stock, for they are permitted to harvest the stocks near the mouth of the Fraser River.

Second, access problems could occur, for the combination vessels will have greater opportunity to harvest the stocks. This will be a problem unless a single gear regulations is introduced. This problem is greater under this configuration relative to the previous mentioned ones for the harvesters' alternatives will be reduced. To off-set this, expansion in the use of two gear will be greater.

Third, if the resource is allocated by gear and area, the harvesters may not realize the provincial average catches, due to the
different regulations for each gear group, and the limited predictive capability in determine stock strength, gear. For example, if the pre-season stock strength prediction is greater than the in-season estimation, certain gear groups will not realize their catches. If the Fraser River stocks are diverted through Juan de Fuca Strait, the gillnet and troll fleets in the SouthB harvest area will bear the cost of ensuring that escapement targets are realized: The fleet at the beginning of the "gauntlet fishery" will be permitted to harvest the stock based on the liberal estimate, but with in-season corrections in stock strength estimates the harvest levels will be reduced. The fleets at the end of the "gauntlet fishery" will be forced to conserve the resource. Thus, they will not realize their provincial catch average.

S.E.P. and Small Area-Whole Coast Configurations

The access issues identified under the previous area licence configurations will be exacerbated under the S.E.P. and Small Area-Whole Coast configurations, for the following reasons: First, under these configurations the variability in catches in each harvest area will be greater (see Chapter 4, Section 4.2) and the mobility of the fleet will be restricted (see Chapter 4, Section 4.1). The fleets in the area that display high degree of variability in catch will not be able to adjust their harvest strategy if the abundance is low, for their mobility will be restricted. Under such conditions some fleets will not realize the provincial catch average.

Second, under these configurations the access problems due to
combination vessels will be greater than under the other configurations. In the small harvest areas fishermen will have less opportunities to harvest fish using a single gear, hence to increase their access a second gear will be used.

Third, with a resource allocation system, the potential for the different fleet not realizing the provincial catch average is greater under these configurations. This is the case if the stock strength is over-estimated. Fleets that harvest the stocks at the end of the "gauntlet fishery" will bear the cost of realizing escapement targets. Also, if the pre-season estimates are conservative, the fleets near the end of the "gauntlet fishery" will realize catches greater than the provincial catch average. This problem is greater under these configurations than the others, for the coast will be factored into smaller harvest areas and their opportunity to access the stock is limited. The fleets under the other configurations have two or three points where the runs can be harvested.

Summary

In general the area licence configurations can be ranked as follows, in order of increasing distributional problems:

1. Small Area-Part of the Coast and NorthA-SouthA;
2. NorthB-SouthB-WestB;
3. S.E.P.; and
4. Small Area-Whole Coast.
B. Access to Salmon Enhancement Production

The purpose of this section is to assess the possible consequences of area licensing, in terms of the distribution of benefits (i.e., access harvesters have to the production) from salmon enhancement opportunities.

Two factors are important: 1) mobility of the fleets; and 2) the geographic distribution of enhancement opportunities. These are important, for the enhancement opportunities are not evenly distributed on the coast and to access the production the fleet needs to be mobile.

NorthA-SouthA and Small Area-Part of the Coast

These configurations pose the least distributional problems compared to the other area licence configurations, for the following reasons. First, though the production from the manageable salmon enhancement opportunities is not equally distributed among the harvest areas (refer to Chapter 4, Section 4.5), the fleets within each harvest area will have access to the production from the enhancement projects within their area. This is the case for the vessel can move from one fishery to another.

Second, it may be necessary to restrict the NorthA fleet from harvesting stocks that originate from the SouthA region. This could adversely effect the access the NorthA fleets will have to increased production from the enhancement projects based in the SouthA area. This is not a major problem, relative to the other area configurations, for it does not entail major changes in existing harvest or licensing regulations.
Third, under the Small Area-Part of the Coast area licence configuration the harvest regime is similar to the status quo. The majority of the fleet, except those who elect the small harvest areas, will have access to the production from enhancement projects, for their mobility will not be restricted.

**NorthB-SouthB-WestB**

Under this area licence configuration the distributional problems could be greater than for those discussed in the previous section, due to the following reasons. First, the production of the different species is unequally distributed among the different harvest areas. With the fleet confined to smaller harvest areas, fishermen will not be able to access production from enhancement projects as readily under the NorthA-SouthA configuration.

Second, the problem related to access of the stocks from the SouthA and WestB region by the NorthB fleet will exist under this configuration. However, changes to existing regulations will not be great if the NorthB fleet is not permitted to harvest stocks that originate from the SouthB and WestB regions. However, if the WestB fleet is restricted in harvesting enhanced stocks from the SouthB region the distributional problems will be greater. This will be the case for a large percentage of the enhancement potential is in the SouthB region.

Third, due to the different rate of diversion of Fraser River stocks through Johnstone and Juan de Fuca Straits; the different harvest regulation for each gear type; and restriction on the mobility of the
fleets, the fleets and gear group in each harvest area may not have equal access to the production from enhancement projects. This problem is similar to that discussed in the previous section, on the harvesters' access to the resource.

**S.E.P. and Small Area - Whole Coast**

Under these configurations the distribution of the benefits from the enhancement projects will be less equitable compared to the forementioned schemes, for the following reasons. First, the distribution of enhancement production (i.e., total number of pieces and species mix) is not equal for each harvest area (refer to Chapter 4, Section 4.5). With the harvesters' mobility restricted, the distribution of benefits from the enhancement projects will not be equitable. This problem will be greater if the vessels are distributed among the different harvest areas, and there is a failure to take into account enhancement opportunities.

