ELECTORAL REDISTRIBUTION: THE CASE OF THE PRELIMINARY REPORT OF THE FISHER COMMISSION FOR BRITISH COLUMBIA, CANADA

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ABSTRACT

Different sets of electoral district boundaries can be selected to delineate a state, province, or country. Election results would likely differ depending upon which set of constituency boundaries were used. Some sets of ridings may result in one party being favoured at the expense of the other(s), or the electorate of certain regions being allowed relatively more representation in the legislature. Although these consequences can be identified following an election, it would be too late to remedy such representational disparaties. The purpose of this study is to develop a framework that could be employed to either assess the fairness of a particular redistribution before it is implemented, or aid in the process of electoral boundary readjustment.

Many authors have suggested different measures that can be used in determining the degree of fairness in an electoral system. These criteria include equalizing riding populations within a prescribed tolerance range, respecting natural barriers, communities of common interest and transportation and communication routes, and measuring urban and suburban ridings for compactness. In order to evaluate these measures, they are applied to a case study, the Preliminary Report of the Fisher Commission for British Columbia.

The criteria are found to be effective at identifying possible readjustment maladies. They are able to reveal several shortcomings contained in the Prelimi-

nary Report. During the evaluation process, it became apparent that the definition of a parameter and the index value denoting compactness for one of the compactness measures are possibly too rigid. They are relaxed and this compactness index was recalculated for each of the affected ridings. As a result, several constituencies are found to be compact. Due to the successful application of this set of criteria to the case study, it is felt that this method is well suited for analyzing a proposed system of electoral districts. Since this method allows for consistency in both measuring and evaluating various electoral district parameters, it is also felt that it could assist any redistribution authority in completing its mandate.

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CONTENTS

TABLES

FIGURES

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Fucking
Asshole.

So says me,
ex-Wife #3!

DEDICATION

This thesis is dedicated to William M. Ross, Ph.D. and in memory of Professor William Warntz, Ph.D., F.R.S.C.

> No man can reveal to you aught but that which already lies half asleep in the dawning of your knowledge.
>
> The teacher who walks in the shadow of the temple, among his followers, gives not of his wisdom but rather of his faith and his lovingness.
>
> If he is indeed wise he does not bid you enter the house of his wisdom, but rather leads you to the threshold of your own mind.
>
> Kahlil Gibran, 1985 ed., The Prophet, p.56.

Chapter 1

INTRODUCTION

1.1 Nature of the Problem

Elections translate voter support into political power. The political outcome of an election, however, depends upon more than just the number of votes that a candidate or a party receives. It also depends upon the relative location of voters to candidates. This is particularly true in plurality type elections. Canada, as well as most other English-speaking nations, employs this system of representation (Gudgin and Taylor, 1979). A plurality election results in members being admitted to the legislature when they win a seat in a particular riding, constituency, or electoral district. A candidate's success depends upon many factors including party or leader popularity, personal opinions regarding relevant issues, and the riding of candidacy. The candidate that receives the most votes in a riding becomes the legislative member for that constituency. However, in an election conducted using a plurality electoral system there could be distinctly different political results, depending upon which set of riding boundaries are in place at the time of the election.

In a British type parliamentary system, the political party that wins the most seats in the legislature forms the government. It is expected that the party which wins the most seats is the party that has received the most votes in total. While this is usually the case, there are certain peculiarities of the plurality electoral

system that can allow a party to form the government even though it received a lower percentage of the popular vote than did the "opposition" parties. It is also possible for a party to achieve a strong majority in the legislature when its victory, in terms of the percentage of popular vote received, is marginal. The latter result occurs much more frequently than the former, although both results are possible (Prescott,1972; Muir, 1975; Taylor and Johnston, 1979; Gudgin and Taylor, 1979; Morrill, 1981).

These peculiarities are possible because there is not a one-to-one relationship between the percentage of the popular vote received and the percentage of seats in the legislature won in a plurality election. A candidate is elected if he/she receives the most votes cast in the riding. In ridings where there are more than two candidates, the successful politician need not obtain a majority of the votes (more than 50 percent), he/she merely has to receive more votes than any other candidate. In turn, a party can form the government without winning a single seat by a landslide. In fact, a marginal victory at the polls, in terms of the percentage of popular vote received, can translate into a major victory in the legislature if the government won a large majority of the ridings. The size of the government is not dependent on the margin of victory in any or all ridings. It is also possible for a party to obtain a majority of the seats in the legislature while receiving a minority share of the votes cast. In order for the latter scenario to take place in a two party election, a party's support must be concentrated in less than half the ridings. Even if it received more than 50 percent of the popular vote, with this concentrated distribution of support it could not win 50 percent of the seats in the legislature. In a plurality electoral system it is not just the percentage of popular

vote received that is important to a particular party's success, but, it is the location of the votes received that can determine the party's ulitimate success in the legislature. Consequently, the system of ridings used in a plurality election can play an important role in determining which party forms the government.

In a plurality electoral system each and every voter is assigned to a polling station of an electoral district for the purpose of voting and candidates seeking election do so in a particular riding. The location of voter residence binds the voter to the riding and the riding boundaries spatially define voters and link together voters and legislative members. As a result, each voter can readily identify his/her representative. In Commonwealth countries, the candidate does not have to live in the riding that they are contesting (Butler and Cain, 1985). Candidates are free to select their riding of candidacy.

Some ridings are traditional party strongholds, whereas others are not loyal to any one party over a series of elections. Constituencies that have proved to be party strongholds are popular choices for candidates for the simple reason that the chances of success appear greater than in ridings which have either a history of marginal or opposition party support. Often it is the choice of riding that is most important to a candidate's success. Ridings that typically elect one party over the other(s) can be labelled as being safe ridings for that party. Since election results are recorded on a poll-by-poll basis for each election, it is easy to identify the ridings, or section of ridings, that are usually safe for a particular party.

It follows that if safe ridings can be found within an electoral system, they can also be manufactured whenever riding boundaries are readjusted. They are assembled by grouping together polling divisions of known party support. To form

a safe riding, a riding's boundaries can be defined in such a manner so as to group together these areas of known party support, while separating them from polling divisions of unknown or opposition party support. It is also possible to transform a marginal riding into a safe riding by adding a segment of known political support from an adjacent riding. The careful delineation of electoral districts, then, can allow a party to achieve a large majority with a marginal victory or a slim majority while actually incurring a marginal loss in terms of the percentage of popular vote received.

The opportunity to create politically safe ridings is not an unique occurrence. Systems of ridings are adjusted periodically; new ridings can be instituted, certain existing ridings can be eliminated, or the boundaries of some or many ridings can be modified. Electoral riding readjustments can involve some or all of these changes. At the federal level in Canada, electoral boundaries are modified following each decennial census (Ward, 1967; Qualter, 1970). This accounts for changes that have occurred in the population numbers and distribution since the last adjustment. If riding boundaries are not altered periodically, they eventually bear little meaningful relationship to the populations that they delimit (Johnston, 1979). When the readjustment procedure is open to input from any source, or is controlled to some extent by the party in power, each time that riding boundaries are modified an opportunity exists to create safe ridings.

The process of modifing electoral boundaries at the federal level and in most provinces in Canada is currently undertaken by independent commissions (Carty, 1985). Placing this procedure in the control of independent commissions has greatly reduced the ease with which politically safe ridings can be designed and

implemented. However, there are several ways to affect either the implementation of the commission's recommendations or to influence the recommendations made by the commission.

The first opportunity to influence this process occurs during public hearings that boundary commissions hold. Any group, individual, incumbent, or political party has the opportunity to present arguments favouring a certain riding boundary or set of riding boundaries to the commission. Complete sets of proposed ridings can also be presented (Ruff and Ross, 1988b). The problem for the commission is how to determine the degree of fairness of each submission and how to decide among them or how to create an optimum solution of its own.

Other opportunities to affect the final recommendations of the commission depend upon who receives the commission's report and if and how the report is enacted. Incumbents may have an interest in maintaining existing electoral district boundaries because they and their work are known to their current set of constituents. As a result, they may vote against changes that will affect their own ridings. If the commission's recommendations are presented to the entire legislative assembly for open debate and subsequent vote, the government has a decided advantage due to its majority position in the House. In cases when the commission presents its findings to the cabinet, as is the case in British Columbia, the cabinet can determine the fate of the proposed readjustment of riding boundaries. In these latter two cases the governing party has both the power and the ability to veto, implement, or modify the recommendations of the commission.

In the last two cases it is difficult to prevent the partisan manipulation of riding readjustments by the government due to its ultimate decision making

ability. This does not mean to say, however, that external pressures could not be applied if the riding system about to be enacted was analyzed and deemed to be unfair to the other parties involved. A methodology that would both measure the degree of fairness and detect safe ridings would be extremely helpful in applying such external pressure. This same methodology could be used by commissions when deciding between several sets of proposed riding readjustments. They could apply this tool to each set of ridings and recommend the readjustment that was deemed to be the most fair. Although a number of criteria have been used in the past to assist in the readjustment of electoral ridings, a comprehensive methodology to measure the degree of fairness or to detect safe ridings in a particular electoral system has not been designed.

1.2 Purpose of Study

The purpose of this study is to develop a framework that could be employed to design a fair electoral system, to select the fairest system from several proposed riding readjustments, or to analyze a proposed system of electoral districts that has been prepared. Central to this purpose is the selection of a method that will detect the existence of politically safe ridings.

The specific objectives of this study are to:

1. describe the redistributing process of a British type parliamentary system with emphasis on the Canadian and British Columbia contexts;
2. identify the problems of establishing riding boundaries in physiographically and culturally diverse regions such as British Columbia;

3. review and assess the methods of detecting ridings that are politically safe for any party and measuring the degree of fairness of an actual or proposed set of electoral ridings; and
4. empirically evaluate conceptually appealing methods by applying them to the 1988 Preliminary Report of the Fisher Royal Commission on Electoral Boundary Selection for British Columbia

1.3 Outline of Thesis

This thesis consists of six chapters. Chapter 2 describes the process of electoral boundary readjustments, and the contributions of geographers. The concepts of malapportionment and gerrymandering are explained and historical examples of these maladies are presented. Chapter 3 addresses the problem of gerrymandering. This includes an explanation of the notions of contiguity and non-compactness as indicators of gerrymandering. The political effects of this problem are explained as are the various methods of creating safe ridings. Existing methods of detecting politically safe ridings are identified and evaluated. Methods are selected for use in the empirical study and justification is provided for their selection. Chapter 4 presents the case study and the reasons for its selection. Chapter 5 analyzes the case study in terms of measuring its degree of fairness and the existence of ridings that may be safe for one party using the methods selected in Chapter Three. Chapter 6 presents both the implications and conclusions of this research.

Chapter 2

ELECTORAL BOUNDARY READJUSTMENT

2.1 Introduction

There are two distinct methods of electoral readjustment. Redistribution by independent commission is the most popular method in Canada (Carty, 1985), whereas redistricting at the state level in the United States is frequently accomplished by the governing party (Johnston, 1979; Morrill, 1981; Butler and Cain, 1985). The latter method is more likely to allow for the development of specific partisan goals or objectives. This chapter describes the various methods of readjusting electoral ridings. As well, the terms and concepts of electoral boundary redistribution, malapportionment, and gerrymandering are defined.

2.2 Terms and Definitions

The process of electoral boundary readjustment is known by several terms, readjustment, redistricting, and redistribution. The first and last of these terms are frequently used in studies of British type parliamentary electoral systems. American scholars appear to be more comfortable with the term redistricting. The terms reallocation and reapportionment refer to the process of allocating the number of seats to each state, province, or region. Although there are different names for this process, the overt goals and objectives of riding readjustment are gererally the same, regardless of which system is being adjusted.

It is important that the terms and concepts of electoral boundary readjustment are fully understood before describing the process itself. This section contains definitions and examples of the key terms and concepts. They have been ordered so as to integrate the general concepts, such as plurality electoral systems, with the more specific, such as gerrymandering and to indicate the relationship between the terms and concepts.

2.2.1 Ridings, Polling Divisions, and Plurality Electoral Systems

The basic building block of a plurality electoral system is generally known in Canada as the **riding.** It "...is the arena within which the basic electoral battle is fought." (Anstett and Qualter, 1976, p. 154) The population of a country or province is spatially divided into a set of districts such that each voter is assigned to one and only one district without overlooking any geographical territory. Each of these districts is deemed to be a riding. With very few exceptions, such as the existence of multi-member ridings, the number of members belonging to a legislature equals the number of ridings in a country or province. Each member of the legislature represents the voters from one particular riding. Other terms that are interchangeable with the term riding include **seat, division, constituency,** and **electoral district.** For the purpose of registering each voter for an election and for voting, electoral districts are sub-divided into **polling divisions.** In Canada, a polling division usually contains a maximum of about 300 or so voters (Anstett and Qualter, 1976).

2.2.2 Boundaries

There are several types of boundaries: legal, conceptual, and political/administrative. Electoral ridings have boundaries of the latter type. A **boundary** can be defined as

> ...something that indicates or fixes a limit or extent: something that marks a bound (as of a territory or a playing field): a boundary or separating line (Gove, 1976, p.260)

. **Political boundaries** form the limiting lines of political territories, such as nations, states or provinces, electoral ridings, or municipalities. They can be classified into a simple three level hierarchy, inter- or extra-national, national, and sub- or intra-national (Prescott, 1978; Taylor and House, 1984). It is important that the boundaries of electoral ridings be easily recognized. Constituents should know to which riding they belong since each riding has its own elected representative. Therefore, obvious electoral riding boundaries will enable consituents to easily identify both their riding and their legislative member (Brown, 1977; Warren, 1982).

Natural landscape features such as lakes, oceans, rivers, and mountain ridges are frequently used as political boundaries. Besides being clear delimiters, these natural features are thought to:

> ...provide more permanent and satisfactory political boundaries than others because population areas tend to separate along those features (Hartshorne, 1936, p.57)

. Major thoroughfares are also perceived as being excellent physical boundaries for electoral districts (Taylor and Johnston, 1979; Morrill, 1981). Lines of latitude and longitude are also favourite political boundaries. However, while these boundaries are easy to locate on a map, they are seldom obvious to anyone on the

ground unless they happen to coincide with some other topographical feature. Other political boundaries are simply straight lines that join pairs of selected points. Again, boundaries of this sort stand out on a map, but unless they correspond to some natural or man-made topographical feature, they are difficult to observe in the geographical setting.

2.2.3 Electoral Boundary Readjustment

Electoral boundary readjustment is the practice of redefining riding boundaries to take into account population growth and shifts that have taken place since the previous redistribution (McMeney, 1980). At the federal level in Canada, readjustments usually take place every ten years. Some riding boundaries may be radically modified while others remain unchanged as a result of a redistribution. An electoral boundary readjustment can involve the reduction of seats in some areas of the province or country, while other areas experience an increase (Johnston, 1979; McMeney, 1980; Morrill, 1981).

2.2.4 Malapportionment and the Electoral Quota

Malapportionment exists when there are large differences between the population of electoral districts. It is a condition that has been tolerated in many countries, including England and Canada for many years (Taylor and Johnston, 1979; McMeney, 1980; Morrill, 1981). Substantial discrepancies in riding populations are usually found between the physically large and remotely populated rural ridings and the small and densely settled urban ridings. Traditionally it was felt that serving rural ridings was more difficult than serving the small tightly packed urban ridings because the limited rural population was scattered over a

very large area (Brown, 1977; Warren, 1982). As a result, representatives of rural ridings were not expected to serve as many constituents as were their urban counterparts. Although this practice has survived in Canada since Confederation, there is increasing pressure to design ridings so that the population of any riding is not significantly different from that of any other riding (Waller, 1983; Ruff and Ross, 1987).

The reason for this stems from the constitutional requirement that all Canadians be treated equally. Malapportionment causes discrimination between voters in two ways. First, a vote cast in a very highly populated riding is actually worth less than a vote cast in a sparsely populated constituency. This is due to the fact that it takes far fewer votes in the small riding to elect a member compared to the number in a larger riding. This concept is illustrated clearly by using the largest and the smallest, in terms of population per Member of the Legislature, current provincial ridings of British Columbia, Surrey-Newton and Atlin respectively. There were 3,174 registered voters in Atlin in 1986 compared to 36,336 in Surrey-Newton (Goldberg, 1987). Since each riding elected one representative, a vote cast in Atlin was worth 11.4 times as much as one cast in Surrey-Newton. If both ridings had the same population, a vote cast in one riding would have been equal in importance to that cast in the other.

Unchecked malapportionment can also lead to unequal representation of voters between regions. This can be readily illustrated by combining the eight northern ridings in British Columbia of Atlin, Skeena, Omineca, Prince George North and South and North and South Peace River and Prince Rupert. If there were no regional malapportionment, the percentage of voters living in these

ridings would equal the percentage of members that these ridings elect to the Legislature. Combined, these ridings constitute 6.7 percent of the Province's voters, yet they receive 11.6 percent of the seats in the Legislature (Goldberg, 1987). This over representation in the north results in other regions of the Province receiving fewer than their fair share of seats in the Legislature. The ideal number of people that should belong in each constituency in an electoral system is called the **electoral quota.** This quota is derived by dividing the total population of the province or country by the number of seats in the legislature. The electoral quota can be used as a benchmark that enables malapportionment to be identified and measured.

2.2.5 Gerrymandering

The process of purposely creating politically safe ridings is known as **Gerrymandering.** It was first reported when Governor Gerry signed the Massachusetts Senate Redistricting Bill of 1812. This Bill established new boundaries for the state's 40 electoral districts. In the election held the following year, Gerry's Republican-Democrats defeated the Federalists 29 to 11 even though the latter won the popular vote by receiveng 602 more votes than the Republican-Democrats (Taylor and Johnston, 1979; Morrill, 1981). Political observers of the time noted the long and sinuous nature of these districts and likened their appearance on the electoral map to a salamander; hence the term "Gerrymander". While many definitions of this term exist, one of the most straightforward describes gerrymandering as the "...practice of drawing constituency boundaries to favour one party over another" (Taylor and Johnston, 1979, p.368).