Second, if funds for enhancement projects are allocated based on efficiency criteria distributional problems will surface. With the fishermens' mobility constrained, they will not be able to access production from enhancement projects. Relative to the other configuration these two configurations pose the greatest problem, for the coast will be factored into small harvest areas.

Third, with a greater number of areas from which stocks originate, it may be necessary to develop a complex allocation scheme. This may result in changes in existing harvest regulations, which in
turn will effect the harvesters' access to the production from non-enhancement projects.

Fourth, the distributional problem related to diversion of stock will be greater, for the fleet is restricted in its mobility. With limited capability in predicting stock strength, problems could arise in the distribution of catches.

Summary

The area licence configurations can be ranked in increasing order of disproportionate distribution of production from salmon enhancement projects.

1. NorthA-SouthA and Small Area-Part of the Coast;
2. NorthB-SouthB-WestB;
3. S.E.P.; and
4. Small Area - Whole Coast.

C. **Unemployment Insurance Eligibility**

The purpose of this section is to assess and rank the different area licence configurations in term of their effects on the harvesters' eligibility for Unemployment Insurance Benefits. Fishermen are eligible to receive Federal Unemployment Insurance benefits, if they fulfill the eligibility criteria. This depends on the nature of the individual's legal arrangement, i.e., whether or not the fishing operation is incorporated. To be eligible, the number of weeks an individual must work is as follows: 18 weeks for repeaters, i.e., individuals who claim on an annual basis, and 20 weeks for new claimants.
The length of a fishing season under the present system, depends on: (1) the timing of the opening and closure of the fisheries; and (2) the harvest strategy of the individual fishermen. The timing of the opening and closure of each fishery, is determined based on: (1) the strength or abundance of the stocks; (2) the timing of the runs; (3) the amount of fishing capacity involved in each fishery; and (4) other biological and fleet considerations.

For the troll fleet, the length of the season is determined considering the forementioned factors. However, the season is closed when the fleet has harvested its allotted quota, or when there is potential for over-harvesting the stocks.

To evaluate the effect of area licensing on the fishermen's eligibility for unemployment benefits, the following procedure was used:

1. For each gear group, in each harvest area under each area licence configuration, the value of their catch for the length of the season was computed. The 1977-1980 Fisheries and Oceans, Pacific Region catch statistic was used, and this period was selected for it reflects current fishing conditions.

2. For each group in the harvest areas, the weeks where $100,000 catches were realized was considered as a week for unemployment. This figure was selected for it is the minimum amount the fleet would have to harvest, to ensure average catch, where the individual fisherman would qualify for a "weekly work stamp."
NorthA-SouthA and NorthB-SouthB-WestB

Under these area configurations the fleets are not at great risk of losing unemployment insurance benefits. However, the net fleet in the NorthA region is at slight risk of not qualifying (Table 20).

The seine fleet is at greater risk of losing the benefits for their ability to switch gear within season, is restricted compared to the gillnet and troll fleet, due to the physical layout of the vessel, economics of inseason gear changes, and the organizational nature of the operation (i.e., seine operation employs 5-6 people and the troll operation employ a maximum of 3 people). Also, the number of harvest areas available to the seine fleet is less than the gillnet and troll fleet. Harvest regulations are such that seine fleets are permitted to fish in specific areas, but such restriction do not exist for the troll and gillnet.

S.E.P. and Small Area - Whole Coast

Under the S.E.P. configuration, the number of harvest areas where the fishermen do not fish enough weeks to be eligible for unemployment insurance benefits is greater than the NorthA-SouthA and NorthB-SouthB-WestB configurations. However, the troll fleet is at less risk than the net fleet (see Table 20). By implication the Small Area-Whole Coast configuration will provide even fewer weeks of fishing, hence increase the risk of fishermen not qualifying for unemployment insurance benefits.
Table 20 - Length of the Fishing Season in weeks  

<table>
<thead>
<tr>
<th>Harvest Area</th>
<th>Gillnet</th>
<th>Seine</th>
<th>Troll</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NorthA-SouthA Configuration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NorthA</td>
<td>16</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>SouthA</td>
<td>28</td>
<td>24</td>
<td>33</td>
</tr>
<tr>
<td><strong>NorthB-SouthB-WestB Configuration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NorthB</td>
<td>16</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>SouthB</td>
<td>27</td>
<td>21</td>
<td>28</td>
</tr>
<tr>
<td>WestB</td>
<td>23</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td><strong>S.E.P. Configuration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. Coast</td>
<td>17</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td>Central Coast</td>
<td>17</td>
<td>11</td>
<td>21</td>
</tr>
<tr>
<td>N.W. Van. Island</td>
<td>2</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>S.W. Van. Island</td>
<td>22</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Johnstone Strait</td>
<td>18</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Georgia Strait</td>
<td>4</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Fraser River</td>
<td>22</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Juan de Fuca Strait</td>
<td>15</td>
<td>14</td>
<td>-</td>
</tr>
<tr>
<td><strong>Small Areas Configurations</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rivers-Smith Inlet</td>
<td>11</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Barkley Sound</td>
<td>17</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>Nass River</td>
<td>14</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Rest of Coast</td>
<td>27</td>
<td>22</td>
<td>33</td>
</tr>
</tbody>
</table>

*The length of the season is based on the number of weeks the areas was opened for fisheries and the average annual catch for a given week was greater than or equal to $100,000 for all gear groups for a given area. These figures were computed using the Department of Fisheries and Oceans, Pacific Region, catch statistics.*
Small Area - Part of the Coast

Under the Small Area-Part of The Coast configuration, the fishermen at greatest risk of being ineligible for unemployment insurance benefits will be those that elect to fish in the small areas. For example, if Rivers and Smith Inlets, Barkley Sound and Nass River are alienated from the rest of the coast, the fishermen that elect to fish there will be at risk of not qualifying for unemployment insurance benefits (Table 20).

However, this may not be a major problem for fishermen have a choice under this configuration; to fish in an area where their mobility is restricted, or to fish in areas where their mobility is not restricted. The risks associated with qualifying for the benefits will be less. Unlike the other configurations this scheme places the least number of fishermen at risk of not being eligible for benefits.

Summary

Based on the information used in this analysis, the area licence configurations, that will result in least risk to fishermen of not qualifying for unemployment insurance benefits are: Small Area-Part of the Coast; NorthA-SouthA; and NorthB-SouthB-WestB. The area licence configurations that will have the highest risk are: S.E.P.; and Small Area-Whole Coast, particularly the latter configuration.

When interpreting these results, one must be careful because the analysis is based on the 1977-1980 data. This period was chosen because it reflects the nature of the existing management system. Also, only
the weeks where $100,000 catches were recorded for each gear group was considered a week.

There are a number of limitations to this analysis. First, in some areas the weeks could be longer or shorter, depending on the cycle year. For example, under the NorthB-SouthB-WestB, S.E.P. and Small Area-Whole Coast configurations, the net fleets seasons could be shorter if the Fraser stocks are routed through Johnstone Strait. The fleet will not be able to respond to variability in abundance due to the restriction in mobility imposed by the management plan.

Second, if the management trend is to harvest stocks when escapement can be attained, the seasons could be shorter, though the opening could be longer in duration. This has been the recent strategy adopted by the Department of Fisheries and Oceans particularly, in areas where there is a terminal fishery.

Third, if the coast is factored into small areas, and the vessels are distributed in an optimum manner (i.e., the capacity in each area is such that the gross catch for each vessel in all areas is equal or close to the provincial average), the length of the season may not be restricted so that the fishermen may not be at risk of being ineligible for unemployment benefits. In some of the areas, the season could be extended for the risk of over-harvesting stocks could be reduced.

D. Effects of Labour Disputes

Though the whole fishing industry is not unionized, strikes can effect the gross income of fishermen. The purpose of this section is to
assess and rank the area licence configurations in terms of the potential effects of two week strikes. This analysis was carried out using the quantitative information generated in Chapter 4, Section 4.4.

NorthA-South A-Small Area-Part of the Coast

The effects due to a two week strike is not as great under these area configurations as it will be under the other schemes, for the following reasons. First, the loss of gross revenue by all gear groups in the harvest areas is not as great as it is under the other configurations (refer to Chapter four, section 4.4). This is the case for strikes in the early and late season, and for periods when maximum loss could be realized.

Second, under the Small Areas-Part of the Coast area configuration, the loss of gross revenue by fleets in small harvest areas, though great, should not be a major concern, for fishermen that elect these areas do so assuming the risks associated with their decision.

Under this configuration the difference in revenue losses by each gear group in the different harvest areas, for both the early and late strikes ranged from: 1:1 for the troll; 1:2 for the gillnet; and 1:3 for the seine fleet (Table 17). If the labour disputes take place in the early season the net fleet in the NorthA area will lose more than the fleet in SouthA area. The reverse occurs if the labour disputes take place later in the season.

Also, under this configuration, the different gear groups could
be effected differently if the strikes take place during periods when each gear group, in the different harvest areas, will experiences the greatest loss in revenue (Table 16). The troll fleet will be least affected, then the gillnet, and they will be followed by the seine fleet.

NorthB-SouthB-WestB

Under this area configuration the effect of strikes will be greater than under the aforementioned configurations, but not as great as under the S.E.P. and Small Area-Whole Coast schemes.

First, the loss of revenue is greater for each gear group and in some cases the percentage loss in revenue is greater relative to the loss under the NorthA-SouthA configuration (refer to Chapter 4, Section 4.5). However, relative to the other area licence configurations the losses are not as great. Also the difference in revenue losses are not as great.

Second, under this configuration the difference in revenue losses, by each gear group in the different harvest areas, for both early and late strikes, ranged from: 1:1 for the troll fleet; 1:2 for the seine fleet; and 1:6 for the gillnet fleet. If an early strike takes place, the NorthB fleet will be effected more than the WestB fleet. Also, the least affected group will be the troll fleet, followed by the gillnet fleet and then the seine fleet. If a late strike takes place the SouthB fleet will be affected the greatest, but the difference in revenue loss by the fleets in the different harvest areas will not be
substantial, the differences ranged from: 1:1.43 for gillnet; 1:2 for seine; and 1:1 for troll (Table 17).

If the strikes take places during the period when the gear groups would experience the greatest loss in revenue, the troll fleets will be least affected (e.g., maximum loss of 22% of gross revenue), followed by the gillnet fleet (e.g., maximum loss of 30% of gross revenue) and then the seine fleet (e.g., maximum loss of 37% of gross revenue).

S.E.P. and Small Area - Whole Coast

Strikes will have the greatest effect on the gross revenue of the fleets under these area licence configurations, for the following reasons. First, the loss of revenue for all gear types, in the different harvest areas is greater than the aforementioned configurations (refer to Chapter 4, Section 4.4).

Under the S.E.P. configuration, the loss in revenue due to an early strike showed the following ranges: 2% to 38% for the troll fleets; 2% to 36% for the gillnet fleets and 1% to 41% for the seine fleet (Table 17). Similar trends existed if a late strike took place during this period (Table 17).

The timing of the labour disputes effects the fleet differently. If the strikes takes place early in the season, the fleets in the harvest areas that have earlier runs (e.g., North Coast and Central Coast) will be most adversely effected. If the strikes take place later in the season, the fleet in the harvest areas with latter run (e.g., Johnstone Strait, Georgia Strait, Fraser River and Juan de Fuca Strait) will be affected the most.
Second, the percentage loss in the gross revenue is the greatest under these configurations than under the above schemes (Table 17). This is the case for an early or late strike and if a two week strike takes place when the potential for maximum loss will be realized.