2.3 Geography And Electoral Redistribution

Electoral studies is an interdisciplinary field that has its roots in both political science and political geography (Busteed, 1975). Electoral riding redistribution is one aspect of electoral studies. Geographical approaches have been used in electoral studies ever since E. Krebheil concluded, in 1916, that between 1885 and 1910 poor farming areas in Britain elected Liberal representatives, whereas, Conservatives were elected by farmers from the more fertile regions (Prescott, 1959). Geographers were also involved in electoral studies undertaken during the 1930s in the United States and in the 1940s and 1950s in France. The goal of the research undertaken during this period was to determine which economic, historical, sociological, political, psychological, and/or demographic characteristics found in a region accounted for its prevalent political philosophies (Prescott, 1959). For example, in 1954, R. Thiervoz observed that as industrialization in Bas Dauphine, of Savoy France, attracted more and more young immigrant workers who had an indifferent attitude toward religion, the strength of the left-wing parties increased (Prescott, 1959). Many, political geographers of the late 1950's, however, felt that such an approach would lead geographers away from geography toward the discipline of sociology and political science (Prescott, 1959). These same geographers only saw electoral geography as a possible research area within political geography if:

a. electoral issues pertained to the **raison d' etre** of the state, as would have been the case in the elections that immediately followed the creation of independent Ghana, Nigeria, and Indonesia; and

b. the electoral system was completely free from bias, that is free from gerrymandering (Prescott, 1959).

In the mid 1960's all branches of human geography, including political geography, were influenced dramatically by the behavioural approach (Johnston, 1983). This approach advocated studying actual human processes and information flows within a spatial context (Busteed, 1975; Johnston, 1983). This new approach had a profound impact on electoral geography because geographers realized that their understanding of spatial relationships and distributions was particularly well suited to studying the process of electoral distribution (Busteed, 1975, 54). Consequently, this new approach enabled geographers to shed the strict and limiting criteria that the stoic political geographers of the late 1950's had applied to this field. As a result, many geographers, including Bunge (1966), Prescott (1972), Busteed (1975), Muir (1975), Gudgin and Taylor (1979), Taylor and Johnston (1979), Morrill (1981), Taylor and House (1984), and Rumley (1985), became involved in studying the process of electoral boundary readjustment.

Electoral boundary readjustment is a matter of spatially arranging and organizing areal distributions of voters into an identifiable system of constituencies for the purpose of electing representatives to government (Johnston, 1979). It is a process that makes use of the expertise and opinions of politicians, the general populace, academics and professionals from many disciplines. However, the process of electoral redistribution parallels the geographic process of dividing a region into small districts and assigning the relevant boundaries (Morrill, 1981). Even the criteria that are used in electoral readjustment are very similar to those that are central to geographic studies (Busteed, 1975).

Morrill (1981) argues that the role of the geographer in this process is large and important. He suggests that geographers are best able to relate natural topography, communities of common interest, and transportation and communication linkages to the redistribution process. As well, Lijphart (1985), a political scientist, and O'Loughlin (1987), both acknowledge the contributions that geographers have made to the field of electoral studies. Lijphart (1985) notes that only a dozen significant books have been written on electoral studies in the last 50 years, but two of them were written by geographers Johnston (1979) and Gudgin and Taylor (1979). He emphasizes that these two texts are important because the authors integrated research that had been undertaken in the various fields of both political science and political geography and, as a result, channels of communication began to open between previously estranged scholars. O'Loughlin (1987) emphasizes the relationships that geographers have made between different sets of electoral systems and unique election outcomes. Since the process of delimiting the electorate into ridings requires both the application of various geographic criteria and a degree of spatial awareness, the role of the geographer in the redistricting process is readily apparent.

2.4 Electoral Boundary Readjustment

Once established, riding boundaries are not frozen in place for all time; they are temporary. There have been dozens of boundary modifications made during the last sixty years in many countries including France, England, Canada, Ireland, New Zealand, Australia, and the United States (Taylor and Johnston, 1979). As population distributions change over time, within a country or province, there is a

need to alter the structure of electoral districts (Prescott, 1972; Muir, 1975; Anstett and Qualter, 1976; Taylor and Johnston, 1979; Morrill, 1981). The main objective of riding readjustment is to reallocate the electorate to new or modified ridings in order to account for the changes in population distribution since the last readjustment. Another major objective of this process that has become increasingly important in recent years is to equalize the riding population across all ridings in the electoral system (Taylor and Johnston, 1979; Morrill, 1981; Ruff and Ross, 1987).

It is extremely difficult if not impossible, however, to design ridings so that the population of each electoral district exactly equals that of every other district. In practice, efforts to equalize riding populations during redistribution usually result in assigning riding boundaries so that electoral district populations do not deviate more than a prescribed amount from the electoral quota. There are, however, several popular views of what these tolerance levels should be. The strictest application of equal population is found in the Congressional seats of the United States where the Supreme Court has insisted that the tolerance level is only plus or minus one percent from the electoral quota (Morrill, 1981; Butler and Cain, 1985). Others propose that constituency population figures should not be allowed to deviate more than plus or minus ten percent from the quota (Ruff and Ross, 1987). Currently, a tolerence level of plus or minus 25 percent is used for the Canadian federal ridings and several provinces (Fisher, 1988).

There are two major factors that combine to cause changes in population distributions. These changes occur due to the relationship between birth and death rates, and net migration. Because birth and death rates will not be exactly

equal across communities, electoral district populations will grow at different speeds. If electoral districts are not modified periodically, these varied rates of growth can result in dramatic differences in population levels between ridings. Net migration can also bring about large and often rapid changes in the spatial distribution of people. Migration trends can be either short or long term causing sudden or gradual impacts, respectively. Short term migration is typically fueled by economic conditions. People move from depressed economic regions to areas that have improved occupational opportunities (Heilbrun, 1981). Such an occurrence took place in Canada during the mid 1970's when hundreds of people from various parts of the country moved to Calgary and Edmonton in order to reap the benefits of the booming oil industry.

Ethnic or culturally based migration can result in population change as well. This type of immigration is also destination specific, but it is usually long term in nature with a flow of people directed toward a certain municipality or even a specific neighbourhood. Compatible ethnic or cultural enclaves attract new immigrants from the same culture (Christian and Harper, 1982). Montreal, Toronto, and Vancouver are examples of Canadian cities that annually attract large numbers of immigrants due to the multitude of job opportunities and the existence of ethnic "towns", districts, or neighbourhoods.

Other long term changes in population distribution occur due to migration flows within a country or province. One example of internal changes in population settlements is the rural-to-urban shift that has taken place in developed nations since the industrial revolution. Because people have been moving from rural areas to urban environments, the percentage of the population that lives in urban

regions has increased dramatically in Canada and other "western" nations since the turn of the century. However, since the second world war there has been a further shift in the population in many developed nations. This recent shift has been the result of urban sprawl and the rapid development of suburban communities (Johnston, 1979; Christian Harper, 1982).

Changes in population distribution occur due to a combination of varied factors, natural increases or decreases, net migration, internal shifts, and economic conditions. Unless electoral districts are monitored for these changes and modified accordingly, they soon become meaningless and obsolete (Anstett and Qualter, 1976; Johnston, 1979; Morrill, 1981; Butler and Cain, 1985; Ruff and Ross, 1987). Differential rates of population growth without readjusting riding boundaries will cause malapportionment. As well, the rural-to-urban shift in population has been a major contributor to the development of sparsly populated rural Canadian ridings. Due to this internal shift, the percentage of rural inhabitants has decreased significantly since Confederation. Malapportionment exists because there has not been a corresponding reduction and increase in the number of rural and urban constituencies, respectively, in the various provincial and federal legislatures (Ward, 1967; Lyons, 1970; Qualter, 1970). Failure to readjust ridings to reflect these changes in population distribution has been described as being a **silent gerrymander** (Blevin, 1974), particularly if such a "missed" readjustment were to eliminate one or more safe seats for a certain, usually the governing, party.

The need to monitor population changes and to modify electoral riding boundaries has become more important in Canada since 1982 with the

implementation of the Constitution Act. According to sections 3 and 15, of the Canadian Charter of Rights and Freedoms, all citizens of Canada are to be given the opportunity to participate in federal and provincial elections and are to be treated equally in the eyes of the law. If steps are not taken to correct malapportionment in future redistributions in Canada, the Constitution allows citizens to have the courts equalize representation among voters.

The decennial census was designed and implemented, in Canada, in order to monitor and measure population distribution patterns (The Constitution Act, 1867; Taylor and Johnston, 1979; Butler and Cain, 1985). The basic building block of the census is the enumeration area (E.A.) and demographic data are compiled for each of these areas. Electoral districts usually include many E.A.s. Because they are larger than these areas, a particular riding's cultural character and population level can be readily determined. This is accomplished by accumulating data for each E.A. that is found within a riding in its entirety and by including extrapolated population information from those areas that happen to be split between two or more ridings. A less comprehensive census is also taken in Canada during the fifth year following the decennial census.

2.4.1 When to Readjust

There is no ubiquitous rhythm to riding redistribution. Either readjustments follow their own unique periods or they take place on an ad hoc basis (Carty, 1985). Periodic readjustments follow one of three patterns. The first pattern ties redistribution to the completion of the decennial census. Canadian federal ridings are reallocated on this basis (Qualter, 1970; Ward, 1970; Carty,1985). The Constitution (1867) required that electoral ridings be readjusted following the

decennial census. Current legislation now demands that this process begin no later than 60 days from the date that the census data becomes available (Carty, 1985). As a result, reallocation of the Canadian federal ridings commences automatically and independent of government instigation.

The second pattern followed is similar the the first in that it specifies the actual number of years between redistributions, but it is not tied to the decennial census. In this case redistricting is required to occur after a prescribed number of years have elapsed. Although, this pattern does not guarantee that the most up to date census figures will be available for any, or every boundary readjustment, it does ensure that citizens, politicians, and electoral officiers at least know when the next reallocation will take place (Carty, 1985).

The third pattern ties readjustment to the political cycle. For example, in Quebec a proposal for new riding boundaries must be developed within twelve months of each provincial general election (Carty, 1985, Cote, 1984). Alberta requires that redistribution take place after every other election (Carty, 1985; Dixon, 1984). While this type of system regulates the timing of the next readjustment, there is no guarantee that it will coincide with the completion of the next census. It is possible, therefore, that the demographic data available for the next redistribution will be out of date.

Some redistricting is only undertaken when the governing party decides it should be done. This ad hoc readjustment does not allow citizens, opposition members, or electoral officials to predict when the next reallocation of seats will occur. Nor is there any guarantee that up to date census data will be available for the process. As well, the governing party has a decided advantage in the process

not only by controlling the timing of any redistribution, but also by determining whether a reallocation of seats even takes place. If an existing arrangement of constutuencies is seen to benefit the governing party and a redistribution is long overdue, the governing party could be accused of silent gerrymandering (Blevins, 1974).

2.4.2 Who Readjusts

There are basically two distinct groups who readjust electoral ridings, the governing party or an independent commission. In cases where the government controls the redistribution process it not only decides when to redistrict, but it also assigns the riding boundaries. In this scenario, the party in power is free to develop readjustment criteria that will ensure that as many safe seats as possible are created for the government. The privilege to control this entire process allows the governing party a decided advantage in contesting subsequent elections. The original gerrymander of 1812 is a classic example of the dramatic political results that are possible when the redistricting process is completely controlled by the government.

A variation on this method of reallocating seats is the all member or select committee. One such committee was formed in 1977 in Nova Scotia to consider whether or not to increase the size of the Legislative Assembly, and what criteria should be used in completing such a modification. This committee was composed of legislative members from each of the major parties, five Liberals, three Progressive Conservatives, and one New Democrat (Brown, 1977). However, even if the opposition members were to have formed a temporary coalition, the governing Liberal party would have had a distinct majority in the committee.

Such committees allow the oppostion parties to have input into the redistribution process, but the government maintains ultimate control. For this reason, select committee readjustment is not seen as a significant departure from absolute government control of the redistribution process.

Although redistribution by the government still occurs, particularly at the state level in the United States (Butler and Cain, 1985), this manner of riding boundary adjustment has become less popular in recent years in Britain, Canada, Australia, New Zealand, and the United States. The redistricting process for the federal and some provincial or state electoral systems in these countries has been placed in the hands of independent commissions (Ward, 1967; Qualter, 1970; Taylor and Johnston, 1979; Morrill, 1981; Butler and Cain, 1985). All commissions in Canada, however, are not created equal. Some are permanent with fulltime staff such as in Quebec (Drouin, 1972) and the federal government of Canada (Carty, 1985). Others are temporary in nature being formed to complete one reallocation of seats. These temporary commissions can either be automatically legislated into existence, or they can be created by an Order in Council signed by the Lieutenant Governor. In Alberta, for example, section 5 of the Electoral Boundaries Commission Act of 1984 clearly states that a **new** commission be appointed during the first sitting of the legislature following every other general election (Dixon, 1984). In British Columbia in 1987, a Royal Commission was created under the Inquiry Act to allow Judge Thomas K. Fisher to recommend modifications to riding boundaries while eliminating dual member constituencies (Ruff and Ross, 1987; Fisher, 1988).

The manner in which the final recommendations of these commissions are acted upon also varies substantially. In both the federal and Quebec situations, the final reports of the commissions are promulgated outright (Carty, 1985). In contrast, the fate of the final recommendations of temporary commissions rest with either cabinet or legislative assembly approval. If the commission's report is presented to cabinet, as is the case in British Columbia, it could be shelved and effectively vetoed without ever reaching the Legislature for a debate or vote. If the final report is submitted to the Legislature for approval, as is the case in Alberta, the recommendations can be debated and vetoed, modified, or accepted outright through a majority vote. Because the final recommendations made by permanent commissions, such as the Canadian and Quebec Electoral Commissions, are automatically enacted they are not subject to veto or modification as are those made by temporary commissions where final approval is dependent upon either cabinet or general assembly acceptance and approval.

2.4.3 Current Canadian Redistribution Procedures

In Canada, from Confederation to the late 1950's, electoral boundary readjustments were both timed and directed by majority governments and gerrymandering became a part of Canadian politics (Greer, 1978; Carty, 1985). The legislature of Manitoba in 1957, was the first in Canada to take a major step toward reforming the highly partisan art of redistribution into a structural administrative science (Ward, 1970; Lyons, 1970; Qualter, 1970; Carty, 1985). The federal government followed with a reform of its own in 1964 (Ward, 1967; Lyons, 1970; Qualter, 1970; Carty, 1985).

There were two major goals of the 1964 Electoral Boundaries Readjustment Act. First, malapportionment was to be reduced by designing constituencies so that their individual total populations were within plus or minus 25 percent of the relative electoral quota. Second, Parliament's influence in the redistribution process was to be significantly reduced, if not eliminated, by allowing the Commission's final recommendations to be enacted automatically. This was desirable because each incumbent has a vested interest in preserving the overall character of the constituency that elected him/her (Greer, 1978; Courtney, 1988). Since 1966, the various federal commissions have been quite successful in reducing malapportionment. For example, following the 1966 readjustment, 48 percent of the federal ridings had populations that were within plus or minus 10 percent of the provincial quotas and 24 percent were within plus or minus 5 percent. After the 1987 redistribution, the percentage of electoral districts that are in each of these two categories increased to 65 and 36 percent, respectively (Courtney, 1988).

Certain members of Parliament, however, have not seen this as an improvement (Courtney, 1988). They feel that rural and remote ridings have become too large to service through the "equalization" of riding populations. As a result, the Act was amended in 1986 to allow commissions to deviate from the plus or minus 25 percent limits for "extraordinary" circumstances and five of the 1987 constituencies have populations that are outside of this tolerance range (Courtney, 1988). Quebec and Newfoundland each have two such extraordinary ridings while Ontario has one. As Courtney (1988) points out, the combination of the 1986 amendment to the Act along with the recent decisions of the Quebec,

Newfoundland, and Ontario commissions may result in future redistributions containing riding populations that deviate from the electoral quota by more than 25 percent. He also suggests that Parliament may be able to effectively lessen a commission's independence by amending the Electoral Boundaries Readjustment Act to include more "extraordinary circumstance" clauses. Should this be the case, he advises that the courts may be drawn into the readjustment process. Such judicial participation is possible should a group or individual decide to challenge the resulting malapportioned constituencies using sections 3 and 15 of the Canadian Charter of Rights and Freedoms.

Since 1964, many of the provincial legislatures have also reformed their respective redistricting processes. One major reform has been that independent commissions now play a major role in this procedure (Manitoba, 1981; Carty, 1985; Dixon, 1984; Saskatchewan, 1986-87-88; Cote, 1987b; Ontario, 1987; Fisher, 1988; Wells, 1988; Whalen, 1988). As well, some attention has been paid to correcting, or at least limiting, malapportionment. Although no two Canadian readjustment procedures are exactly alike, they can be classified into a few major groups using the criteria of redistribution timing or period. Because British Columbia forms the case study, its readjustment procedures are dealt with in Chapter 4.

2.4.3.1 Fixed Interval Readjustment: Canada, Manitoba, and Newfoundland

Fixed interval readjustments occur after a prescibed amount of time has elapsed since the last adjustment. It happens that the legislation pertaining to each of the House of Commons and the Manitoba and Newfoundland House of Assemblies requires that a redistribution be completed every ten years. All three regions make use of independent commissions in this process. The federal

procedure requires that the redistribution begin as soon as the decennial census is complete (Lyons, 1970; Qualter, 1970). In Manitoba, riding readjustment takes place every ten years following 1968, using population data supplied by Statistics Canada for that year (Manitoba, 1981). The base year for Newfoundland is 1973 and the Electoral Boundaries Delimitation Act No. 44 of 1973 specifies that the most recent census figures must be used by the Commission. This requirement, however, can result in the Commission using population data that is out of date. The Report issued by the 1983-84 Commission, highlighted the fact that its recommendations were based on 1981 Census data. The Commission felt that Statistics Canada data for 1983/84 would have provided them with more accurate population information, but they were not allowed to use this data because of stipulations in the Act.

In determining the electoral quotas in each of these jurisdictions, the total population was used in place of the total number of legal voters (Ward, 1970; Qualter, 1970; Newfoundland, 1973; Manitoba, 1981). While this is a pragmatic manner of calculating the electoral quota, cities with large numbers of recent immigrants may be awarded more seats than if the quota was to be calculated using the number of voters (MacDonald, 1985). The Constitution Act presents a complicated formula for determining the number of seats that each province is allowed. Each province has its own unique quota. This formula is based upon the number of representatives that Quebec receives and several safeguards. One of these safeguards prevents a province from having more Senators than Members of Parliament. This allows Prince Edward Island more M.P.s than it would otherwise have following the strict application of the formula. In both Newfoundland and

Manitoba, the Electoral Acts state the number of ridings that are to be included in the distribution.