If strikes take place when the gear groups in the different harvest areas will experience the greatest losses, this configuration will result in losses greater than under the other configurations. For example, under the S.E.P. configuration the loss in revenue ranged from 15% to 37% for the troll fleet; 15% to 40% for the gilnet and 32% to 82% for the seine. These losses are greater than under the other configurations except the Small Area-Whole Coast configuration (refer to Chapter 4, Section 4.4).

Third, similar trends should exist for the Small Area-Whole Coast configuration. Though this analysis was not conducted for this configuration the analysis for the small harvest areas under Small Area-part of the Coast indicate such trends would exist. This will be the case for the small areas under this configuration are areas within the harvest areas under the S.E.P. configuration. Thus, factors that affect these harvest areas under the S.E.P. configuration will affect the harvest areas under the Small Area-Whole Coast configurations.

**Summary**

Based on the effect that a two week strike will have on the gross revenue of fleets, under the different area licence configurations, the schemes can be ranked in order of increasing effects:
1. Small Area-Part of the Coast and NorthA-SouthA;
2. NorthB-SouthB-WestB;
3. S.E.P.; and
4. Small Area-Whole Coast.

5.3.2 Effect on Employment

The purpose of this section is to assess and rank the different area licence configurations in terms of the possible effects they will have on the displacement of fishermen. Area licensing could result in the reduction of the number of fishermen employed in the industry. With area licensing the catches by the fleets will be more variable within each harvest area (refer to Chapter 4, Section 4.3). To minimize the variability in their catch, fishermen could pool their catches (i.e., work with other fishermen licensed for different harvest areas) or purchase or lease a second licence/vessel. The latter approach would reduce the variability in catch and could result in an increase in catches (refer to Chapter 4, Section 4.2). These strategies will result in fishermen being displaced from the industry.

This analysis was based on the 1980 fleet mobility data. To determine the number of fishermen that would be displaced from the fishery the following assumptions were made: one gillnet vessel equals one person; one troll vessel equals two people; and one seine vessel equals six people. Also, 50% of the mobile vessels will buy or lease a second vessel, and the owners of the stationary vessels (i.e., any vessel that harvest 80% to 100% of their catch from a single area) will not purchase or lease a second licence.
Based on the advantages of acquiring a second licence and the above assumption, the different configuration can be assessed and compared in terms of this criteria as follows.

NorthA-SouthA and Small Area-Part of the Coast

Under these area licence configurations the number of fishermen that will be displaced will be less than under the other configurations. There are two major factors to consider: First, the variability in catch (see Chapter 4, Section 4.2) and advantages of holding a second licence/vessel (see Chapter 4, Section 4.3) will be least under this configuration. Thus, there will be fewer fishermen effected under the NorthA-SouthA configuration (Table 21). For example, 332 people in the gillnet and 816 in the seine fleet will be displaced under the NorthA-SouthA configuration, and 637 people in the gillnet and 1,174 people in the seine fleet under the S.E.P. configuration.

Second, under the Small Area-Part of the Coast configuration, the number of vessels that elect the small harvest area will be small, hence the number of fishermen that will purchase or lease a second licence/vessel will be less than the other area licence configurations.

NorthB-SouthB-WestB

Under this area licence configuration the number of fishermen that will be displaced could be greater than the above area licence configurations, but less than the S.E.P. and Small Area - Whole Coast schemes.
Table 21 - Number of Fishermen that could be Displaced Under Different Area Configurations.

<table>
<thead>
<tr>
<th></th>
<th>Gillnet</th>
<th>Seine</th>
<th>Troll</th>
</tr>
</thead>
<tbody>
<tr>
<td>NorthA</td>
<td>240</td>
<td>432</td>
<td></td>
</tr>
<tr>
<td>SouthA</td>
<td>92</td>
<td>384</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>332</td>
<td>816</td>
<td></td>
</tr>
<tr>
<td>NorthB</td>
<td>227</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td>SouthB</td>
<td>117</td>
<td>441</td>
<td></td>
</tr>
<tr>
<td>WestB</td>
<td>77</td>
<td>126</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>421</td>
<td>927</td>
<td></td>
</tr>
<tr>
<td>North Coast</td>
<td>200</td>
<td>186</td>
<td></td>
</tr>
<tr>
<td>Central Coast</td>
<td>186</td>
<td>435</td>
<td></td>
</tr>
<tr>
<td>N.W. Van. Island</td>
<td>13</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>S.W. Van. Island</td>
<td>105</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Johnstone Strait</td>
<td>35</td>
<td>456</td>
<td></td>
</tr>
<tr>
<td>Georgia Strait</td>
<td>12</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Fraser River</td>
<td>68</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Juan de Fuca Strait</td>
<td>18</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>637</td>
<td>1,174</td>
<td></td>
</tr>
</tbody>
</table>

*Note: This analysis is based on the 1980 fleet mobility data. In calculating the figures the assumptions were; one gillnet vessel equals one person; one troll vessel equal two people; one seine vessel equals six people. 50% of the mobile vessel owners will buy or lease a second licence; and the owners of the stationary vessels will not purchase or lease a second licence (a stationary vessel is any that harvests 80% - 100% of its' catch in a single area).
The variability in catch under this configuration is greater than NorthA-SouthA and Small Area-Part of the Coast configurations, but less than the other configurations (see Chapter 4, Section 4.2). Also, the advantage of holding a second licence/vessel is greater under this area configuration than the NorthA-SouthA and Small Area-Part of the Coast configurations, but less than the S.E.P. and Small Area-Whole Coast schemes (see Chapter 4, Section 4.3). Thus, the number of fishermen that will be displaced will be greater under this configuration than the NorthA-SouthA and Small Area-Part of the Coast configuration but, less than the other configurations (see Table 21).

S.E.P. and Small Area-Whole Coast

Under this area licence configurations, the number of fishermen that could be displaced will be greater than under the other area licence schemes. The variability in catch (refer to Chapter 4, Section 4.2) and the advantage of acquiring a second licence/vessel (refer to Chapter 4, Section 4.3) will be greater than the other configurations. Hence, the number of fishermen that will be displaced will be the greater under these configurations (Table 21).

Summary

Due to the trends in catch variability and the potential gains in catches by leasing or purchasing a second licence, the area licence configurations can be ranked in the following increasing order in terms of the displacement of fishermen:
1. Small Area - Part of the Coast and NorthA-SouthA;
2. NorthB-SouthB-WestB;
3. S.E.P.; and
4. Small Area - Whole Coast

5.4 Biological Effectiveness

The purpose of this section is to evaluate and rank the five area licence configurations in terms of the following criteria: (1) will they result in sufficient escapement; (2) will the plans minimize the harvesting of multiple stocks; (3) will the plan facilitate the enhancement of stocks at low productive levels; and (4) will the plans reduce the fleet concentration?

To assess the configurations against the forementioned criteria, the quantitative information on the variability of the stocks will be used along with qualitative assessments. For example, with the "gauntlet fishery" under a resource allocation system, the risk of over-harvesting is greater if the pre-season stock estimates are greater than the actual strength of the returns. In the case of the Johnstone and Juan de Fuca Straits fisheries, the risk of over-fishing of the major stock and lesser stock is greater, and multiple stock fisheries will not be reduced.

In terms of fleet concentration, the area configurations will be qualitatively assessed, considering the size and number of harvest areas under each area configuration.
NorthA-SouthA and Small Area-Part of the Coast

These configurations offer the greatest opportunity in terms of realizing the biological goals, for the following reasons. First, in terms of attaining sufficient escapement, area, time, gear, and species regulations can be applied. Under these configurations these regulations will meet less political resistance than the others. This is the case for the fishermen will have greater harvest opportunities under these configurations than they would under the other schemes. Thus, they will have more flexibility to adjust their harvest strategies.

Second, in terms of minimizing multiple stock harvests, these configurations offer the greatest flexibility. Due to the large geographic extent of the harvest areas—the diversity in stocks will be greater, and area to harvest the stocks will be greater—harvest restrictions can be imposed with a minimum impact of the harvesters' access to the resource. Thus, under these configurations there will be less political pressure against such changes, than under the other configurations.

Third, under these configurations, low productive stocks can be protected by applying different harvest regulations. There will be less political pressure against such changes for the geographic extent of the harvest areas, hence the diversity in stocks, will be greater under these configurations than under the other configurations. This means that the fishermen will have other options to realize their catches.
Fourth, problems related to fleet concentration, though less than under the status quo situation, will be greater than under the other configurations. Under the NorthA-SouthA configuration the effect of fleet concentration will be reduced for the fishing fleet will be distributed among the two large harvest areas. The Small Area-Part of the Coast configuration will not offer any major advantage for this configuration is similar to the status quo: fleet concentration will be reduced in the small harvest areas.

NorthB-SouthB-WestB

In terms of the biological effectiveness criteria, this area licence configuration will have the following effects. First, some problems could be encountered in realizing escapement targets. Under this scheme it may be necessary to introduce a system to allocate the resource by area and by gear group. If the pre-season stock estimates are greater than the actual return, fishermen may apply political pressure to ensure they attain their allotment. This problem will be greater in the harvest areas that target on the Fraser River stocks: with the varying rate of diversion of these stock through Johnstone and Juan de Fuca Straits, the opportunity to access the resource will vary.

Second, in terms of reducing fishing effort on multiple stocks, this area configuration offers less flexibility than the previous configurations. This is the case for the harvest areas under this configuration are smaller, in particular the NorthB and the SouthB areas, hence the fishermen's options to harvest the resources will be
reduced for the stock diversity will be less. Thus, if regulatory changes are to be introduced, to minimize multiple stock fisheries, there will be greater political pressure against such changes under this configuration.

**S.E.P. and Small Area-Whole Coast Configurations**

Under these configurations the problems in terms of realizing escapement goals, minimizing mixed stock harvests and enhancing low productive stocks will be exacerbated, but there will be a reduction in the effects of fleet concentration, for the following reasons. First, with the reduction in the geographic extent of the harvest areas (in particular the Small Area-Whole Coast configuration) fishermen will have less harvest opportunities. To realize these biological goals, harvest restrictions will be necessary, but such regulatory changes will be politically opposed, for the fishermen will not have the flexibility to adjust to such changes.

Second, these problems will be exacerbated if a resource allocation scheme is adopted in the industry. If the pre-season stock strength estimate is greater than what is estimated based on in-season harvest levels, stocks could be over-harvested. The fleets at the beginning of the "gauntlet fisheries" will realize their allotment, but fleet at the end of such fisheries will have to bear the cost of attaining the biological goals, unless stocks are to be over-harvested. Under such circumstances there will be political pressure to extend fishing time at the risk of over-harvesting to ensure the fleets catch
their fair share of the resource.

This is a major problem under these area configurations for the mobility of the fleet will be severely restricted, for the coast will be factored into a number of small harvest areas. Also, the ability of fisheries managers to predict stock strength is not accurate.

Third, under these configurations, the problem related to fleet concentration will be reduced. This is the case for the fishing fleet will be distributed among a number of harvest areas. This could pose some biological problems, for if an areas is over-subscribed (i.e., more vessels than what the catches can economically support) fishermen may apply political pressure to have a fishery at the risk of over-harvesting the stocks. The pressure will be greater under these configurations, for the fishermen will not have the flexibility to adjust their harvest strategy to accommodate periods of low abundance.