The Electoral Redistribution Acts for each of these regions specify maximum tolerance levels that riding populations are allowed to deviate from the respective electoral quotas. For federal ridings the tolerance level is plus or minus 25 percent. The Acts of both Newfoundland and Manitoba also set the maximum tolerance as being plus or minus 25 percent, but each allows for exceptions. In Newfoundland, Labrador is guaranteed four seats regardless of its population level relative to the rest of the province (Newfoundland, 1979; Whalen, 1988). The legislation in Manitoba distinguishes between northern and southern ridings. North of the 53rd parallel ridings are allowed to deviate plus or minus 25 percent from the quota, while ridings south of this boundary are required to fall within 10 percent of the quota (Manitoba, 1981). Such exceptions preserve a certain amount of malapportionment in the Canadian electoral system, typically to the benefit of rural voters. Allowing the populations of these chosen ridings to deviate substantially from the electoral quota results in the rural or remote voter having relatively more voting influence than his/her urban counterpart. However, some legislators in Canada feel that these exceptions are needed to offset the fact that rural constituents are physically remote from their respective representatives and governments (see, for example the summaries of the submissions made by British Columbia M.L.A.s Mr. Harold Long and Mr. Dan Miller, from the ridings of MacKenzie and Prince Rupert respectively, to the Fisher Commission in Fisher, 1988, p.4.).

There are two significant differences between the federal redistribution commission and those of Newfoundland and Manitoba. First, the federal Commission is a permanent commission, whereas the Commissions of the two provinces are temporary. Commissioners of temporary readjustment authorities typically participate in only one redistribution. As a result, expertise gained in one redistribution is not readily passed on to subsequent Commissions. Without the overlap of some personnel between successive redistributions, it is difficult to improve either the efficiency or the effectiveness of the process.

The second major difference is the manner in which the final report of these commissions is received and implemented. The federal Commission presents its preliminary report to the House of Commons and the members critique it. The report is then returned to the Commission with comments and objections and the Commission decides whether or not to modify it. Regardless of whether any modifications are made to the preliminary report or not, once the final report, is submitted to the House, it is adopted without further debate. The final reports of the two provincial commissions can be approved as submitted or approved with alterations by a simple majority vote in the respective legislative assembly (Newfoundland, 1973; Manitoba, 1981).

Although Newfoundland has a set of clearly defined rules for demarcating ridings, selected partial redistribution has occurred twice since 1979 without the formation of a commission or the holding of public hearings. Prior to 1979 Labrador had three ridings of its own and shared a fourth with the Island (Newfoundland, 1973). In 1979, Labrador was awarded its fourth guaranteed seat in the Legislature (Whelan, 1988). As well, the boundaries of four districts of the

1985 reallocation were changed because constituents of these districts presented the Assembly with a petition requesting the changes (Whelan, 1988, 2). In these two cases,

> ...The Electoral Boundaries Delimitation Act was circumvented...when it was expedient and where the consent of all parties in the House of Assembly was received (Whelan, 1988, p.2).

2.4.3.2 Political Cycle Readjustment: Quebec, Alberta, and Saskatchewan

The provinces of Quebec, Alberta, and Saskatchewan redistribute ridings subsequent to a prescribed number of general provincial elections being held (Dixon, 1984; Saskatchewan, 1986-87-88; Cote, 1988). It is for this reason that readjustments in these provinces are said to follow political cycles (Carty, 1985). Each province, however, has its own cycle. Alberta and Saskatchewan undertake redistributions after every second provincial general election, whereas Quebec has a readjustment following each general election (Dixon, 1984; Saskatchewan, 1986-87-88; Cote, 1988).

Like Newfoundland and Manitoba these three provinces also employ independent commissions in the redistribution process. Quebec has a permanent electoral commissionCommission de la Representation Electorale. Like its federal counterpart, the final report of the Quebec Commission is promulgated without a vote in the National Assembly. The members of the Assembly have an opportunity to discuss the preliminary report, but it is the Commission that decides if and how to modify the preliminary report (Cote, 1987b). The final report of the Commissions of Alberta and Saskatchewan must be approved as submitted or approved with alterations depending upon the vote in the House. Of course, this process does tip the scales of redistribution in favour of the

government, provided they are not in a minority government situation. As well, this may result in very few riding changes because each member of the government has a vested interest in preserving the status quo (Qualter, 1970).

All three provinces calculate their respective electoral quotas using the total number of voters in the province. Because representation is dependent upon the actual number of voters in these provinces and each riding, these provinces base their respective redistricting decisions on relatively accurate data. This is true for Quebec, but not for the other two provinces. Both Alberta and Saskatchewan determine the total number of votes by using the voter list of the **last** general election. This could result in using data that was five years old if a government were not to call an election until the last possible moment. In Quebec, however, a voter enumeration is completed each year (Cote, 1987a). Each redistribution, therefore, is based on the latest ennumeration figures. Currently, no other electoral readjustment commission has annual ennumeration statistics to use in carrying out its respective mandate.

Each provincial commission is required to allow for public input during the redistribution process. In all three cases, public hearings are required following the submission of the preliminary reports to the respective House of Assembly. Proper advance notice is to be given prior to each meeting and the preliminary reports are also to be available to the public well in advance of the hearings (Dixon, 1984; Saskatchewan, 1986-87-88; Cote, 1987b).

Each of these commissions is also given the number of seats that should be used in their calculations. In Quebec, a range of seats is usually specified. For example, before the last redistribution in this province, the Commission had to

decide on a number of ridings between 122 and 125, inclusive (Cote, 1987a). The most recent Commissions in Alberta and Saskatchewan had far less latitude in determining the number of ridings as each was required to create a particular number of urban and rural constituencies (Dixon, 1984; Saskatchewan, 1986-87-88). In Alberta, the requirements were to increase the number of ridings from 79 to 83, and to provide 42 urban seats of which seventeen were to be in Edmonton and eighteen in Calgary (Dixon, 1984). Saskatchewan is currently undergoing a redistribution and its Commission is required to delimit 29 urban, 35 rural, and two northern ridings (Saskatchewan, 1986-87-88).

The commissions in each of these provinces have tolerance ranges for riding populations built into their respective mandates. However, they are slightly different from each other. Quebec has the most straightforward policy. Any redistribution must ensure that every riding is within plus or minus 25 percent of the provincial electoral quota (Cote, 1987b). The policy for Saskatchewan is slightly more complicated in that it specifies two distinct tolerance ranges. All southern ridings, regardless of whether they are urban or rural, must be within 25 percent of the electoral quota and the two northern ridings are allowed populations within plus or minus 50 percent of the quota (Saskatchewan, 1986-87-88).

Alberta's policy on population tolerance is even more complex. First, rural ridings are to be as equal as possible to each other in terms of voter population, but no rural riding tolerance range is prescribed in the Electoral Boundaries Commission Act of 1984. It is simply stated that new rural ridings can be no larger than the 1984 rural ridings. Urban ridings, however, must be within 25

percent of the average voter population of the 1984 urban ridings (Dixon, 1984). These tolerances, however, are dependent upon some very specific conditions being met. Urban constituencies are to be as equal as possible to each other and the boundaries of urban ridings are not to cross municipal boundaries (Dixon, 1984). If an urban riding is more than 25 percent above the average, it is to be split into two separate ridings, providing it is not in either Calgary or Edmonton. If any urban riding, including a riding that has just been created through the splitting process, has a population that is more than 25 percent below the average, exceptions to respecting municipal boundaries are made. These small urban ridings may have rural population added to them until the total population of the urban riding is as large as the urban average (Dixon, 1984).

2.4.3.3 Ad Hoc Readjustments: Ontario

Readjustments that occur on an **ad hoc** basis are completely dependent upon government instigation. This allows the government to preserve the status quo and possibly benefit from silent gerrymandering. Ontario falls into this category because it has no formal redistribution legislation in place (Wells, 1988). Supposedly, readjustments have taken place in Ontario shortly after the federal decennial census has been completed (Wells, 1988). However, the most recent redistribution began in 1984 using 1981 census figures, but was not enacted until 1987 (Ontario, 1984; Ontario,1987; Wells, 1988). This example illustrates that without redistribution legislation and a prescribed time frame for completing the process, a readjustment can be based on out of date population figures.

Ridings are redistributed in Ontario by an independent commission (Ontario, 1984). However, the most recent case (1984/87) was the first time that a

commission held public hearings (Wells, 1988). The Commission was given a clear set of terms of reference which included the number of ridings that were to be delimited. It was required to fix the boundaries of 125 to 130 ridings of which at least fifteen were to be north and west of the pre 1984 ridings of Algoma-Manitoulin, Sudbury East, and Nippissing, inclusive (Ontario, 1984).

The electoral quota was to be calculated using the total population of the province, as opposed to the total number of voters. The mandate also included a tolerance range for riding populations of plus or minus 25 percent (Ontario, 1984). However, the Commission was allowed to deviate from this range if, in its opinion, special circumstances existed (Ontario, 1984). The Commission could make population allowances due to diversity of community interests, special accessibility or communication problems, unique population density or growth rates, or special riding shape and size (Ontario, 1984). Unfortunately, the mandate did not provide any details on how to identify the special or unique character of any of these criteria.

The 1984 terms of reference were clear in terms of preparing the report, public hearings, and submission of the report to the Legislature (Ontario, 1984). Public meetings were to be held by the Commission after the Commission had drafted and made public its preliminary report. If, in the opinion of the Commission, arguements presented by the public were seen to be valid, the preliminary report could be altered before presenting it to the Legislature (Ontario, 1984). After public input and any modifications, the report was to be given to the Speaker and circulated to all members of the Legislature. If within fifteen days of submittal ten or more members objected to the report in writing,

the report and objections were to be sent back to the Commission for consideration. The Commission was then to resubmit or alter and resubmit the report along with a draft Bill of the Representation Act that embodied its report. The draft Bill was then to be given to the appropriate Minister who would present the Bill to the Legislature (Ontario, 1984).

It is interesting to note that the recent redistribution in Ontario was instigated by the Progressive Conservative Party in 1984. However, it was not until 1987 that the readjustment was completed and implemented under the Liberal-New Democratic coalition Government formed in 1985. It is not known if the boundaries established in 1987 under the Liberal government are different from those that would have been implemented by the Progressive Conservatives, had they not been defeated in 1985.

2.5 Readjustment Malaise

Although electoral riding readjustments in Canada are undertaken by independent commissions, problems remain in the process. These maladies can be divided into first and second order problems. First order problems concern fundamental issues of electoral redistribution. As a result, they should be addressed by the respective legislature and include :

a. prescribing the timing of the redistribution process;

b. establishing the time frame for the commission to complete its mandate;

c. determining the tolerance ranges for acceptable riding population levels;

d. deciding whether to use total voters or total population in calculating the electoral quota;

e. determining the number of seats that are to be in the legislature; and

f. prescribing the timing and the amount of public involvement.

Second order problems are issues that must be dealt with by the electoral commisssion as it carries out its mandate. These problems included identifying:

a. riding boundaries that intentionally serve the interests of one particular party (gerrymandering); and

b. malapportionment.

Despite the fact that the redistribution procedure in Canada has been placed in the hands of independent commissions, gerrymandering remains a malaise of this process. There are two major reasons why this is still the case, neither of which are the fault of the commissions. First, in cases where the legislature votes on the commission's recommendations, or where its report is merely submitted to cabinet and may not be brought before the legislature for a vote, the governing party has a distinct advantage in the redistricting process. Simply by using its majority in the house, the government can decide the fate of the suggested redistribution. It can be implemented, modified, or simply vetoed. The second reason is that although gerrymandering is a well defined problem, it is difficult to detect and prove conclusively that either a particular riding or set of ridings has been gerrymandered (Johnston, 1979; Gudgin and Taylor, 1979; Morrill, 1981; Butler and Cain, 1985; MacEachren, 1985; Backstrom and Robins, 1987). Therefore, a redistricting commission may not be able to detect gerrymandered

ridings in submissions made during the hearing process or in their final set of recommended electoral districts. Opposition parties are no better equipped to identify conclusively that gerrymandering is or is not present in a proposed set of electoral districts.

A fair electoral system requires that gerrymandering be absent. The reason for this is that the creation of gerrymandered or safe party ridings can undermine some of the basic principles of democracy. In cases when a majority government is formed by a party that received a smaller percentage of the popular vote than did an opposition party, the principle of "majority-rule" is flouted. If safe ridings were constructed for all political parties, election results at the constituency level could be predicted. In such safe ridings, regardless of which party is guaranteed to be elected, the voter may feel that his/her vote is unimportant to the election outcome. This can translate into voter apathy. Consequently, the elected official may become less accountable to the voter since the voter may feel that the incumbent cannot be defeated at the next election. In turn, elected representatives may become less responsive to the needs or desires of some of the electorate if the incumbents perceive that their seats are safe. Therefore, the democratic principle of majority-rule and representative accountability and responsibility to the electorate can be compromised through the construction of many safe electoral districts (Busteed, 1975; Morrill, 1981).

Malapportionment involves the creation of a set of ridings where the populations between constituencies vary widely, or more widely than a specified tolerance range. One of the most blatant examples of Canadian malapportionment occurred in 1963 when the federal ridings were redistricted.

The largest riding in this electoral system was York-Scarborough with a population of 267,252, while the smallest riding was Ilse-de-la-Madeleine with a population of 12,479, a ratio of 21.4 to 1 (Ward, 1976; Courtney, 1985).

Malapportionment is a problem for two reasons. First, although the Supreme Court of Canada has yet to rule on malapportionment as a constitutional issue, it appears that malapportionment is unconstitutional since the Canadian Charter of Rights and Freedoms states that all citizens must be treated equally. A small riding, such as the 1963 riding of Iles-de-la-Madeleine, allows its constituents more representation per voter than does a riding close in size to the electoral quota.

Second, malapportionment can be used as a gerrymandering tool. The creation of very large and very small ridings could benefit a particular political party. The ratio of seats won to percentage of popular vote received could be drastically reduced for an opposition party, relative to the respective ratio for the government, whenever large ridings are won by an opposition party with landslide victories. This is an effective way for wasting the opposition's vote by concentrating it in a large riding, as it allows one opposition representative to be elected when otherwise two or more may have been elected had the large electoral district been made up of several evenly sized ridings. On the other hand, if the voters in the small ridings were to elect government candidates, this would result in the efficient use of the government's vote since several more government candidates could be elected than would be the case if all the ridings were of equal size. Hence, malapportionment can be used to help create safe ridings.

Politicians, political scientists, geographers, and other observers are all interested in the redistricting process. Incumbents dislike having their riding populace altered because they feel that the new constituents may not be aware of the results acheived in past terms (Prescott, 1972; Muir, 1975; Gudgin and Taylor, 1979; Johnston, 1979). Politicians often believe that winning an election in a redistricted riding is more difficult. Therefore, incumbents wish to have safe polling stations added to their regions of support as opposed to losing them to adjacent ridings. Political parties scrutinize redistricting proposals to ensure that the other parties have not been favoured at their expense. Political scientists, geographers, and other observers are concerned that redistricting creates fair ridings or, as noted by Backstrom and Robins (1987, p.107), a:

> ...level playing-field [upon which each party has an] unbiased chance to win their fair share of seats.

This group understands the democratic system and its inherent goals and they are aware that the system can be manipulated by gerrymandering.

2.6 Summary

This chapter has defined the terms and concepts of electoral boundary readjustment and explained the need for electoral redistribution. As well, the various methods of redistribution in Canada, including fixed interval, political cycle, and ad hoc readjustment, have been described in detail. Gerrymandering and malapportionment have been explained and reasons have been presented that show how these maladies undermine the basic principles of democracy. In order to create fair electoral systems, it is important that these problems be eliminated or, at least, significantly reduced. Chapter Three indentifies existing methods

that have been suggested for the purpose of detecting politically safe ridings. It concludes by suggesting a set of criteria that can be used in detecting gerrymandering, as well as assessing the degree of fairness intrinsic to a set of electoral ridings.

Chapter 3

GERRYMANDERING: EFFECTS AND METHODS OF DETECTION IN PLURALITY ELECTORAL SYSTEMS

3.1 Introduction

This Chapter examines the spatial component of plurality elections and the relationship between votes received and seats won. The concept of gerrymandering is reviewed as are the various methods of detecting politically biased ridings. In addition, the effectiveness of each of these methods is evaluated. It concludes by proposing a set of criteria that can be used to detect political bias in a system of electoral districts.

3.2 Spatial Relationship Between Votes and Seats

In order to appreciate the effects of creating politically safe ridings in a plurality electoral system, the relationship between votes received and seats won by each party must be understood. The spatial location of voters is extremely important in determining the number of members elected to the legislature from each party. Riding boundaries serve to identify and delimit a particular set of voters and link them to a unique set of candidates. Voters can only vote for candidates in their riding and a candidate is elected if he/she receives the most votes in a riding. In turn, a party is awarded a seat in the legislature for each riding that is won by one of its members. While ubiquitous factors such as leader

popularity, party policies and track record may affect how every member of the electorate votes, each riding is contested independently. If supporters for one particular party are concentrated in a riding, it is quite likely that this party's candidate will be elected regardless of whether he/she is a member of the government party.

It follows that if a party's support can be concentrated within electoral district boundaries, the party will win these ridings. Since the location of party support, measured in votes, is likely as important as the number of votes a party receives in an election, some governments may be tempted to alter riding boundaries in order to win as many seats as possible. Once a political party forms the government, one of its main objectives is to preserve its political power. This can be accomplished in many ways including formulating popular policies, designing acceptable taxation structures, creating employment, removing controversial government members from senior and/or cabinet positions, and even by granting political favours to ridings that elect government members. A party can also preserve or even expand its power base by carefully redesigning the system of electoral districts so that the support for the governing and the opposition parties is efficiently used and squandered, respectively. This latter method of preserving or creating political power is gerrymandering.

Understanding the relationship between votes and seats in a plurality system is of paramount importance in recognizing the effects of gerrymandering. Elections in plurality electoral systems do not produce a one-to-one relationship between the percentage of seats or ridings won and the percentage of popular vote received by any one party. The relationship that does exist in a plurality electoral

system is due to the spatial distribution of party support throughout the entire political region. It is unlikely that any party's support would be evenly distributed throughout the entire political system. Nor is it likely that any party would receive all or none of the votes in any riding. It is more reasonable to expect that there will be some small areas where each party is either held in high or low regard and many regions where party popularity will fall between these extremes.