With the reduction in fleet concentration, there is the potential for a "husbandry ethic" to be established. Under such conditions it could be in the best interest of fishermen to protect the resources within their harvest area, to ensure a sustainable revenue. This type of behavior would only be possible in the harvest areas where the fleet has sole acces to the resource. Under such situations the biological goals could be effectively realized.

Summary

In terms of attaining biological goals the different area licence configuration will have varying effects. The area licence
configurations can be ranked in decreasing order of realizing the biological goals as follows:

1. Small Area-Part of the Coast and NorthA-SouthA;
2. NorthB-SouthB-WestB;
3. S.E.P.; and
4. Small Area-Whole Coast.

In general, as the coast is factored into smaller harvest areas, the greater the problems in attaining the biological goals. However, under the configurations with smaller harvest areas fleet concentration will be reduced. Area licensing could pose problems in realizing the biological goals, unless a "husbandry ethic" is established.

5.5 Economic Efficiency (Vessel Fleet Efficiency)

The focus of the following section will be the efficiency of the harvest sector, as it relates to area licensing. The efficiency aspects that will be assessed are the effects of area licensing on the fixed and variable costs of the fleet.

The analysis will be conducted in the following manner. The different area configurations will be qualitatively assessed in terms of their effect in reducing capital investment. Equipment and fuel costs, in terms of economic effects of vessel cannibalization (i.e., purchase or lease of a second licence to allow for double licensing) the quantitative information on advantage of such investment will be used (see Chapter 4, Section 4.3).
NorthA-SouthA and Small Area-Part of the Coast Configurations

The economic efficiency gains under these configurations will not be as great as the gains under the other configurations that factor the coast into smaller harvest areas, for the following reasons. First, efficiency gains could be attained by the cannibalization of vessels through the purchase or lease of a second licence/vessel. This will be the case if the cost of purchasing or leasing is less than the revenue generated during the capitalization period. The efficiency gain through such investments will not be as great under these configurations, as it will be under other configurations, for the advantages of double licensing are not as great (see Chapter 4, Section 4.3).

Second, it may not be necessary for fishermen to invest in gear and equipment to engage in a number of fisheries. The NorthA seine fleet need not invest in power skiffs to engage in the Juan de Fuca fishery, and the SouthA fleet need not invest in equipment for the fishery in the NorthA region. The gillnet fleet, which requires specialized gear (in particular the physical dimension of the meshes and twine), will not need to purchase gear for a number of fisheries. Since the fleet mobility will be restricted, the NorthA and SouthA fleet would purchase gear specific for the fishery in their harvest area. For example, the NorthA fleet will not invest in nets for the Juan de Fuca, Barkley Sound, Fraser River and Johnstone Strait fisheries.

Third, there will be a reduction in the variable costs of fishing, in particular fuel, for inter-area mobility will be restricted. However, the fleets that have had strategies that focused
their fishing effort within the NorthA or SouthA harvest areas may not realize any reduction in the fuel costs.

Fourth, under the Small Area-Part of the Coast area licence configuration there could be a reduction in the size of vessels. This would take place in the harvest areas where the local conditions do not warrant a vessel for heavy seas. This will result in the reduction in the fixed cost of harvesting fish. However, the number of vessels involved under this configuration will be less than the other configurations.

**NorthB-SouthB-WestB**

Under this area licence configuration the potential for the reduction in harvest costs, hence the increased efficiency of the fleet, will be greater than the previous configurations, for the following reasons. First, the number of vessels/licences that could be cannibalized will be greater under this configuration than under the Small Area-Part of the Coast and the NorthA-SouthA configurations (refer to Chapter 4, Section 4.3). This will mean that the fixed and variable costs will be less under this configuration than the above schemes. This assumes that the fixed and variable costs of the new operation does not exceed the costs under the old operation, during the amortization period.

Second, with the reduction in the geographic extent of the harvest areas, fishermen will not need a diverse inventory of fishing gear. Thus, there will be a reduction in harvesting cost under this
configuration, compared to the NorthA-SouthA and Small Area-Part of the Coast configurations.

For example, gillnet fishermen licensed for the WestB harvest area will not need nets for the Fraser River, Johnstone Strait, and Rivers-Smith Inlet fisheries. And fishermen licensed for the SouthB harvest area will not need net for the fisheries in the WestB harvest area.

Third, the harvest areas under this configuration will be smaller in geographic extent relative to the above configurations, hence there will be less movement within these harvest area. Thus, the fuel cost will be less under this configuration relative to the NorthA-SouthA and the Small Area-Part of the Coast configurations.

Fourth, if the older vessels are replaced, capitalization costs could be less. Under this configuration, relative to the above mentioned configurations, the harvest areas are smaller in geographic extent. In some harvest areas the vessel will be designed for local harvest conditions in lieu of building vessels to meet the tonnage limit of the licence. This means that the fixed and variable cost of harvesting will be less.

S.E.P. and Small Area - Whole Coast

Under this area licence configuration the reduction in the fixed and variable cost could be greater, than under the forementioned area licence configurations, for the following reasons. First, vessel/licence cannibalization could be greater than under the above
mentioned area configurations (refer to Chapter 4, Section 4.2), which
in turn means that the fixed costs of harvesting fish will be reduced
upon completion of the amortization period.

Second, the regulatory, biological and aquatic conditions will be
less diverse in each harvest area, for the areal extent of the areas
will be substantially reduced. This would mean that there will be a
reduction in the investment in fishing gear because there would be less
need for diversity in fishing equipment. This will be greater under
this configuration for the harvest areas will be smaller than under the
other configurations. Thus, the efficiency gains will be greater under
these configurations.