A political party's popularity depends upon many factors including, cultural, historical, regional, and socio-economic criteria (Busteed, 1975; Gudgin and Taylor, 1979; Morrill, 1981; O'Loughlin, 1987). Therefore, it can be expected that party popularity at the constituency level, measured in votes, will vary from very low to very high with some ridings marginally favouring one party over the other(s). Such an array of votes for one party can be represented as a histogram as shown in Figure 3.1.

Gudgin and Taylor (1979) argue that as the range of popular vote received is reduced, the histogram or frequency distribution assumes the shape of a smooth curve which resembles the bell shape of a normal distribution. Empirical observation of frequency distributions from plurality elections held this century in Britain, New Zealand, and the United States (excluding the Deep South state elections prior to reapportionment) indicates that all have been approximately normally distributed (Gudgin and Taylor, 1979). As a result, Gudgin and Tayor (1979) argue that the normal distribution, with a specified standard deviation (which indicates the degree that party support varies between ridings) can be employed as the model frequency distribution for plurality elections. One benefit of adopting this model is that the relationship between seats won and votes

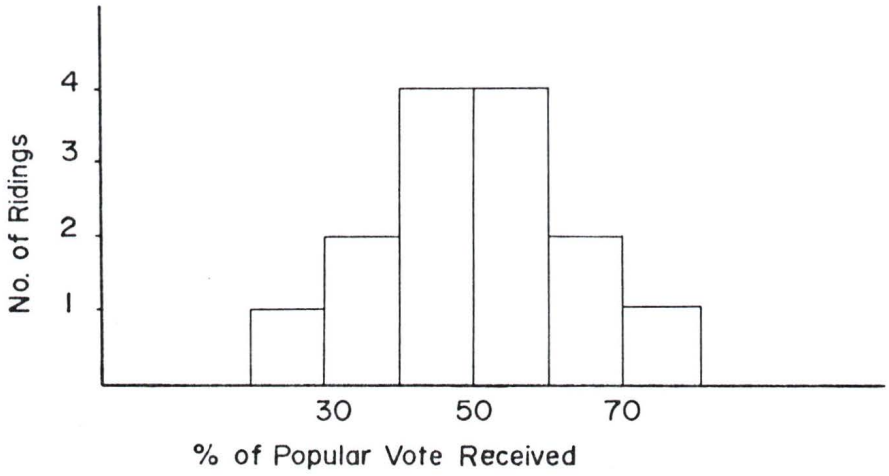


Figure 3.1 Histogram Showing the Frequency of Ridings That Supported a Party by Preference of Popular Vote

received can be derived from the cumulative normal distribution (CND) (Gudgin and Taylor, 1979).

The accuracy of the CND function for predicting the number of riding victories was tested by Gudgin and Taylor (1979) using the five United Kingdom plurality elections between 1945 and 1970. The number of seats won by the Labour Party was calculated twice for each election. One set of calculations was made using the standard deviation of percentage of popular vote received by the Party across all ridings. Depending on the election, the standard deviations in this

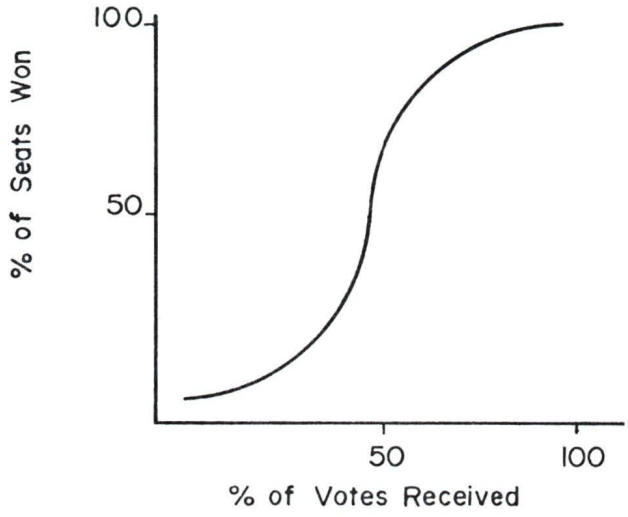


Figure 3.2 Percentage Seats Vs. Percentage Votes in Plurality Election

set of calculations ranged between 13.5 and 14.9 percent. The other set of predictions applied a common standard deviation to the CND function of each election. Table 3.1 lists the actual percentage of vote received by the Labour Party, the predicted seats won, and the actual seats won for each election. It is evident that the predictions of the CND functions for the percentage of seats won by the Labour Party were very close to the actual percentages. Prediction errors for each election ranged between 1.9 to -2.8 percent and 2.2 to -2.8 percent for the actual and common standard deviation values, respectively.

Table 3.1 ACTUAL AND PREDICTED PERCENTAGE OF SEATS WON BY THE LABOUR PARTY IN BRITISH ELECTIONS BETWEEN 1945 AND 1970

Election Year	Vote Received (%)	Predicted Percentage of Seats Won			Actual Seats Won (%)	Prediction Error		
		Actual σ	$\sigma = 13.7$	Cube Law*				
	(a)	(b)	(c)	(d)	(e)	(e) – (b)	(e) – (c)	(e) – (d)*
1945	54.8	63.9	63.6	64.1	64.9	1.0	1.3	0.8
1950	51.5	54.2	54.2	54.5	51.4	– 2.8	– 2.8	– 3.1
1955	48.3	45.4	45.0	44.9	44.5	– 0.9	– 0.5	– 0.4
1966	53.5	59.4	60.0	60.4	58.9	– 0.5	– 1.1	– 1.5
1970	48.1	44.8	44.5	44.3	46.7	1.9	2.2	2.4

Source: Gudgin and Taylor, 1979

* Calculated by author

The common standard deviation of 13.7 percent was selected by Gudgin and Taylor intentionally. The slope of a CND function calculated with this standard deviation is very nearly three at the point where a party receives 50 percent of the popular vote (Gudgin and Taylor, 1979). This is important because this slope matches that of the S shaped distribution of the law of cubic proportions at the same 50 percent point. Figure 3.2 illustrates this distribution which is expressed mathematically as:

$$S = \frac{v^3}{v^3 + (1 - v)^3}$$

where S = population of seats and V = proportion of votes

Gudgin and Taylor (1979) argue that since the **cube law** is a mathematically simpler distribution that very closely matches the CND with a standard deviation of 13.7 percent, it can be used to accurately relate the percentage of seats won to the percentage of votes received in a two party plurality election. For example, using the cube law equation and assuming that gerrymandering does not exist, a party that receives 55 percent of the popular vote could expect to win 64.6 percent of the seats in the legislature. In Table 3.1, the predictions for the

percentage of seats won in each of the elections was relatively close to the actual percentage won, With prediction errors ranging between -3.1 and 2.4 percent. Although the error range is slightly larger for the cube law as compared to those of the CND functions, the cube law prediction was closer to the actual percentage of seats won in both the 1945 and 1955 elections.

The cube law was first used to describe the relationship between votes and seats in a plurality election by James P. Smith in a submission to the 1910 Royal Commission on Systems of Elections (Qualter, 1968). Kendall and Stuart (1950) and Butler (1963) applied it to plurality election results to dispell the myth that the relationship between votes and seats was random and /or haphazard (Qualter, 1968). Other academics that have demonstrated that the cube law can adequately predict this relationship in a two party plurality election, assuming that gerrymandering does not exist, include Qualter (1968), Casstevens and Morris (1972), Rae (1971), and Taylor and Johnston (1979).

Two attempts have been made to modify the cube law to predict the percentage of seats that can be won with a given percentage of the popular vote in a multi party election (Qualter, 1968; Casstevens and Morris, 1972). However, the cube law function has not performed as well at predicting the votes-to-seats relationship in multi party elections as it has in two party contests (Gudgin and Taylor, 1979). The Qualter modification has been labelled as an example of "blind modelling" because it models the results and not the process (Gudgin and Taylor, 1979). Since the Casstevens and Morris "decomposed cube law" function is based upon Qualter's, it too has fundamental conceptual weaknesses (Gudgin and Taylor, 1979). Besides being conceptually weak, these models have failed to predict the

votes-to-seats relationship in multi party plurality elections outside of Canada (Gudgin and Taylor, 1979).

The fact that the cube law function does not perform well in elections where a third major party or several minor parties are contesting seats, does not mean that the results of multi party elections are less disproportionate in terms of the votes-to-seats relationship. In effect, the presence of either a third major party or several minor parties reduces the percentage of the vote that is needed to ensure victory. In a three party election, for example, the winning threshold is 33 1/3 percent, as compared to 50 percent for a two party election. As a result, third or minor parties allow a lower proportion of the votes to be as effective as a higher percentage of the votes in a two party contest. In elections involving more than two parties, or where an abnormal distribution of votes exists throughout the ridings, as would be the case in gerrymandered districts, the relationship between the number of seats won and the popular vote received would be more disproportionate than predicted by the cube law. An example of this phenomena is provided in the following discussion on the direct effects of gerrymandering.

3.3 Effects of Gerrymandering

Gerrymandering can either directly or indirectly undermine some of the basic principles of democracy. The direct effects of gerrymandering usually result in over-stating the governing party's popularity and possibly extending the government's tenure. The indirect effects usually occur after an extended period of gerrymandering and can lead to voter apathy, reduced representative accountability and responsibility, and the election of weak candidates (Busteed,

1975; Morrill,1981). Gerrymandering can also produce altruistic effects. Lijphart (1981) notes that riding boundaries can be drawn so that political or ethnic and racial minorities are given elected representation. He uses the terms **sophisticated** and **affirmative gerrymandering** to describe the creation of such ridings (Lijphart, 1981, p.901).

In 1973, when the California Legislature was unable to agree on reapportioning the state, the California Supreme Court took charge of the process and created seats that were winnable by black candidates (Cain, 1984). Eight years later, in the next reapportionment, the Legislature managed to delineate districts that Hispanic candidates were able to win (Cain, 1984). The main goal of gerrymandering, however, is not to ensure that political or cultural minorities receive membership in the legislature. Efficient gerrymandering maximizes the relationship between the votes that the government receives and the number of party members elected.

The most significant direct effect of gerrymandering is the over emphasis of one party's support at the expense of all other parties. Due to the spatial arrangement of voters and the cube law relationship between votes and seats in a plurality election, a party obtaining a slight majority of the popular vote can form a majority government. For example, according to the cube law function, a party that receives 51 percent of the popular vote in a two party contest can expect to win 55.1 percent of the seats in the legislature. However, through thoughtful delineation of riding boundaries during redistribution, the relationship between votes and seats in a plurality system can be even more disproportionate. Gerrymandering can allow a party to form a large majority government when its

victory, in terms of popular vote, is marginal (Muir, 1975; Prescott, 1978; Taylor and Johnston, 1979; Gudgin and Taylor, 1979; Morrill, 1981; Rumley, 1985). In extreme cases, gerrymandering can result in a party forming the government without receiving a majority of the popular vote. In the famous 1812 gerrymander, for example, the Republican-Democrats received 49.2 percent of the vote (602 votes fewer than the Federalists) yet they won 72.5 percent of the Senate Seats (Taylor and Johnston, 1979).

Delineation of riding boundaries in order to overstate a government's power base has not been restricted to the United States. In 1882, the ridings of several Canadian provinces were readjusted by the Conservative Party. This redistribution has been called "The Gerrymander of 1882" (Cartwright, 1912; Dawson, 1935; Ward, 1950) and the boundaries of the 14 or 15 safe Tory seats remained in effect until the readjustment following the 1904 election (Cartwright, 1912). Because of this gerrymander, the Conservatives won a majority of the seats with less than half the popular vote in the elections of 1882 and 1887 (Cartwright, 1912). In the election of 1891, the Liberals received 7,276 more votes than the Tories, but won only 44 seats in the House of Commons compared to the Tories 48. Not only did the Conservatives win the three elections between 1882 and 1891 due to the gerrymander, but they also withstood over half a dozen non-confidence motions (Cartwright, 1912). This gerrymander, then, not only over stated the Conservative's power base, but it also allowed them to remain in power longer than they might have had a fair set of ridings been in place.

The indirect effects of gerrymandering result from a domino effect of several factors. The first factor is time. If gerrymandered ridings are left in place for

several elections, voters in these constituencies may become aware of the fact that the incumbent or the incumbent's party can not be defeated. This would be possible because the riding boundaries of these districts group together enough government party supporters so that this party always wins. This in turn could lead to the second domino of voter apathy. Because individual voters in these constituencies do not feel that their vote will alter the election results, they may become apathetic and not exercise their franchise (Busteed, 1975; Morrill, 1981). Voter apathy also has several consequences. If both the voter and the incumbent perceive that a change in a riding representative is unlikely, the lines of accountability and responsibility between the constituent and the politician can disintegrate. Incumbents who believe that they are assured of re-election may also feel that they are above voter reproach. This can lead to a representative supporting policies and measures in the legislature that are not in the best interest of his/her constituents (Busteed, 1975; Morrill, 1981). As well, if the government is confident that it will be victorious in particular safe ridings, it may decide to run weak candidates who might otherwise not get elected. Candidate placement of this sort could also be a form of party patronage where service to the party and not the voter would be the deciding factor (Busteed, 1975; Morrill, 1981). While the indirect effects of gerrymandering are dependent upon a series of factors, they can be just as important as the direct effects in undermining some of the basic principles of democracy such as majority rule and representative accountability and responsibility.

3.4 Methods of Gerrymandering

The two basic goals of successful gerrymandering are to: a) waste the opposition vote, and b) efficiently use the government's vote. In order to accomplish this, a government must determine the location of both traditional government and opposition support. It can then draw riding boundaries that will maximize and minimize the support for the government and opposition, respectively. To illustrate this process, consider the hypothetical country shown in Figure 3.3. There are 600 voters and two political parties, A and B, and each party is supported by one half the voters. However, each party has a region where it is the favoured party (the West for Party A and the East for Party B), and consequently each has two seats in the four seat legislature. For the purpose of this illustration, it is assumed that party support is evenly distributed in each region. In Figure 3.3 the country is in a political stalemate. Even though each party has the same number of supporters, it is still possible for one party to form the government.

The ridings in this country can be delimited many different ways so that each will produce an obvious political winner. Four distinct gerrymanders are illustrated that favour Party B. The first depicts a situation where no limits are placed on the population differences between ridings. Malapportionment is allowed in the first case but will be limited in cases two and three and not allowed at all in case four.

The first system of ridings divides the country into seven constituencies. The six eastern ridings contain 50 voters each while the large western district has a population of 300 voters. This configuration of one western and several eastern

120 (A) 30 (B)	30 (A) 120 (B)
120 (A) 30 (B)	30 (A) 120 (B)

Figure 3.3 Country With Two Party Plurality Electoral System

240 (A)	10 (A)	40 (B)
	10 (A)	40 (B)
	10 (A)	40 (B)
60 (B)	10 (A)	40 (B)
	10 (A)	40 (B)
	10 (A)	40 (B)

Figure 3.4 A Gerrymander With Malapportionment Allowed

120 (A) 30 (B)	20 (A) 80 (B)
	20 (A) 80 (B)
120 (A) 30 (B)	20 (A) 80 (B)

Figure 3.5 A Gerrymander With 33 ⅓ Percent Population Tolerance

80 (A) 20 (B)	15 (A) 60 (B)
80 (A) 20 (B)	15 (A) 60 (B)
80 (A) 20 (B)	15 (A) 60 (B)
80 (A) 20 (B)	15 (A) 60 (B)

Figure 3.6 A Gerrymander With 25 Percent Population Tolerance

120 (A)	180 (A)
30 (B)	270 (B)

(a)

120 (A)	60 (A) 90 (B)
	60 (A) 90 (B)
30 (B)	60 (A) 90 (B)

(b)

Figure 3.7 A Gerrymander With Zero Population Tolerance

ridings was chosen for two reasons. First, half the voters in the country support Party A, the party that will be partitioned into a minority position in the legislature. Second, the support for each party is evenly distributed throughout each region. These two facts, make it impossible for Party B to win every riding in the country as Party A will always have an advantage in the west. If, however, the boundaries of the western region are used to define one large riding, (Figure 3.4) Party A would win one seat due to its regional advantage. Conceding a seat in this fashion is referred to as either concentrating or packing the oppostion's vote (Taylor and Johnston,1979; Morrill, 1981). Since Party B enjoys a similar regional advantage in the east, it can form the government if this region is divided into more than one riding. Because this example allows malapportionment, the east has been divided into six small equally sized constituecies. In this system of ridings, Party B would obtain six of the seven seats in the legislature even though each party would receive the same number of votes.

The second system of ridings (Figure 3.5) is based upon the criterion that the population of the smallest riding must not deviate by more than 33 1/3 percent from the largest. The gerrymander is accomplished by first deciding upon the population of the largest riding. The total number of voters, the location and the number of voters that support each party as well as the 33 1/3 percent population differential all have to be considered in calculating this system of ridings. With the population of the largest riding set at 150 voters, the population of the small ridings can include no fewer than 100 voters. Since the objective of the gerrymander is to minimize the number of seats that Party A will win, the large ridings are placed in the west. This allows the more numerous smaller

constituencies to be located in Party B's stronghold. Since each region has 300 voters, the west receives two ridings and the east three. In this system, Party A wins both western ridings, but Party B forms the government because it wins the three eastern seats.

The third configuration of constituencies is developed so that the population of the smallest riding must be not more than 25 percent below the largest. Again the population of the largest riding is calculated first using the same factors employed in the last example. This time the largest ridings are to include no more than 100 voters. As a result, the smallest can contain no fewer than 75. The large constituencies are again placed in the west so as to minimize the number of seats Party A wins and Party B forms the government, by winning four of the seven seats in the legislature.