Third, with reduction in the areal extent of the harvest areas,
mobility will be constrained, hence the amount of inter-area movement
will be reduced. Also, the intra-area movement will be reduced for
there will be less fisheries in each area. This will result in a
reduction in the variable costs (i.e., fuel and other cost related to
the number of hours logged on the vessels).

Fourth, under these area licence configurations the fleets in
some areas will not be exposed to harsh oceanic conditions. Thus,
fishermen may down size their vessels to suit the needs for the areas
they may select. This investment strategy will take place if the
harvesters recapitalizes, and the benefits of such activity will only be
realized if the fixed and variable cost of the new vessel is less than
the fixed and variable cost of the previous one.
Summary

Economic efficiency of the harvest sector can be affected by area licensing in a number of ways. Based on the above discussion of the effects on fleet efficiency, the area licence configurations can be ranked in the following order of least to greatest increase in efficiency:

1. NorthA-SouthA and Small Areas-Part of the Coast;
2. NorthB-SouthB-WestB;
3. S.E.P.; and
4. Small Area-Whole Coast.
CHAPTER 6: SUMMARY STATEMENT AND CONCLUDING REMARKS

6.1 Summary Statement

In this study five area licence configurations were assessed, using quantitative and qualitative approaches. The area configurations assessed, ranged from where the coast was factored into large harvest areas to small (statistical area) harvest areas: NorthA-SouthA, NorthB-SouthB-WestB, S.E.P., Small Areas-Whole Coast and Small Areas-Part of the Coast.

The evaluative criteria used to assess the different area licence configurations included four broad subject areas: (1) Management Operations; (2) Socio-Economic Effects; (3) Biological Effectiveness; and (4) Economic Efficiency. Each subject area was factored into related sub-criteria. It was based on the review of the fisheries management literature, and the key issues identified in the B.C. salmon fishery.

Table 22 summarizes the effects of the area licence configurations according to the evaluative criteria. The effects, in brief are as follows.

Management Operation was broken down into two criteria: Implementation (social acceptability and complexity of the management plan); and Flexibility of the management plan. The potential distributional effects and uncertainties that fishermen may be subjected to will increase as the coast is disaggregated into smaller harvest
Table 22 - Summary of Relative Effects Under Different Areas Licence Configurations.

<table>
<thead>
<tr>
<th>Area Configurations</th>
<th>Small Area-Part of Coast</th>
<th>NorthA-SouthA</th>
<th>NorthB-SouthB-WestB</th>
<th>S.E.P.</th>
<th>Small Area-Whole Coast</th>
</tr>
</thead>
</table>

A. Management Operation

1. Effect on Implementation (Complexity and Acceptability)
   Low
2. Effect on Management Flexibility
   Low

B. Socio-Economic Effects

1. Distributional Effects
   a. Effect on Harvesters' Access to the Resource
      Low
   b. Effect on Harvesters' Access to Enhancement Production
      Low
   c. Effect on Unemployment Insurance Eligibility
      Low
   d. Effect of Strikes
      Low
2. Effect on Employment
   a. Increase in Unemployment
      Low

C. Biological Effectiveness

1. Manageability of Harvest Capacity (Fleet Concentration)
   Low
2. Attain Biological Goals
   High

D. Economic Efficiency

1. Attain Vessel/Fleet Efficiency Gains
   Low

1In reading this table, the effects are a subject comparison of the different area configuration in terms of the different criterion. Hence, they are relative weight within each criterion. For example, in terms of management flexibility, it is high under the Small Area-Part of the Coast and NorthA-SouthA configuration, relative to the other configurations; moderate for NorthB-SouthB-WestB relative to the other configurations; and for the S.E.P. and Small Area-Whole Coast configuration relative to other configurations.
areas. Hence, as the management plan becomes more different from the status quo, the plan will be less acceptable to the user groups. Also, the area licensing management plan will be more complex, as the coast is factored into smaller harvest areas, for other regulations and policy tools may be necessary.

As the coast is disaggregated into smaller harvest areas the harvesters' ability to respond to spatial and temporal variability in abundance will be reduced, hence reducing their operational flexibility. Thus, in-season management flexibility will be reduced. From a management perspective, options may be foreclosed making it difficult to refine or change the initial management plan in the future, thus reducing management flexibility.

The Socio-Economic Effects subject area was broken down into two broad areas: Distributional Effects; and Employment Effects.

The Distributional Effects were factored into the following sub-criteria: harvesters' access to the resource: the harvesters' access to enhancement production; effect on eligibility for unemployment insurance; and economic effects of strikes.

The constraints on the harvesters' access to the resource will be greater as the coast is disaggregated into smaller harvest areas, for the following reasons: The reduction in mobility of the fleets; spatial and temporal variability in stock abundance; and harvest regulations. Due to the uneven distribution of the enhancement opportunities and the restriction in the harvesters' flexibility to adjust to the abundance of fish, area licensing will lead to unequal distribution of salmon
production from enhancement projects. The access to the production from enhancement projects will be increasingly restricted as the coast is factored into smaller harvest areas.

The fishermen's eligibility for unemployment benefits will be eroded if area licensing is introduced. The effects will be greater under the area licence configurations with the small harvest areas.

Fishermens' gross incomes will be affected by strikes. The loss in income for specific fleets will be greater under the area licence configurations that factor the coast into smaller harvest areas.

The Employment Effects - focused on the effects area licensing may have on the employment levels in the harvest sector. The number of fishermen that will be displaced will be greater under the area licence configurations with smaller harvest areas. This will be the case assuming: double licensing takes place; and vessels would be cannibalized for their licences.

The Biological Effectiveness was be factored into two criteria: manageability of harvest capacity; and attainment of biological goals. As the coast is disaggregated into smaller harvest areas, the amount of harvest capacity in an area will be set. The potential for fleet concentration will be reduced, thus reducing the risk of overfishing. This is the case assuming strength of runs are accurately predicted, the allocative issues are resolved; and an area is not over-subscribed.

Biological objectives (e.g., maintain existing runs, minimize multiple stock fishery, and enhance weaker stocks), will be more
effectively realized under the area licence configurations with smaller harvest areas, but only where other fishing management goals can be met. This is the case if mixed stock fisheries issues are resolved; allocation problems minimized; and stocks strengths accurately predicted. However, if these issues cannot be resolved or reduced, area licensing will pose problems in attaining biological goals. These problems will be greater under the area licence configurations with small harvest areas than large harvest areas.

The focus of Economic Efficiency criterion was vessel and fleet efficiency. Vessel and fleet efficiency will be enhanced under area licensing. The fixed and variable costs of harvesting fish will be reduced with area licensing. The reduction in costs under the area configurations that factor the coast into smaller harvest areas will be greater than the configurations with large harvest areas.

6.2 Planning Recommendations

Given the biological, socio-political, economic, management and physical aspects of the fishery, and the multiple-objective nature of fisheries management, it is difficult to identify the appropriate area licence configuration for the B.C. salmon fishery. Regardless of which area licence configuration is viewed as optimal, trade-offs will be necessary.

Under the area licence configurations with large harvest areas, e.g., NorthA-SouthA, Small Areas-Part of the Coast and NorthB-SouthB-WestB, the problems associated with management operations,
distributional effects and biological effectiveness criteria will be minimized. However, in terms of achieving the economic efficiency goals and biological objectives (in particular managability of fishing effort) these configurations are not optimal.

The area licence configurations with small harvest areas, e.g., S.E.P. and Small Areas-Whole Coast, the problems and issues associated with management operations, socio-economic effects and biological effectiveness criteria, will be greater. In terms of biological effectiveness, the problems is related to stock strength prediction and the allocation of surplus biological production to the different fleets will be greater. In terms of achieving economic efficiency and some biological effectiveness (i.e., manageability of fishing effort), these area licence configurations could be viewed as being optimal.

Given the complex nature of the B.C. salmon fishery; the uncertainties due to the status of knowledge of the biological resource; the dynamic nature of the fishery and its environment (e.g., market, fishermen investment behavior and others); and the need to take into account short-term and long-term consequences of the plan, an incremental planning approach should be adopted. Also, the changes should be complimentary to the existing management system. This means that the management plan should not result in complex and comprehensive changes, for such a plan often results in the failure to attain the desired objectives.

The S.E.P. and Small Area-Whole Coast area licence configurations would be least desirable in terms of the above management approach.
They will require major changes in existing regulations and management system, as well, it will be necessary to introduce new regulation(s) and other policy tools.

The NorthA-SouthA and Small Area-Part of the Coast configurations would be the most desirable configurations in terms of the incremental approach to resource management. They are similar to the status quo, in that new regulations or policy tools are not required. Also, under these configurations management flexibility will be maintained. It will be easier to factor the coast into smaller harvest areas or to adopt other policy tools under these area configuration than under the S.E.P., NorthB-SouthB-WestB and Small Area-Whole Coast schemes.

The NorthA-SouthA and Small Area-Part of the Coast configurations will minimize most negative consequences of area licensing. Also, they will result in low gains in increased the economic efficiency of the fleet and enhancing the manageability of the fleet. These schemes offer the greatest flexibility such that the initial plan can be refined or changed to adjust to new information or to changes in the fishery. In the future, it may be possible to factor the coast into smaller harvest areas, and thus, realize the economic efficiency and biological goals. Also, these configurations would enable the fishermen and fisheries managers to gradually experience and understand the ramifications of area licensing. Thus, after its initial introduction, industry adjustments could be made which could lead to adaptations which may make it easier to introduce changes in the future.
6.3 Concluding Remarks

The area licence configurations appropriate for the B.C. salmon fishery are the NorthA-SouthA or Small Area-Part of the Coast schemes. This is based on the study criteria used to evaluate five configurations (e.g., NorthA-SouthA, Small Area-Part of the Coast, NorthB-SouthB-WestB, S.E.P., and Small Area-Whole Coast), and the problem environment. The criteria included: management operations (social acceptability and flexibility); socio-economic effects (distributional effects and effect on employment); biological effectiveness (manageability of catch capacity and attaining biological goals); and economic efficiency (vessel and fleet efficiency).

When interpreting these conclusions, the following points should be considered. First, all the possible area licence configurations were not evaluated. Only those that represented, as close as possible, the range of options suggested by fishermen and fisheries managers were considered. Second, all the criteria listed in the literature was not applied in the evaluation—the criteria that were viewed as salient to the fishermen's interests, as well as the fisheries managers were applied in the assessment. Third, the assessment was conducted assuming that other policy tool(s) would not be introduced. This is important for if they are considered, the results of the study could differ. This would be the case for the effects of each configuration for each criterion could differ and the policy tool(s) could have some effect in terms of the criteria. Fourth, depending on the readers' value set, perspective(s), and/or motives, the results of this study could diverge from their findings.
In light of the above it would be appropriate to conduct one or more of the following: First, to evaluate area licensing taking into account one or more of the fore-mentioned points.

Second, generate quantitative information where it is not provided in this study. For example, generate figures for the economic efficiency gains that will be realized under the different configurations.

Third, if an area licence configuration is introduced, the management plan should be such that monitoring is introduced. This could be conducted by introducing area licensing as an experiment and/or by adopting an incremental strategy (e.g., management plan that differs slightly from the status quo). This is important for both managers and the industry, for information on the consequences of area licensing can be generated and assessed, and the initial management plan changed to take into account the findings.


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