The fourth example demonstrates that gerrymandering is possible even if all ridings are required to have equal populations. Since half the country supports Party A, it can not be gerrymandered out of the legislature. However, the Party can be limited to one seat if the riding is designed in such a way as to consume much of this support while leaving the regional strength of Party B intact. Party A's riding will be located in the western region although it will not be able to encompass the entire region due to the equal population criterion. Next, the area not included in this constituency, that still favours Party A at a ratio of four to one, must be divided and allocated to ridings that are mostly composed of supporters of Party B. These eastern based ridings must be designed so that the support for the latter party is greater in each district than Party A's residual support left over from the west plus the minority of voters who favour Party A in

the east. At the same time the population of each riding must be the same. The first step in this gerrymander is to create Party A's safe seat. Figure 3.7 illustrates the north-south boundary that delimits a western district of 150 voters, 120 of which support Party A. This leaves 450 voters that must be assigned to three ridings of 150 each. Figure 3.7 indicates that 270 of these remaining voters support Party B, while only 180 favour Party A. If these voters were delimited by north-south boundaries a political stalemate would result because each party would win the two seats assigned to its repective region of support. However, if the remaining three electoral districts are demarcated with east-west boundaries, Party B wins all three ridings and obtains a majority of three seats to one in the legislature. This results because half of Party A's western support is effectively packed into one constituency. The remaining support for the Party is divided into three equal subareas and added to three subregions that strongly favour Party B.

In each of the foregoing gerrymanders, Party A's support was wasted by allowing it to win a few western ridings where it enjoyed a distinct voter advantage. As well, Party B's support was efficiently used in the more numerous eastern ridings. Cain (1984) would argue that each of these gerrymanders was accomplished even though the districts were "compact". Although each constituency is represented by a simple geometric figure, that is a rectangle, neither Morrill (1981) nor Rumley (1985) would describe them all as being compact. According to their definition, an electoral district is compact if its length (maximum diameter) is less than twice its width (minimum diameter). However, no riding boundary had to meander through a region in order to

selectively collect voting support that favoured one of the parties. This was possible because party support was assumed to be evenly spread throughout each party's regional stronghold. Although there are small regions that strongly favour one party over the other(s), in actual elections it would be highly unlikely that partisan support would be evenly distributed over an entire riding.

It is still possible, however, to gerrymander when voting support is not evenly spread throughout a region. A safe riding can be produced by carefully selecting and grouping together polling stations of similar political support. These safe ridings can be either contiguous or non-contiguous in nature. Figure 3.8 illustrates one contiguous and one non-contiguous riding. A contiguous district has one continuous, unbroken delimiting boundary line and the entire constituency population is contained within it. Assigning spatially separated regions together to form electoral districts creates ridings that are not contiguous, or in other words, ridings that are composed of two or more separate and distinct electoral islands.

In an attempt to ensure the defeat of radicals in France in 1852 following male sufferage, Lois Napoleon formed several non-contiguous ridings. Some areas of radical support were combined with larger more populous regions of government support in order to prevent the radicals from gaining political power. Figure 3.9 illustrates two double and one triple "island" ridings that were near Lille, France (Taylor and Johnston, 1979). Ridings of this sort are readily apparent by viewing electoral district maps and immediately become suspect of gerrymandering.

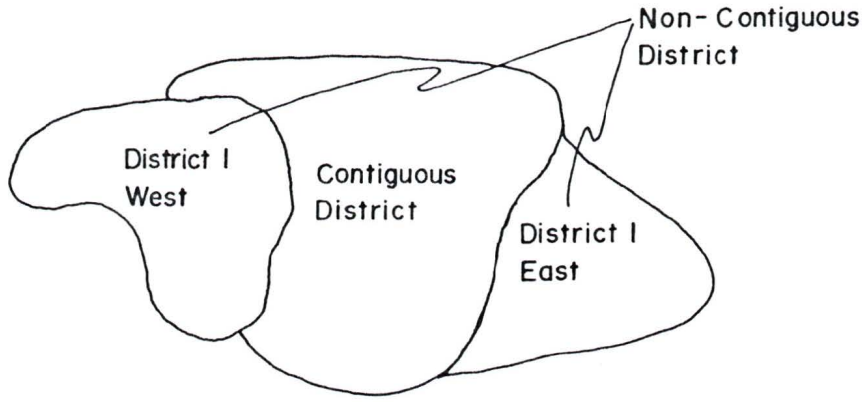


Figure 3.8 Contiguous and Non-Contiguous Electoral Districts

Safe ridings can also be created without designing non-contiguous districts. The careful selection and grouping together of polling stations with known political support can also produce a safe riding. In this case, ridings are created by systematically selecting safe polling stations that have a section of their boundary touching a portion of the riding that is being redistricted. A riding created in this fashion could be seen to meander through the electoral system, grouping together many small and immediately adjacent pockets of known political support. This was one of the features of the 1812 Gerrymander (Taylor and Johnston, 1979; Morrill, 1981). Ridings of this sort have a very long boundary considering the area that is delimited and they are described as being either "non-compact" or "irregularly shaped".

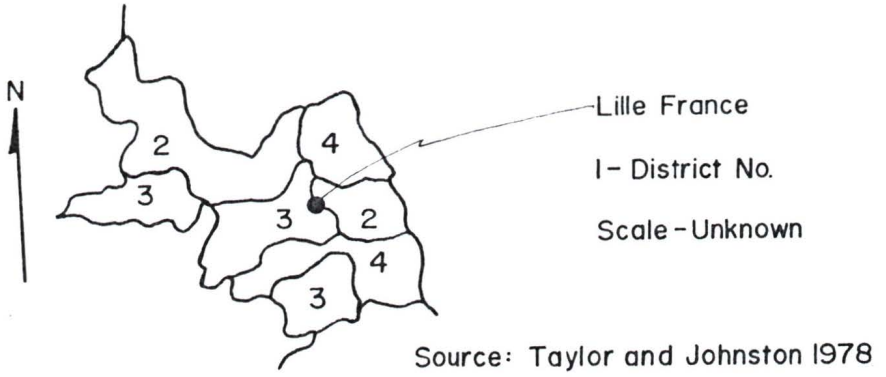


Figure 3.9 Non-Contiguous Ridings Near Lille, France, 1852

Another feature of gerrymandered districts is that existing functional or natural boundaried are ignored. Frequently, safe ridings flout or sever other administrative, municipal, or manmade boundaries such as major arterial roads and highways, natural barriers such as water bodies and mountain ranges, and cultural and/or ethnic encalves (Sauer, 1918; Nagel, 1965; Bunge, 1966; Prescott, 1972; Muir, 1975; Taylor and Johnston, 1979; Lijphart, 1981; Morrill, 1981; Rumley, 1985; O'Loughlin, 1987). An example of gerrymandering that illustrates ignoring natural barriers and physical links, the 1961 readjustment of the New York City Congressional Districts, is shown in Figure 3.10.

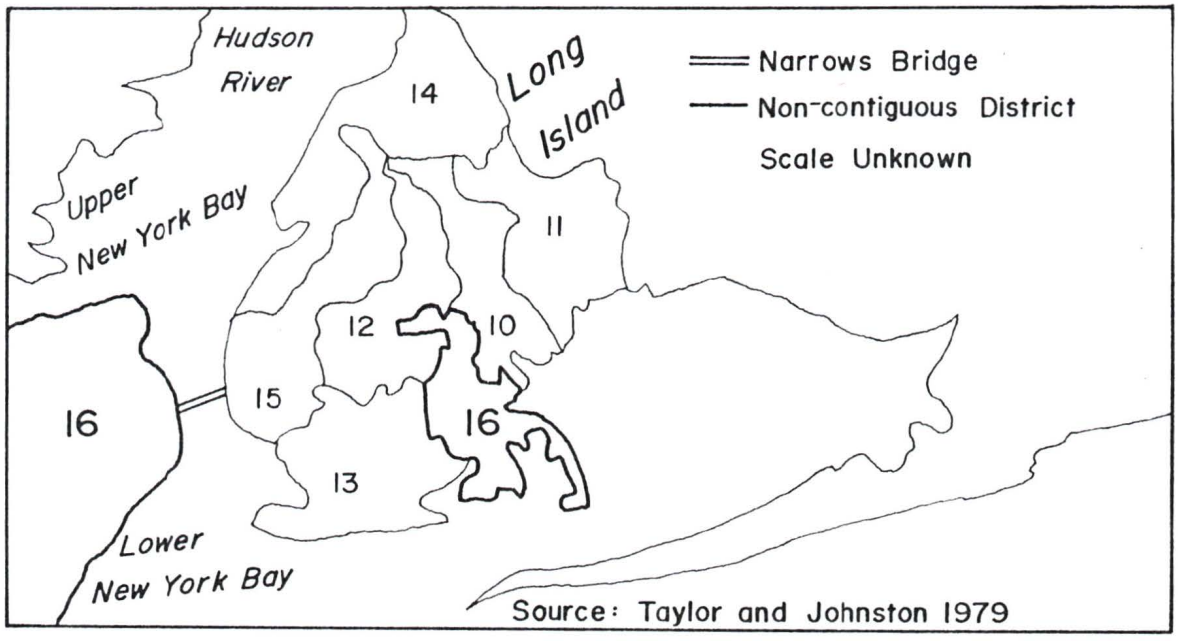


Figure 3.10 1961 New York City Congressional Districts

This reapportionment contains many non-compact and two non-contiguous districts and was labelled the "New York menagerie" by journalists G. Tyler and D. Wells in 1961 (Taylor and Johnston, 1979). The 6th, 8th, 14th, 15th, 23rd, and 24th districts each have extremely convoluted boundaries while the 16th is composed of physically separated regions. The 16th Congressional Seat combines Staten Island with a distant population from Flatbush located on Long Island. Tyler and Wells described this two sectional district as a vulture flying back to its oversized egg

(Taylor and Johnston, 1979). This politically convenient link ignored two physical entities. First, as depicted in Figure 3.10, these two regions of Republican support were separated by water, the Lower New York Bay. Second, the Narrows Bridge that joined Staten Island to district 15 was ignored. If population was needed to bring the Staten Island Congressional Seat up to the electoral quota, it would have made geographic sense to combine a portion of district 15 with the Island because of the bridge link. However, the decision was political, not geographic, and the non-contiguous riding was selected to ensure that the Democrats were defeated by the "imported" republicans (Taylor and Johnston, 1979).

The criterion that specifies that the population of each constituency either be equal to each other or that all riding populations fall within a predetermined tolerence range does not in itself eliminate gerrymandering (Butler and Cain, 1985). As illustrated in the last example, regions of political support which may be separated from each other by considerable physical distance, natural or manmade barriers can be "joined" together until two criteria are met. First, the population of the riding must fall within the specified range and second, enough government support has to be combined in order to defeat the indigenous opposition support. As well, the equal population criterion does not eliminate the establishment of political boundaries that cleave communities of interest, nor does it necessarily respect transportation and communication routes and/or linkages.

Computer programs have been developed to design equally populated ridings. Robertson (1983) suggests that political organizers can use these computer models

to design sets of ridings that will satisfy equal population criteria, while simultaineously serving the interests of the incumbents and the party. He feels that these computer programs have formed a new "Gerrytechnology" (p.128). While the criterion of equally populated ridings can make gerrymandering a little more difficult, it is not a panacea for the maladies of electoral riding readjustment.

In summary, there are several methods of designing politically safe ridings. The goal of gerrymandering is to benefit one party, usually the government, at the expense of the opposition through the careful and deliberate delineation of electoral districts. The objectives of this process are to seek out and combine together areas of like political support in order to maximize the number of seats that are likely to be won by the government. The opposition's support is minimized through the establishment of boundaries that effectively pack or concentrate its votes into as few ridings as possble. If the size of riding populations is unregulated then these opposition ridings can be very large thereby wasting much of its support. Similarly, if a riding population tolerance is specified, effective gerrymandering involves designing "opposition" ridings at the upper end of the tolerance range, while ensuring that all "government" constituencies are at the lower end. This allows the creation of as many government seats as possible and minimizes the number of seats won by the opposition while readjusting within the electoral quota regulations. The objectives of gerrymandering do not respect existing functional, natural, or administrative boundaries. Likewise, communities of similar interests or economic bases may be carved apart in order to satisfy political ends. However, it is difficult to design

politically safe districts while limiting malapportionment, and respecting communities of similar interests, natural and man made boundaries without creating non-compact, irregularly shaped, or non-contiguous constituencies.

3.5 Methods For Detecting Gerrymandering

The use of independent boundary readjustment commissions, particularly those that have their final recommendations enacted without a debate in the Legislature, has drastically reduced the opportunity for any one party to control the redistribution process (Courtney, 1984). As a result, it is extremely unlikely that blatant gerrymandering could occur in such a situation. However, there is still a need to develop a method that can detect political bias in a system of constituencies. This is the case for several reasons. First, there are very few permanent electoral readjustment commissions that have their final recommendations automatically adopted. The federal and Quebec commissions are the only two in Canada. Second, there is no such thing as a politically neutral system of constituencies. Any set of ridings, even those created by independent commissions, create political consequences (Anstett and Qualter, 1976). This does not mean to imply that these commissions set out to favour one particular party. It simply means that since plurality elections are dependent upon the results of voting at the constituency level, it is unlikely that different patterns of ridings will produce exactly the same political results in the Legislature. The task then becomes one of determining which system of electoral ridings is the fairest.

Third, there may be occasions when it is philosophically or politically desirable to allow a certain cultural, ethnic, or political minority representation in

the Legislature. Allowing for this type of representation through purposeful riding boundary delimitation is known as "affirmative gerrymandering" (Lijphart, 1981), and it would be necessary to detect the required region(s) in order to achieve this result. Fourth, as indicated in the preceding chapter, not every redistribution is carried out by an independent commission whose final recommendations are promulgated without the need of a majority vote in the Legislature. In situations where final riding redistribution approval depends upon the need of a majority vote in the Legislature, it is very important that the oppostion or any other political observer be able to detect instances of riding delineation that, depending on voter location, discriminates between voters.

Redistricting provides the opportunity for a political party to enhance its success at the polls by the careful agglomeration of voters. A gerrymandered riding or set of ridings cannot be produced, however, without leaving some evidence to suggest that one party has been favoured over the other(s). Some of these clues are blatant. One of the most obvious being the case when a party wins a majority of the seats while receiving fewer votes than any "opposition" party, as was the case in the original 1812 redistricting. Another observation that tends to raise speculation that constituency boundaries have been partisanly delineated occurs when some ridings are won by the opposition with a large majority of votes. This can be a signal that the opposition's vote has been concentrated and wasted (Taylor and Johnston, 1979; Morrill, 1981). Since redistribution takes place between elections, it is not until election results are analyzed that the foregoing symptoms of gerrymandering can be conclusively determined.

This does not mean to say, however, that certain readjusted ridings are not suspected of being partisanly created prior to an election. Assuming the acceptence of the principle of one-person one-vote, any electoral system, either existing or proposed, that contains ridings with populations that deviate by a wide margin from the electoral quota is highly suspect of being an unfair distribution. While limiting malapportionment does not in itself eradicate gerrymandering, it is far more difficult to design politically safe ridings when strict limits are placed on riding populations (Qualter, 1970; Backstrom, Robbins and Eller, 1978; Taylor and Johnston, 1979; Morrill, 1981; Robertson, 1983; Ruff and Ross, 1987; Boston, 1987). There is a wide variation, however, in setting these population tolerance levels. They range from plus or minus one to 25 percent. For example, the state of Washington's Congressional Districts were redistributed in 1972 fulfilling the plus or minus one percent criterion while Canadian federal ridings have been readjusted using a population tolerance of plus or minus 25 percent (Morrill, 1973; Qualter, 1970; Ruff and Ross, 1987; Courtney, 1988; Fisher, 1988).

Three alternate tolerance levels that have been suggested are five, ten, and fifteen percent. Morril (1976) found that redistricting while achieving a one percent deviation in population was extremely difficult. As a result, he suggested that in cases where district population was in excess of 100,000 the population tolerance should be plus or minus five percent (Morrill, 1981). He further recommended that a plus or minus ten percent level be applied to all other redistributions (Morrill, 1981). Qualter (1970), in criticizing the Canadian federal limit of 25 percent, suggested that a fifteen percent range would allow a redistribution authority considerable discretion in fulfilling their task. In the 1987

Canadian federal redistribution, the Saskatchewan Commission designed all the Province's federal constituencies so that each riding was within plus or minus five percent of the electoral quota (Courtney, 1988). Ruff and Ross (1987 and 1988c) recently suggested that a level of plus or minus ten percent is both fair to the principle of one-person one-vote and pragmatic. This view was supported in the recommendations of the Royal Commission on the Electoral System in New Zealand. The Commission suggested that the allowable population tolerance be set at plus or minus ten percent (Boston, 1987). In further support of a ten percent tolerance range is the fact that the Manitoba Electoral Boundaries Commission used this limit as a guideline while achieving its mandate in its 1988 preliminary report (Ruff and Ross, 1988c). This decision of the Commission was based on the fear that a court challenge of its preliminary report was possible under the Canadian Charter of Rights and Freedoms if a 25 percent population tolerance had been used (Ruff and Ross, 1988c).

A specific population tolerance level can be used to identify malapportioned ridings. However, such a criterion does not evaluate the degree to which the entire electoral system is, or is not, malapportioned. Qualter (1970) pointed out that neither the average population deviation from the electoral quota nor the extreme allowable limits of any redistribution completely describe the system of ridings. This is particularly true of situations where actual riding populations are well within the prescribed extreme limits. For example, the fact that each of the current fourteen federal Saskatchewan ridings deviates no more than four percent from the electoral quota is not readily apparent from the fact that all ridings have populations that are within the 25 percent limits (Ruff and Ross, 1988C). As well,

knowledge of the extreme limits does not infer the amount of influence that wide spread malapportionment may have on election results.

Qualter (1970) suggested that the Dauer-Kellsey (D-K) index is well suited to analyze the system of ridings as a whole for malapportionment. The D-K index is calculated in three steps. First, the ridings are listed in rank order from smallest to largest according to population. As well, the number of representatives that each constituency elects is listed with the riding population. Second, the number of representatives that would constitute a simple majority in the legislature is determined. Last, the minimum population that is required to elect a majority government is calculated by summing together the populations from the smallest to the last district that is needed to obtain a majority of one in the legislature. The D-K index value is the minimum population, expressed as a percentage of the total populaton for all districts, that is needed to elect a government (Qualter, 1970). Although no limit has been suggested that would indicate a severely malapportioned system of ridings, the closer the index value is to 0.50, in a two party election, the higher the likelihood that the distribution is not malapportioned. It is recommended, therefore, that the D-K index be used with the ten percent tolerance range to identify malapportionment in the case study.

Still other ridings suspect of being gerrymandered can be identified from the map of the proposed electoral districts. Ridings with boundaries that cross or ignore natural or manmade barriers may be suspected of gerrymandering (Morrill, 1981; Cain, 1984). While electoral districts that do not respect communities of similar economic bases or cultural and/or ethnic backgrounds are not necessarily evident from the electoral map, they too can be symptoms of the redistribution

malaise. Non-contiguous ridings appear on electoral district maps as multiple sectioned ridings that are separated from each other by at least one other district. Some non-contiguous ridings can be blatant examples of grouping together regions of known political support.

Other non-contiguous ridings are legitimate. This would be the case if an island did not have enough population to warrant its own seat in the legislature. When these non-contiguous ridings are formed they should amalgamate the island's population with the riding on the mainland that is linked to the island by either a bridge or a ferry route (Taylor and Johnston, 1979). These ridings must be analyzed to assure that the closest or linked mainland riding has not been "leap-frogged". An example of "leap-frogging" occurred in the 1961 redistricting of the New York City Congressional Districts. In this case a Long Island district that was quite remote from Staten Island was added to the island's population even though another riding was linked via the Narrows Bridge (Taylor and Johnston, 1979).

Non-compact and irregularly shaped ridings have been associated with gerrymandering ever since Governor Gerry signed the Massachusetts Senate Redistrictng Bill of 1812. The boundaries of these districts were convoluted and they formed irregular areal patterns on the electoral map. As a result, constituencies of this sort are easily found by map inspection and are immediately questioned. The 1812 Massachusetts' ridings were not compact in the sense that the ratios between their boundary length and the area within the boundary were higher than the same ratios for standard geometric shapes. According to Bunge (1966), the most compact shape is that of a circle. Non-compact ridings continue

to be associated with gerrymandering. As recently as 1986, riding shape and compactness were used by the United States Supreme Court to rule that the 1981 Indiana redistricting "...violated the Equal Protection clause by drawing districts that diluted the voting strength of Democrats." (Backstrom and Robins, 1987, p.103)

Although a riding may be non-compact or irregularly shaped, it is not necessarily gerrymandered. This is particularly true of large rural or remote constituencies that are delineated by mountains ridges or water bodies. These electoral districts are large because their population densities are inherently low and huge areas are needed in order to satisfy population limits (Cain, 1984). Boundary setting authorities do not have much control over riding shape in these environments. Respecting communities of common interest, such as Indian reservations, natural barriers and transportation and communication routes are more important than designing compact or regularly shaped remote ridings (Morrill, 1981; O'Loughlin, 1987; Ruff and Ross, 1988).

A method that could be employed to detect gerrymandering would involve applying the results from the last general election, on a poll-by-poll basis, to the redistributed ridings. If the results indicate that one party would benefit at the expense of the other(s), due solely to the system of electoral districts, then a claim of gerrymandering may be justified. In such an hypothetical election, gerrymandering could be suspected if many ridings "won" by the opposition were landslide victories, a large majority of the ridings "won" by slim majorities were government victories, and/or the government's total percentage of the popular vote was less than that of any opposition party. These symptoms of

gerrymandering concentrate the opposition's vote in as few ridings as possible and make efficient use of the government's vote in as many ridings as possible (Busteed, 1975; Musgrove, 1977; Taylor and Johnston, 1979; Morrill, 1981). However, this method of detecting gerrymandering has some serious drawbacks. First, if several years have passed since the last general election, there is little reason to believe that the voting population has remained the same; people will have moved, died, or come of legal voting age since the last election (Backstrom, Robbins, and Ellis, 1978). The people currently living in a polling area may not be the same group that lived there at the time of the last election.

Second, there may have been a major election issue during the last general election that could have polarized the voters in an unusual manner (Backstrom, Robbins, and Ellis, 1978). In such an election, voters may have responded emotionally or morally to the issue and crossed usual party lines. Using election results from an election that was dominated by such a major issue may not provide a set of election results that incorporate traditional party allegiances.

Regardless of whether politically safe ridings are created purposely or accidentally, they can be extremely difficult to detect prior to an election being held using the redistricted ridings. In order to prevent the creation of politically safe electoral districts, a method of detection, other than applying the results of the last general election to the new ridings, is required.

Johnston (1976) suggested a model that could be used to determine if a redistribution was fair. He felt that a system of ridings was not biased if the losing party would receive the same percentage of seats in an hypothetical two party election as the victorious party actually received, given the same

percentage of popular vote. Although this method could assess the degree that one party was favoured over the other, it requires that at least one election be held using the boundaries in question. Johnston's (1976) method therefore, has no predictive capacity.

O'Loughlin (1982) used the LAP (Location-Allocation Program) computer program in three American case studies to check for racial gerrymandering. He ran the LAP program approximately 100 times for each case study, using six criteria and then determined a ratio (F) of the between- to within- variance for the black population across all districts for each redistribution. A large value of F indicated high racial concentration and a low F ratio was indicative of racial heterogeneity. The F ratios were converted to standard z scores and the probability that a particular redistricting was due to chance was computed. O'Loughlin, however, did not suggest a method for measuring the non-compactness of a region. His research goal was to suggest a means of assigning the "burden of proof" should a particular readjustment be contested in a court of law, which has frequently occurred in the United States (Butler and Cain, 1985). He felt that this was important because the plaintiff in such cases is usually left with the onerous task of proving that a redistribution has been gerrymandered. Using O'Loughlin's methodology, a plantiff could make a case for shifting the "burden of proof" to the districting authority. However, simply shifting the task of proving or disproving the existence of gerrymandering does not assist with the development of a method to detect this malaise.

Considerable work has been undertaken dealing with measuring the degree of compactness of a geographic region and designing methods for constructing

compact regions (see for example, Weaver and Hess, 1963; Boyce and Clarke,1964; Nagel, 1965; Bunge, 1966; Schwartzberg, 1966; Goodchild and Massam, 1969; Rushton, Goodchild and Ostrech, 1973; Johnston, 1976; Morrill, 1981; O'Loughlin, 1982; Rumley, 1985; MacEachren, 1985). All the methods that measure the compactness of a region do so by producing either an index or ratio of compactness. However, no absolute index or ratio has been established that can conclusively identify a gerrymandered political district (Backstom and Robins, 1987). As well, there have only been a few occurrences when these methods have been compared and evaluated as measurements of the compactness of electoral districts (Morrill, 1981; O'Loughlin, 1982; Rumley, 1985; MacEachren, 1985).

Cain (1984), however, points out that it is difficult to design compact ridings without violating natural or man made boundaries both in urban and rural environments. He attempts to build a case to illustrate that compact districts are not partisanly more fair than non-compact constituencies. In doing so, he performs a series of redistributions on a hypothetical, two party state and suggests that the highly "compact" readjustment is less fair than the non-compact solutions. There are, however, problems with his example. First, he does not describe how to measure a district's compactness nor does he define the point that differentiates a compact constituency from a non-compact one. He simply points out that both circles and squares are compact and aesthetically pleasing. Cain (1984) also implies that all rectangular districts are compact, because they have straight line boundaries. Frolov (1975), Morrill (1981), Rumley (1985), and MacEachren (1985) would refute this implication. In particular, both Morrill (1981) and Rumley (1985) would only classify rectangles that have lengths that are less than twice their respective widths as being compact.

Second, over 62 percent of his "compact" rectangular districts in his most compact readjustment do not satisfy the Morrill (1981) definition. As a result, the "compactness" of this solution is questionable. Third, Cain's (1984) hypothetical state only has two cities and they are immediately adjacent to each other. Despite the fact that two cities exist, only 25 percent of the state's population is urban. This is hardly indicative of a modern North American state or province. Due to the lack of urbanization in this state, the need to cross municipal boundaries in order to create fair, compact and equally populated electoral districts is over stated in Cain's (1984) example. As a result of these shortcomings, it is difficult to accept Cain's (1984) argument that compact constituencies are no fairer than non-compact districts. However, it is interesting to note that his redistribution which generated the most seats for the minority party made extensive use of irregularly shaped constituencies.

Even though non-compact or irregularly shaped ridings are not necessarily the result of gerrymandering, the existence of these sort of constituencies, particularly in urban settings, may warrant careful scrutiny. It would be difficult to simultaneously satisfy population tolerance limits, preserve communities of common interest, respect natural barriers and man made boundaries, while designing politically safe electoral districts without producing non-compact or irregularly shaped constituencies. By insisting that ridings, particularly those in urban or suburban areas, be compact, the chances of purposely or accidentally creating politically safe electoral districts would be reduced. Therefore, a means of determining a riding's compactness, as well as a benchmark that would differentiate between compact and non-compact districts, would be useful to

include in a method that could be used to assess the degree of fairness in a system of existing or proposed ridings.

Many methods for computing a compactness index for specific shapes have been developed. According to MacEachren (1985), there are four general method types. These basic methods are differentiated according to the 'shape measurement' that is employed in the calculation of the compactness index. The first group of compactness measures is characterized by an index based on a relationship of shape area to shape perimeter. The second group includes all methods that produce an index calculated by comparing the area, diameter, and/or circumference of circles that are related to the shape. Examples of related circles include inscribed or circumscribed circles and circles that have an area that is equal to that of the shape being measured. An index that is derived through a direct comparison of the shape to a standard geometric form is typical of the third group of compactness methods. The last major group includes methods that develop an index by measuring the dispersion of the shape from the shape's centroid (MacEachren, 1985). Morrill (1981) describes this latter group as methods that measure the shape's 'moment of inertia'. Table 3.2 lists the compactness methods that will be described and evaluated.

Methods A and B, from Table 3.2, are both based on the relationship that exists between the perimeter and the area of a two dimensional geometric shape. The perimeter to area ratios for a circle, hexagon, square, and an equilateral triangle each with an area of one square unit are 3.54: 1, 3.72: 1, 4.0: 1, and 4.56: 1 respectively. However, this relationship does not remain constant for shapes other than a circle as the perimeter or area change. For example, the relative

Table 3.2 METHODS OF MEASURING SHAPE COMPACTNESS

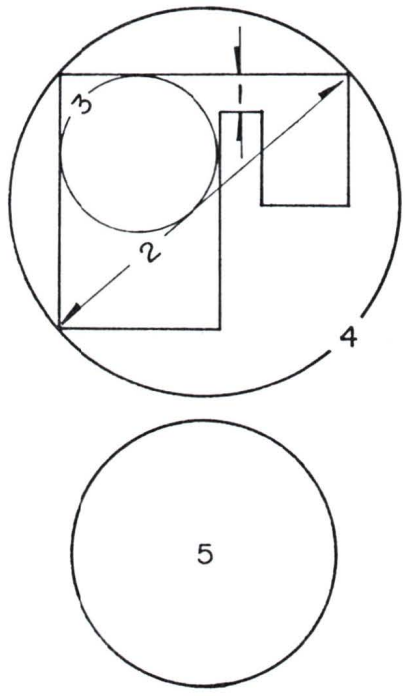
Method Labels	Description
A	$\frac{\text{area of shape}}{0.282\ (\text{perimeter})}$
B	$\frac{\text{area of shape}}{(0.282\ (\text{perimeter}))^2}$
C	$\frac{\text{area of shape}}{\text{area of circumscribing circle}}$
D	$\frac{\text{radius of circle having same area as shape}}{\text{radius of circumscribing circle}}$
E	$\frac{\text{area of inscribed circle}}{\text{area of circumscribed circle}}$
F	$\frac{\text{diameter of inscribed circle}}{\text{diameter of circumscribed circle}}$
G	$\frac{\text{minimum shape diameter}}{\text{maximum shape diameter}}$
H	$\frac{\text{area of inscribed circle}}{\text{area of shape}}$
I	$\frac{\text{circumference of equal area circle}}{\text{perimeter of shape}}$
J	$\frac{\text{area of intersection of the shape and the circle of equal area}}{\text{area of union of the shape and the circle of equal area}}$
K	$1 - \left[\frac{\sum \left\lvert \frac{r\,i\,(100)}{\sum r\,i} - \frac{100}{n} \right\rvert}{200}\right]$
L	$\frac{\text{Area}}{2\pi\ (\sigma x^2 + \sigma y^2)}$
M	$\sqrt{\frac{\text{Area}}{2\pi\ (\sigma x^2 + \sigma y^2)}}$

perimeter/area ratios for a hexagon, square, and equilateral triangle each having a perimeter of 12 units are 1.16: 1, 1.33: 1, and 1.73: 1. Since the simple ratio of perimeter to area does not produce a constant index value for shapes other than a circle as the shape's size varies, it has extremely limited use in determining the relative compactness between different shapes (Frolov, 1975). This problem can be overcome, however, by either squaring the perimeter value or by taking the square root of the area (MacEachren, 1985). As well, by applying a constant factor of 0.282 to the perimeter value and by inverting the numerator and denominator, these two methods of measuring compactness will produce index values that range from zero to one, as shapes are deemed to be more compact (MacEachren, 1985).

MacEachren (1985) states that method B has a tendancy to overemphasize non-compactness since the perimeter is a major component of the index. This would be particularly true of political districts that incorporate a coastline or a peninsula such as Cape Cod or Long Island as a boundary (Schwartzberg, 1966; MacEachren, 1985). Frolov (1975) criticizes the use of perimeter-to-area indices as meaningful measures of a shape's compactness due to the absence of logic in comparing linear to areal magnitudes. As well, he states that the length of the perimeter is a measure of the indentation intrinsic to the shape's boundary and it should not be used in determining shape compactness. Neither Frolov (1975) nor MacEachren (1985) recommend that either of these methods be used as the unequivocal measure of a region's compactness. As a result, neither of these methods will be used to measure the compactness of the ridings in the case study.

Compactness measures that are calculated using the parameters of circles that are related to the shape being measured are labelled C through I in Table 3.2. These methods use the parameters of three circles that are associated with the shape. These related circles were indentified and proposed as measures of compactness by Ehrenburg in 1892 (Frolov, 1975). The circumscribed circle is the most popular of the three. The diameter of this circle is the longest shape axis. The largest circle that can be inscribed within the shape is used in three of these methods. The third related circle that is employed in this group of methods is the circle that has an area that equals that of the shape. Figure 3.11 illustrates these circles. Method G makes use of both the maximum and minimum shapes axes. The minimum shape axis does not necessarily equal the diameter of the largest circle that can be inscribed within the shape. The difference between these two measurements is clearly shown in Figure 3.11.

Several of the methods in this group are mathematically related. The formulae of methods D and F are equivalent to the square roots of the mathematical expressions of methods C and E, respectively. The compactness measure of method C is derived by dividing the area of the shape being analyzed by the area of the circumscribing circle, while that of method D is calculated by dividing the radius of a circle having the same area as the shape by the radius of the circumscribing circle. The compactness indices of methods E and F are simply the ratios of similar parameters of the inscribed and circumscribed circles. The index of the former is calculated by dividing the area of the smaller circle by that of the larger one, while the index of method F is the quotient of the diameters of these same two related circles. As MacEachren (1985) points out, the squared



1 Minimum Diameter
2 Maximum Diameter
3 Largest Inscribed Circle
4 Circumscribing Circle
5 Circle of Equal Area

Figure 3.11 Related Circles and Minimum Shape Diameter

form of each of these related expressions tend to emphasize the differences between relatively compact shapes while the square root versions maximize the differences among non-compact shapes. The parameters that are needed to calculate the index values for these and the other methods in this group are easy to measure or derive. For the case of measuring the compactness of political districts, Schwartzberg (1966) suggests that a map scaled at 1: 25,000 will provide sufficient detail to measure the appropriate riding shape characteristics.

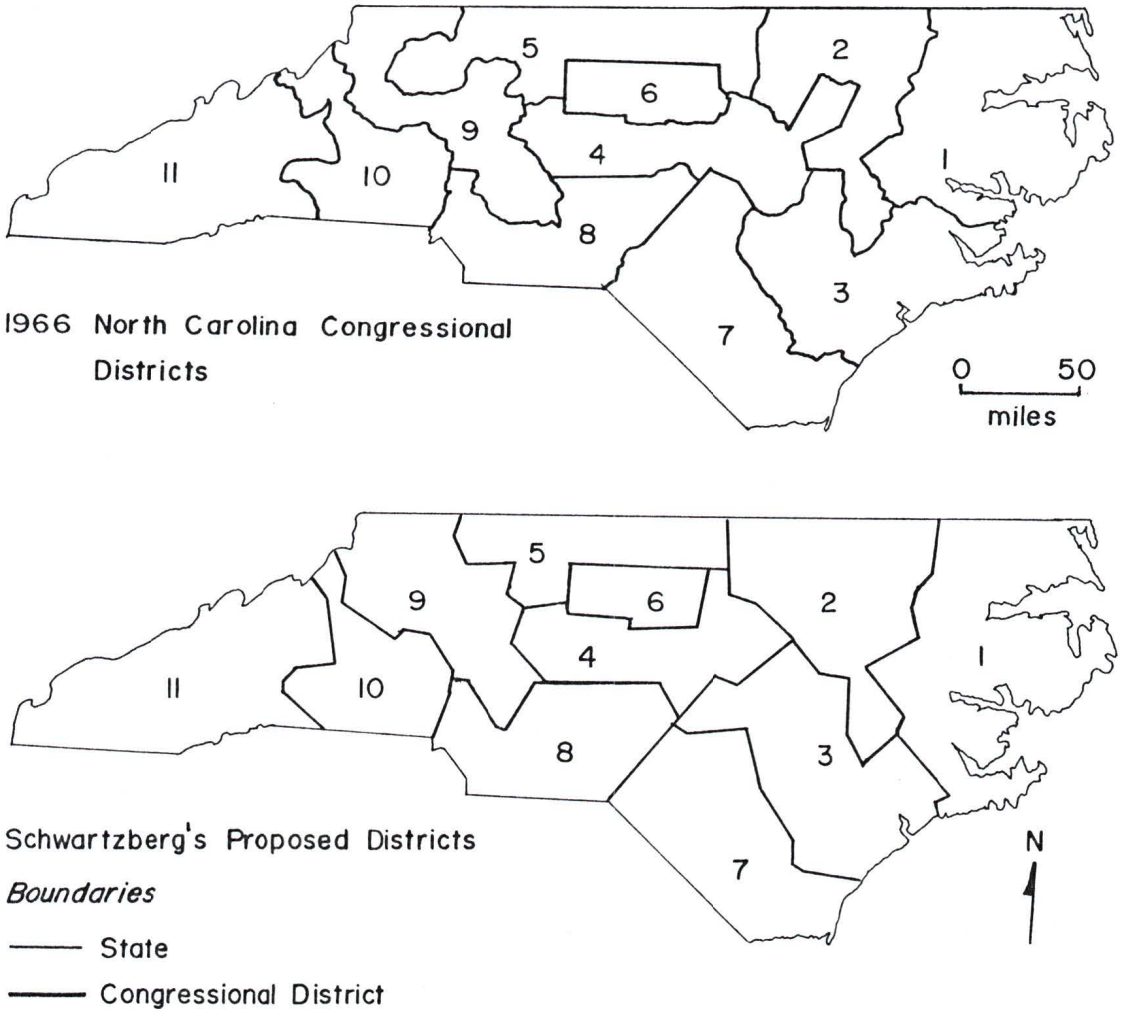


Figure 3.12 1966 N.C. Congressional Districts

These four methods have seen service in measuring the shape and/or

compactness of geographic areas. Reock (1961), Cole (1964) (Frolov, 1975), Backstrom, Robins and Eller (1978), and Austin (1981) applied method C to measure the compactness of political districts. Gibb (1961) used this index to gauge urban form while Haggett (1966) employed it in locational analysis (MacEachren, 1985). Schumm (1956) utilized measure D in studying the evolution of drainage systems (MacEachren, 1985). Method E has seen limited use. It has not been applied since 1892 when Ehrenberg used it to measure the shapes of geographic areas (Frolov, 1975). Method F was used as part of a geologic statistical model by Krumbein in 1965 (Frolov, 1975).

Backstrom, Robins and Eller (1978) conducted an interesting study of the District Court of Minnesota's 1972 reapportionment plan for the state. They concluded that the court's plan was slightly gerrymandered in favour of the Republicans. This conclusion was reached even though the court had redistricted within a two percent population tolerance and had achieved a mean compactness index value of 0.50, using method C, for the 67 seats. Given the strict population tolerance, Backstrom, Robin and Ellis (1978) suggested two additional gerrymandered readjustments. While one plan favoured the Democrats and the other the Republicans, each plan produced a set of districts that had a mean compactness index value of 0.47. Using these results, two compactness classifications can be established for method C. First, the political neutrality of a riding could be questioned if it generated an index vlaue between 0.47 and 0.50. Second, an index value below 0.47 would strongly suggest that the riding was non-compact. Since method D is the square root of method C (MacEachren, 1985), the square root of these index values will delimit the same compactness

classifications for method D. Therefore, any riding that produces a compactness index value less than 0.685 using method D would be highly suspect of being non-compact, while an index value between 0.685 and 0.707 would identify a riding of questionable compactness.

Method G is a method that MacEachren (1985) neither used nor classified in his analysis. It has been included in this group of compactness measures because the shape's maximum diameter, one of the parameters, is equal to the diameter of the circumscribing circle. It is based on an index identified by Morrill (1981) which is calculated by dividing the shape's maximum diameter by its minimum. This index is closely related to one developed by Vereshchagin in 1930 (Frolov, 1975). Both methods are alike in that each determines the ratio between the major and minor shape axes. In the Vereshchagin index, however, the minor axis is defined to be the smallest shape diameter that is perpendicular to the major axis (Frolov, 1975). There is no orientation criterion between the parameters in the Morrill (1981) model. Method G is the inverted from of Morrill's (1981) index. By dividing the shape's minimum axis by its maximum diameter, a compactness index will be produced that ranges from zero to one, indicating non-compact to perfectly compact shapes respectively.

Vereshchagin used his index to measure and compare the shape of lakes (Frolov, 1975), while Morrill (1981) suggested this ratio could be used to measure the compactness of political districts. Morrill (1981) pointed out that the parameters needed in computing the compactness index of this method are merely measured from a map of the appropriate scale. In the case of a political district, he also suggested that a compactness index value in excess of two needs to be

justified in terms of preserving communities of common interest or existing transportation and communication links. Since Morrill's formula has been inverted, he would argue that rationale be provided for any riding that had a compactness index less than 0.5. Rumley (1985) used this method, in Morrill's form, to assess the compactness of the 1982 metropolitan zones of Western Australia. Using Morrill's (1981) index, Rumley found the mean index value for the 30 metropolitan ridings to be 3.3. As a result of this research, he postulated that the gerrymander had been reincarnated in Western Australia (Rumley, 1985).

Methods H and I are the last two procedures in this group. Method H, which calculates a compactness index by dividing the area of the inscribed circle by the area of the shape is also attributed to Ehrenberg (1892) (Frolov, 1975). Ehrenberg proposed that different pairs of radii from the inscribed, circumscribed, and equal area cirlces be used in computing a ratio that would describe a region's shape (Frolov, 1975). Ratios using combinations of these parameters were used by Penck in 1894 and by Seyferth in 1912 to discuss lake morphometry and continental shape respectively (Frolov, 1975). However, neither of these ratios nor method H have been used during the last 40 to 50 years in geographical shape analysis (Frolov, 1975; MacEachren, 1985).

The quotient obtained by dividing the circumference of the equal area circle by the shape's perimeter, method I, is the inverted form of Schwartzberg's (1966) ratio. It has been inverted in order to force calculated index values to fall between the zero (non-compact) to one (perfectly compact) range. Like method G, the Schwartzberg ratio was not analyzed by either Frolov (1975) or MacEachren (1985). Schwartzberg (1966) pointed out that the parameters of this ratio are

readily determined by direct measurement from maps with a 1: 25,000 or larger scale. However, he cautioned that a region's non-compactness could be exaggerated if one or more of the boundaries followed a meandering river or coastline. To help remedy this problem, he suggested that the perimeters of all shapes be smoothed out by joining together, with straight lines, the points where the boundaries of three districts intersected. He called these intersections **trijunction points.** Trijunctions also exist at points where two districts meet territorial waters, another state, or a foreign country and at points where one county meets territorial waters and a state, or two states (Schwartzberg, 1966). He felt that these straight lines would readily approximate both shape and perimeter length while not over stating the length of undulating natural boundaries.

Schwartzberg (1966) used this method to measure the compactness of the eleven North Carolina Congressional Districts for the 89th Congress of the United States. Before applying this method, however, he judged that any district that generated a compactness ratio of 1.67 or greater was non-compact and was also suspected of having been gerrymandered. As a result, he found that eight of the North Carolina Districts were non-compact. Schwartzberg (1966) suggested new boundaries for these districts that would neither reallocate the most populous city of each district, nor would the compactness ratio exceed 1.66. Since method I is the reciprocal of Schwartzberg's ratio, he would argue that a index value of 0.599 or less would indentify a non-compact riding.

Even though Schwartzberg (1966) used his ratio to suggest new configurations for the North Carolina Congressional Districts that were significantly more

compact than the existing confines, as can be seen in Figure 3.12, several of the proposed "compact" districts include areas that appear to have been carved from neighbouring seats. Proposed districts 2, 8, 9, and 10 are not visually compact yet they each generate an index value that is less than 1.67. The questionable boundaries are shown as dashed lines in Figure 3.12.

Two factors combine to limit the usefulness of this ratio in identifying non-compact or gerrymandered ridings. First, the simplest method of gerrymandering involves grouping together small areas of known partisan support to form one safe riding. If a large relatively compact marginal or swing riding was adjacent to a few small pockets of concentrated political support, the riding boundaries could be altered to include the neighbouring voters in order to create a safe district. Such a safe riding could have one or two small lobes or protrusions similar to the area delimited by the dashed line of District 2 in Figure 3.12. Second, based on Schwartzberg's (1966) proposed reapportionment, this ratio does not demonstrate that it is sensitive enough to identify this type of boundary manipulation. Neither the Schwartzberg index nor its inverted ratio will identify these sorts of questionable ridings if the proportion of the boundary that delimits the lobes is small in comparison to the length of the overall perimeter. This implies that either the non-compactness index value of 1.67 is too lenient or that the parameters of this ratio are not the most practical for determining a region's compactness. Therefore, this ratio will not be used to assess the compactness of ridings in the case study.

Frolov (1975) and MacEachren (1985) are not in total agreement as to the general usefulness of this group of compactness measures. Each author assesses

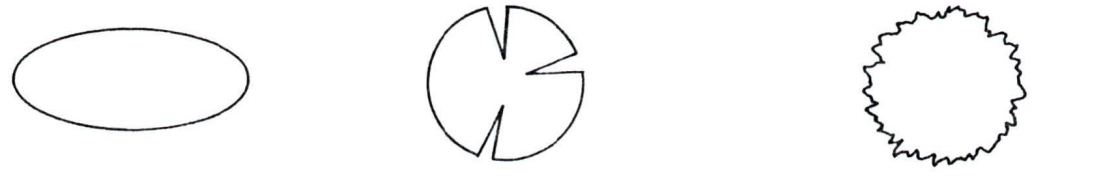


Figure 3.13 Shape Compactness, Dissection and Indentation

the merits of these indices from a different perspective. Frolov's (1975) approach is theoretical and he postulates that there are three independent shape characteristics that must be measured in order to relate one shape to another. These shape features are compactness, dissection, and indentation (Frolov, 1975). Figure 3.13 illustrates these concepts. He suggests that none of these methods are capable of simultaneously measuring all three shape features. He states that methods E and F do not describe the compactness nor the dissection of the region being analyzed. Presumably this is because both the parameters of these indices are derived from two related circles and not the shape itself. Even though the area of the shape being measured is the numerator and denominator of methods C and H respectively, Frolov (1975) does not feel that either of these methods measure the dissection or the indentation of a shape any better than ratios E and

F. He also dismisses method D for the same reason. In Frolov's (1975) analysis of Vereshchagin's ratio, which is similar to method G, he implies that this index only measures dissection. Since method G allows the minimum shape axis to be measured independently from the maximum axis, it has greater potential for identifying highly dissected shapes. Frolov's (1975) analysis does not include method I which has already been excluded from use in the case study due to its inability to detect lobes or protrusions.

MacEachren (1985) analyzes this group of shape measures empirically. He compares the effectiveness of all the methods listed in Table 3.2, except G and I, at ranking a set of 54 American counties in order of decreasing compactness. While none of these are judged by MacEachren (1985) to be the best measure of compactness, method D was judged to be the best in this group. As part of his analysis, MacEachren (1985) calculated Pearson correlation coefficients between the mean standard deviations and the compactness values for each of the eleven methods he evaluated. The correlation coefficients for this group ranged from 0.74 to 0.85, for methods H and D respectively, as compared to 0.93 for the highest ranking measure, method L. MacEachren (1985) also determined whether these methods emphasized the differences between relatively compact or non-compact shapes. He found that methods C, F, H, and E were prone to accentuating the nuances between shapes that were quite compact with method E having by far the greatest degree of bias in this regard. Index D, however, tended to emphasize the variations between non-compact shapes (MacEachren, 1985). Of these measures therefore, method D would be better able to differentiate between non-compact shapes.

Another component of MacEachren's (1985) analysis involved applying each method to a small sub-set of shapes that ranged from the most to the least compact according to method L. This application was designed to rank each ratio according to its abililty to identify highly indented shapes or shapes with gross protrusions. He concluded that the methods in this group were overly sensitive to boundaries that were either highly indented as coastal boundaries would be, or included large protrusions such as a long narrow peninsula. This, however, is a generalization. While his conclusion holds for measures C, F, H (G and I were not analyzed by MacEachren), it does not hold for method D. In his graph plotting index values against each shape, the plot of method D is not aligned with the other ratios in this group. When it is compared to the highest ranking method, it is apparent that index D is less sensitive to highly indented shapes or to shapes with gross protrusions. Therefore, method D should not be used by itself to identify non-compact or irregularly shaped regions. It should only be used with a measure that is capable of identifying regions that are highly dissected or that include protrusions. As Frolov (1975) has pointed out, Morrill's (1981) ratio, method G, is well suited for this purpose.

MacEachren (1985) and Frolov (1975) are in agreement concerning the inadequacies of methods A, B, C, E, F, and H at measuring a shape's compactness, dissection, or indentation. Method I has also been shown to be a poor measure in a preceding discussion. Two methods remain from those discussed thus far, measures D and G. MacEachren (1985) indicates that although method D is not the most accurate measure of compactness, it is a useful index. There are two reasons for this. First, its ratio paramaters are easily determined. Access to

computer programs, terminals, and digitizers is not necessary in order to calculate this index (MacEachren, 1985). Second, due to the work done by Backstrom, Robins and Eller (1978), two index values have been suggested for this method that can be used to identify non-compact shapes. Index G is also easy to calculate (Morrill, 1981). As well, Morrill (1981) has suggested an index value that identifies irregularly shaped regions for method G. As a result, both methods D and G will be used together in the case study. A riding will be classified as being non-compact if the calculated index values are less than 0.685 and 0.50 for measures D and G respectively. Whereas a questionable compactness classification will be applied to any riding that generates an index value below 0.707 for method D or 0.50 for method G.

The compactness measures that directly compare a shape to a standard geometric form are the third group to be discussed. MacEachren (1985) classifies methods J and K, from Table 3.2, in this group. Method J is MacEachren's (1985) version of a ratio that was developed by Lee and Sallee (1970). Frolov (1975), however, suggests that Penck had produced a ratio similar to the Lee-Sallee measure in 1894. In order to calculate the compactness index for method J, the shape that is being measured must be physically compared to a standard geometric figure (Lee and Sallee, 1970). This involves superimposing one figure on the other. Lee and Sallee (1970) used four standard shapes, including a square, circle, equilateral triangle and a three-to-one rectangle, in their study of 25 Nile Valley villages.

The methodology used by Lee and Sallee (1970) was cumbersome. First, they traced the village outlines onto paper from aerial photographs. Second, every

shape was redrawn at a scale that resulted in each village being roughly the same size on paper. Third, each of the four standard forms were designed and oriented with the village shapes so that the non-fit between the standard and village shapes was minimized. Fourth, the largest area within the perimeter defined by the village outline combined with the superimposed standard shape was determined using a planimeter. Fifth, the planimeter was also used to measure the village area that was within the standard shape. MacEachren (1985) defined these enclosures as being the area of intersection and union respectively. Figure 3.14 illustrates these parameters. The last step in the Lee and Sallee (1970) methodology involves calculating the shape index. They do this by dividing the area of union by the area of intersection and then subtracting this quotient from one. The objective of Lee and Sallee's (1970) research was to assign numerical values to the village shapes in order to determine if a particular village was, for example, more circular than square, triangular, or rectangular. They concluded that 60 percent of the villages were more rectangular than any other shape while 20 percent were either more circular or triangular.

The combersome nature of the Lee-Sallee methodology was reduced somewhat by MacEachren (1985). He suggested that a circle of equal area to the shape be used to measure compactness. This modification reduces the number of standard shapes applied and it makes orientation of the two shapes irrelevant (MacEachren, 1985). As well, he inverted the Lee-Sallee ratio to eliminate the need to subtract the quotient from unity.

The other measure in this group, method K, is a form of a model that was developed by Boyce and Clark (1966). MacEachren (1985) pointed out that the

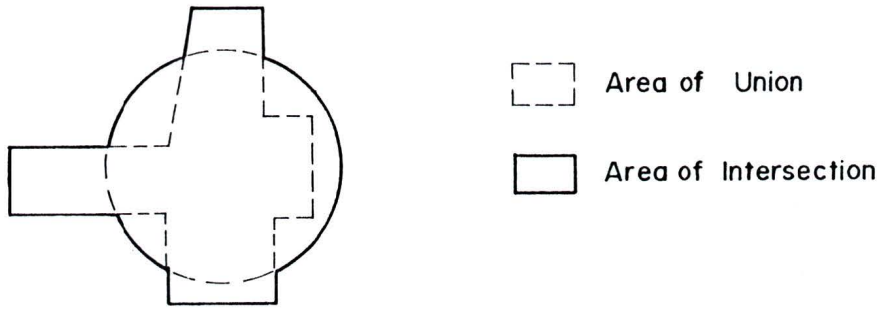


Figure 3.14 Areas of Union and Intersection

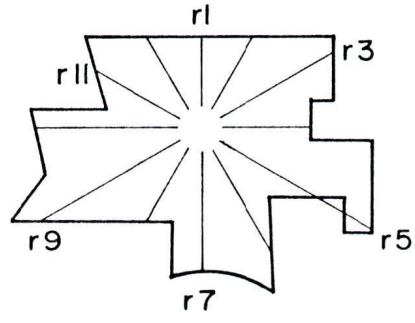


Figure 3.15 Radial Lines and Terminal Points of Boyce and Clark Method

Boyce-Clark ratio has been extensively used in geographic applications since its development. In one such application, it was used to measure the shape of West Malaysia's political districts (Austin, 1981). This method requires that radial lines be drawn between a common internal point of origin and the perimeter of the shape being measured. The length of these lines are measured and summed. The Boyce and Clark (1966) form of this ratio produces index values that range between zero for a circle and 200 for a straight line (Frolov, 1975; MacEachren, 1985). MacEachren (1985) subtracted the Boyce-Clark ratio from one in order to produce an index range that corresponds to the range of the other methods that have been discussed.

Frolov (1975) and MacEachren (1985) are not in agreement as to the usefulness of the two compactness measures in this group. Both authors, however, pointed out several major weaknesses in the Boyce-Clark ratio. A measure of compactness that does not generate the same index value each time it is applied to a particular shape has little use in shape description (Lee and Sallee, 1970; Frolov, 1975; MacEachren, 1985). The potential to produce a different index value each time the Boyce-Clark ratio is applied to a figure is high (Lee and Sallee, 1970; Frolov, 1975; MacEachren, 1985). There are four reasons for this. First, different radial origin points will affect radial lengths. Unique index values will be computed for an irregular shape depending upon whether the geometric centre or the centre of gravity is used. Second, the number of radials that are used will also affect the index value. MacEachren (1985) illustrated this point clearly by plotting the change in index value for four shapes as the number of radial lines is increased from one to 120. The third variable that can alter the index value is the

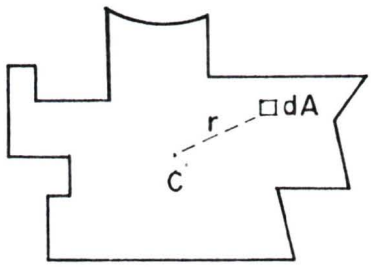
orientation of the radial lines about the point of origin. If, for example, radial lines were spaced eight degrees apart, each shift in orientation of the first or prime radial drawn about the origin, other than a multiple of eight, would create a unique set of radials. The index value would likely be different for each set of lines. Frolov (1975) pointed out another problem with radial orientation in measuring irregular shapes. Since the radials are evenly spaced at the origin, they will not meet the shape perimeter at equal intervals. This could result in some sections of the perimeter being given more weight in the index calculation. The method of dealing with radial lines that intersect the perimeter of highly dissected shapes more than once is the fourth way to effect this ratio (Lee and Sallee, 1970; Frolov, 1975; MacEachren, 1985).

MacEachren (1985) addressed these weaknesses when he applied the Boyce-Clark ratio to his study shapes. He used the centroids of each county as the origin point and he measured 120 evenly spaced radial lines for each shape. He postulated that with this number of radials a change in oreintation would have minimal effect on the computed index value. Although he used 120 radials, he suggested that 40 to 50 would adequately describe most shapes. This is significantly more than the sixteen radial lines that Boyce and Clark (1966) drew and measured. MacEachren (1985) also developed a systematic procedure for dealing with radial lines that crossed the perimeter more than once. He first measured the length of the line from the origin to the terminal point of the radial line and perimeter intersection. To this measurement, he added the length of every segment of the radial line that was not within the shape but was between the origin and terminal points. Figure 3.15 illustrates this concept. MacEachren

(1985) felt that highly dissected figures could be more readily identified by using this modification. In conclusion, however, he found that the index values of method K only occupied a very narrow segment of the zero-to-one compactness range. He felt that this method did not allow enough differentiation between compact and non-compact shapes to be useful in further studies. Even though this ratio has been widely used in the past, due to the identified problems it is not recommended for use in the case study.

Frolov (1975) did not see merit in using method J as a compactness measure. He dismissed its use on theoretical grounds. Frolov (1975) stated that the indices generated by this method are not independent shape measurements because areas of union and intersection are both dependent upon which standard shape is used. MacEachren's (1985) suggestion that an equal area circle be used as the standard geometric form eliminates the problem of standard shape selection and it relates the standard to the study figure. Using a standard equal area circle, MacEachren (1985) found that this method was better than all the methods previously discussed at ranking 54 American counties according to their compactness. Since it is far easier to calculate this index by hand than the remaining group of methods, MacEachren (1985) recommended that it be used to calculate compactness scores when computer facilities are unavailable. However, no index value was suggested that could be used to identify non-compact from compact shapes. Without such a benchmark, this method can not be applied in the case study to identify ridings of quentionable compactness.

The last group of compactness ratios that will be discussed include methods that measure the dispersion of elements of area around the shape centroid. Figure



dA Element of Area
r Radius
C Centroid

Figure 3.16 Moment of Inertia

3.16 illustrates this measure. Two common mathematical expressions of this form of compactness measurement are listed in Table 3.2 as methods L and M. MacEachren (1985) pointed out that these measures have been derived independently by several authors, including Blair and Bliss (1967), Massam and Goodchild (1971), Whittington, Beavon and Mabin (1972), and Bachi (1973). Both Frolov (1975) and MacEachren (1985) argee that these are the best measures of compactness because these methods consider the shape as a whole instead of concentrating on a few limited shape characteristics as do each of the preceding models. In the case of electoral redistribution, MacEachren (1985) pointed out that population figures can be incorporated into methods L and M so that the compactness measure of a riding is influenced by the riding's population distribution. He also found that each of methods L and M ranked the 54 counties in the same order of compactness. However, he determined that method L was

more suitable for measuring compactness because it provided a more obvious distinction between relatively non-compact shapes. In contrast, the compactness index values produced by method M occupied a narrow segment of the zero-to-one compactness range.

There are, however, two drawbacks to using either of these methods. The first is not a major one. The mathematics involved in applying these methods without the aid of a computer is burdensome. Therefore, access to computer facilities and a digitizer is recommended when working with either of these measures (MacEachren, 1985). The second restraint is quite major as far as identifying non-compact shapes is concerned. While both of these measures can be used to rank a set of shapes in order of increasing compactness, no author has suggested an index value or range of values that could be used to identify a non-compact shape. As a result, these methods can not be used in the case study due to the absence of an index value that would serve to identify a non-compact riding.

The underlying concept of these compactness measures is also the basis of models that are able to design compact and/or equally populated electoral and administrative districts (Weaver and Hess, 1963; Goodchild and Massam, 1969; Rushton, Goodchild and Ostrech, 1973; Morrill, 1976). They are based on transportation cost models that reassign each market in a system to one warehouse in a given set until the total distance between each market and its assigned warehouse for the entire system is minimized. Maximum compactness in an electoral redistribution is achieved in this type of model when the aggregate distance between each voter (market) and the centre of their assigned riding

(warehouse) is minimized. Implementing a warehouse capacity constraint in the transportation model will result in equalizing the market demand between warehouses. In the case of an electoral readjustment, this would translate into maximizing riding compactness while assigning equal numbers of voters (markets) to each riding (warehouse).

This methodology has been used by several authors, including Weaver and Hess (1963), Nagel (1965), Goodchild and Massam (1969), Morrill (1976), Morrill (1981), and O'Loughlin (1982), to suggest readjustments for electoral or administrative districts. Although these models may appear to be the panacea for electoral redistribution maladies, Morrill (1981) cautioned that these sort of solutions give too high a priority to the compactness criterion. He stressed that respecting the behavioural shape and communities of common interest are more important than the physical shape of a political district. This view is shared by Muir (1975), Gudgin and Taylor (1979), Johnston (1979), Robertson (1983), Cain (1984), Keller (1986), Fryman (1987), O'Loughlin (1987), and Ruff and Ross (1987). This would be particularly true for rural or remote ridings where transportation and communication links are limited due to a sparse population and/or rugged terrain. In such cases, equalizing the population between ridings, respecting natural barriers along with transportation and communication routes would be more appropriate than designing all constituencies to be as compact as possible. However, a definition does not exist that clearly differentiates between urban and remote/rural ridings. Since provincial electoral quotas range from 3,958 in P.E.I. to 70,104 in Ontario (Fisher, 1988), such a definition should be made independent of existing electoral quotas. Therefore, for the purpose of the case study in the

following chapter, the compactness criterion will only be applied to a riding if it is completely within a Census Metropolitan Area (C.M.A.).

3.6 Selected Criteria For Assessing Fairness and Detecting Gerrymandering

Many authors have suggested that different criteria can be used in determining the degree of fairness of an electoral system and to detect the existance of partisanly safe ridings (Taylor and Johnston, 1979; Gudgin and Taylor, 1979; Morrill, 1981; Taylor and House, 1984; Ruff and Ross, 1988). These criteria include equalizing population within a prescribed tolerance range, respecting natural barriers, communities of common interest and transportation and communication routes, and measuring urban and suburban ridings for compactness. However, no author has applied all of these measures to a complete electoral system. Therefore, the following list of criteria will be used to assess the Fisher Commission's proposed redistribution for the electoral districts of British Columbia.

1. the population of each proposed riding will be determined to see if it falls within ten percent of the electoral quota and the D-K index will be determined for the entire system of ridings;
2. communities of common interests should not be cleaved;
3. natural boundaries, such as rivers and mountain ridges, should be respected;
4. transportation and communication routes and/or linkages should be respected especially for remote or large rural ridings; and

5. all ridings are to be contiguous and those ridings that are completely within a C.M.A. should be measured for compactness using methods D and G. The D index is calculated by dividing the radius of a circle that circumscribes the riding by the radius of a circle that has the same area as the constituency. The G index is the quotient obtained by dividing the district's minimum diameter by its maximum. A riding will be classified as being non-compact if calculated index values are below 0.685 and 0.50 for methods D and G respectively. It will be of questionable compactness if an index value is obtained that is below 0.707 for method D and 0.50 for G.

3.7 Summary

This chapter examined the spatial component of plurality elections and the relationship between votes cast and seats won. In addition, the concept of gerrymandering was defined and its direct and indirect effects identified. Methods that have been proposed to detect this malaise have also been reviewed and evaluated. A set of criteria is proposed that can be used to determine the degree of malapportionment, fairness and possible instances of gerrymandering in a proposed redistribution. The following chapter describes the political region of British Columbia and its history of electoral readjustment. It will form the study region and these criteria will be evaluated while assessing the proposed redistribution of the Province in Chapter 5.

Chapter 4

THE CASE STUDY: ELECTORAL REDISTRIBUTION IN BRITISH COLUMBIA

4.1 Introduction

The purpose of this chapter is twofold. First, it sets out the rationale for selecting British Columbia as the study area. Second, it provides background information on the redistribution process in British Columbia since the mid 1960's when independent electoral boundary commissions were first used in the province.

4.2 Rationale For Selecting British Columbia For The Case Study

Much of the existing electoral redistribution research has used selected ridings or districts from separate readjustments, as examples of poor and/or unfair redistricting procedures. There are very few cases where entire redistributions have been completely and thoroughly analyzed for fairness. As well, most existing work focusses on British, American, and Australian readjustments. Canadian redistributions, particularly at the provincial level, have largely been ignored. Another overlooked area of study has been the assessment of proposed or preliminary boundary readjustment's of redistribution Commissions. Research to date has concentrated on analyzing existing ridings. While this approach allows for valid theoretical studies to be undertaken, it lacks the potential to detect unfair boundaries, ridings, or sets of ridings before they are implemented. It is far

more beneficial to voters, politicians, political parties, and boundary Commissions to be able to objectively assess a proposed redistribution before it is enacted rather than afterwards.

In order to test the criteria selected in the preceding chapter and to augment existing readjustment studies, a case study is required. The ideal case study will include several features. First, a recent proposal to readjust riding boundaries must exist. Second, since very few political regions are composed of flat featureless terrain, the case study should possess a rugged topography with a variety of natural barriers and islands. Third, the population should be distributed unevenly over the entire region and the sub-regional economies should vary. In an attempt to augment existing readjustment studies, the Fisher Commission's Preliminary Report of Proposed Boundaries for British Columbia Electoral Districts will form the case study because it satisfies these conditions.

British Columbia is the third largest province in terms of area and has some of the most diverse and rugged terrain in Canada. Two major mountain ranges, the Coast and Rocky Mountains, run roughly parallel to each other over its entire length. As a result, the province has an intricate drainage system made up of dozens of major rivers and lakes. The west coast is highly indented with fiord-like inlets and includes dozens of islands, the largest being Vancouver Island, just offshore. Due to the province's imposing topography, the location of natural barriers must be taken into account when designing efficient administration units. This is particularly the case where each and every community is not joined to the main road system. Many small coastal and northern interior British Columbia communities are very isolated with air and water links being the only connection between these communities and the rest of the province.

The population is not spread evenly over the province. Vancouver, the third largest Census Metropolitan Area (C.M.A.) in the country, is the most populous region accounting for approximately one third of the province's population (Statistics Canada, 1986). Nor is the population ethnically homogeneous. High concentrations of indigenous groups can be found in small pockets within the province. In addition, since the mid 1960's when independent boundary commissions began to play a role in the province's redistribution process, there has been dramatic growth and a shift in the location of the population. In 1966, 1,873,674 people lived in the province (Statistics Canada, 1966). By 1986 the population had grown to 3,883,367 (Statistics Canada, 1986). This represents a growth of approximately 107 percent. During this same period, the percentage of the population considered urban increased from 75 to 90 percent (Statistics Canada, 1966; Statistics Canada, 1986). Since previous readjustments of the province's ridings have not compensated for these changes, malapportionment exists in the current system of ridings favouring rural and remote voters at the expense of the urban and suburban electorate (Ruff and Ross, 1987).

The major components of the economy also vary regionally. The lower mainland and Victoria are home to most of the Province's industries. Vancouver is also a major national port and is connected to national and international markets, suppliers, and transportation systems. Vancouver and Victoria have been the traditional administrative centres for the province and have maintained a high percentage of the bureaucratic jobs and related government service industries. Most economies of the cities and towns of the interior and nothern parts of the province are based on resource extraction industries such as mining and logging,

whereas the fishing industry is the major economic source for small coastal communities.

The politics of British Columbia are unique in Canada. Although at least three major national party organizations have been present in the province since 1941, provincial politics have been bipolar. The focus of partisan politics since this time has been to unite the parties of the right to prevent the socialists from forming the government (Morley et. al., 1983). The union of the right was so strong that for both the 1945 and the 1949 provincial elections, the Liberals and Conservatives formed a formal coalation in order to keep the Co-operative Commonwealth Federation (C.C.F.) from assuming power. However, during the late stages of this coalition, the Social Credit (S.C.) party was established in the province. As a result, three parties, the Liberals, Conservatives and Social Credit, favoured free enterprise while only the C.C.F supported "socialism". The emergence of the S.C. party as both an option to the "Socialist" C.C.F. and the weakening Liberal-Conservative coalition together with the use of the alternative ballot in 1952 and 1953 combined to allow the S.C. party to assume power (Morley et. al., 1983). They remained the governing party until their defeat by the N.D.P. in 1972. However, during this 20 year period, both the Liberals and the Conservatives were all but eradicated from the provincial legislature. In no election since 1952 did the Liberals or Conservatives win more than six or two seats respectively. Neither party has elected a member to the provincial legislature since the 1979 election (Morley et. al., 1983; Goldberg, 1987).

British Columbia has had a long history of redistribution problems and frequent electoral boundary studies (Fisher, 1988). Historically its riding

readjustments have produced sets of constituencies where extremely wide variations in population levels have existed. Population levels varied so much prior to World War II that it was possible for a small percentage of the voters to elect a majority of the province's M.L.A.s (Morley et. al., 1983). While not limited to British Columbia, malapportionment is a remnant of early Canadian electoral systems. Immediately following Confederation, a large percentage of Canada's population was rural. The first systems of ridings took this into account with large numbers of legislative seats being assigned to rural and/or remote voters. However, as the Canadian population has become more urban in recent decades, few systems of ridings have reflected this population shift (Ward, 1967; Qualter, 1970; Carty, 1985). As a result, some existing provincial rural and remote ridings tend to be much smaller in terms of population than do urban and suburban constituencies. Even though independent boundary commissions have been a part of the redistribution process in British Columbia since 1966, the Province's readjustments have not kept pace with the rural-to-urban and urban-to-suburban shifts. Malapportionment exists on the current electoral map of the province because many recommendations made by these boundary commissions to reduce malapportionment have not been adopted by the legislature (Fisher, 1988).

A characteristic of the British Columbia provincial electoral system that differentiates it from other provincial systems is the continued use of multiple member ridings. With the exception of of Prince Edward Island, the practice of preserving multimember ridings has fallen out of favour in Canada since the turn of the century (Courtney, 1988). The dual member ridings of Prince Edward Island are the result of the abolition of its upper chamber. British Columbia, however,

has traditionally used dual member ridings to increase an area's representation without readjusting riding boundaries (Greer, 1978). The mandate of each electoral boundary commission prior to Fisher did not include the elimination of dual member ridings. The combination of the Fisher Commission's preliminary report, the rugged topography, the uneven population distribution, the variation between sub-regional economic bases, as well as a history of maldistribution make British Columbia and the Fisher report an excellent area for a case study.

4.3 Redistribution in British Columbia

Redistribution in British Columbia has taken place on an infrequent ad hoc basis. In fact, since the 1966 readjustment that delineated the ridings for the election later that year, there have only been two sets of riding redistributions in the Province. The first of these occurred in 1978 and the second in 1984 (Goldberg, 1987; Fisher, 1988). While there were 12 years between the 1966 and 1978 readjustments, there were only six years between the latter two. However, this should not be interpreted to imply that the Government infrequently studies its system of ridings and their respective boundaries.

There have been six independent Royal Commissions formed to investigate the need to modify the boundaries of the provincial ridings and/or the number of representatives elected to the Legislature since 1966 (Fisher, 1988). While each Commission conducted its investigation independent of the Legislature, only the McAdam Commission of 1984 was constitutionally enacted following the May 1, 1984 amendment to the Constitution Act. The Angus (1966), Norris (1975), Eckardt (1978), Warren (1984), and Fisher (1987/88) Commissions were each

formed through an Order-in-Council pursuant to the Public Inquiries Act to make recommendations to amend the Constitution Act and/or the Provincial Elections Act. The McAdam Commission submitted its recommendations to the Provincial Secretary, whereas those of the other Commissions were presented to the Lieutenant Governor. In all cases, however, the recommendations were presented to the Legislative Assembly for debate before being either vetoed or enacted, with or without modifications.

To fully appreciate the scope of the Fisher Commission, it is important to review the history of independent boundary commissions and the role that they have played in redistributing the Province's electorate. A summary of each commission's recommendations is presented in the following sections.

4.3.1 The Angus Commission

The Angus Commission (1966) was established as the result of the Lieutenant-Governor approving Order in Council number 2233 on August 5th, 1965. The riding boundaries that existed when this Commission was formed were approximately ten years old and they had delineated the Province for the 1956, 1960, and 1963 provincial elections (Greer, 1978; Goldberg, 1987). At the time of forming the Commission, there were 42 ridings, ten of which were dual member ridings, and 52 seats in the legislature. The Commission was directed to make recommendations that would ensure proper and effective representation for all people of the Province by applying four criteria. First, it was instructed to take into account both historical and regional claims for representation. As well, it was directed to extrapolate 1975 population figures for each electoral district based on 1961 census figures and the apparent population growth trend of the early 1960's, in

order to ensure that no riding would be comprised of fewer than 7,500 people in 1975. Third, the Commission was asked to recommend the number of members, between 48 and 52 that should make up the Legislative Assembly. Finally, it was asked to consider the provision of two member ridings for the metropolitan areas of Vancouver and Victoria (Angus, 1966).

In consideration of its mandate, the Angus Commission made several major redistribution recommendations that would have resulted in dozens of riding boundary changes. It suggested that the members of the Legislature first be reapportioned among nine regions of the province and second, that there be further readjustment of representation within each region. The desired effect of this recommendation was to reduce the amount of malapportionment found in the northern and rural regions. The Commission advocated the distribution of 31 members in total to the highly populated regions of the Lower Mainland and Metropolitan Victoria, and that the other seven regions be assigned a total of 21 representatives. This recommendation would have increased urban and decreased rural and/or remote representation by eight members each. The Commission advised, however, that although this adjustment would reduce the over representation of the non-urban portion of the province, these seven regions would still maintain five members more than they would otherwise be allowed if representation were based strictly on equal population (Angus, 1966). In its recommendation concerning dual member ridings, the Commission was very clear in that it advised that there should be no multiple member ridings in British Columbia.

Figure 4.1 Angus Commission Boundaries

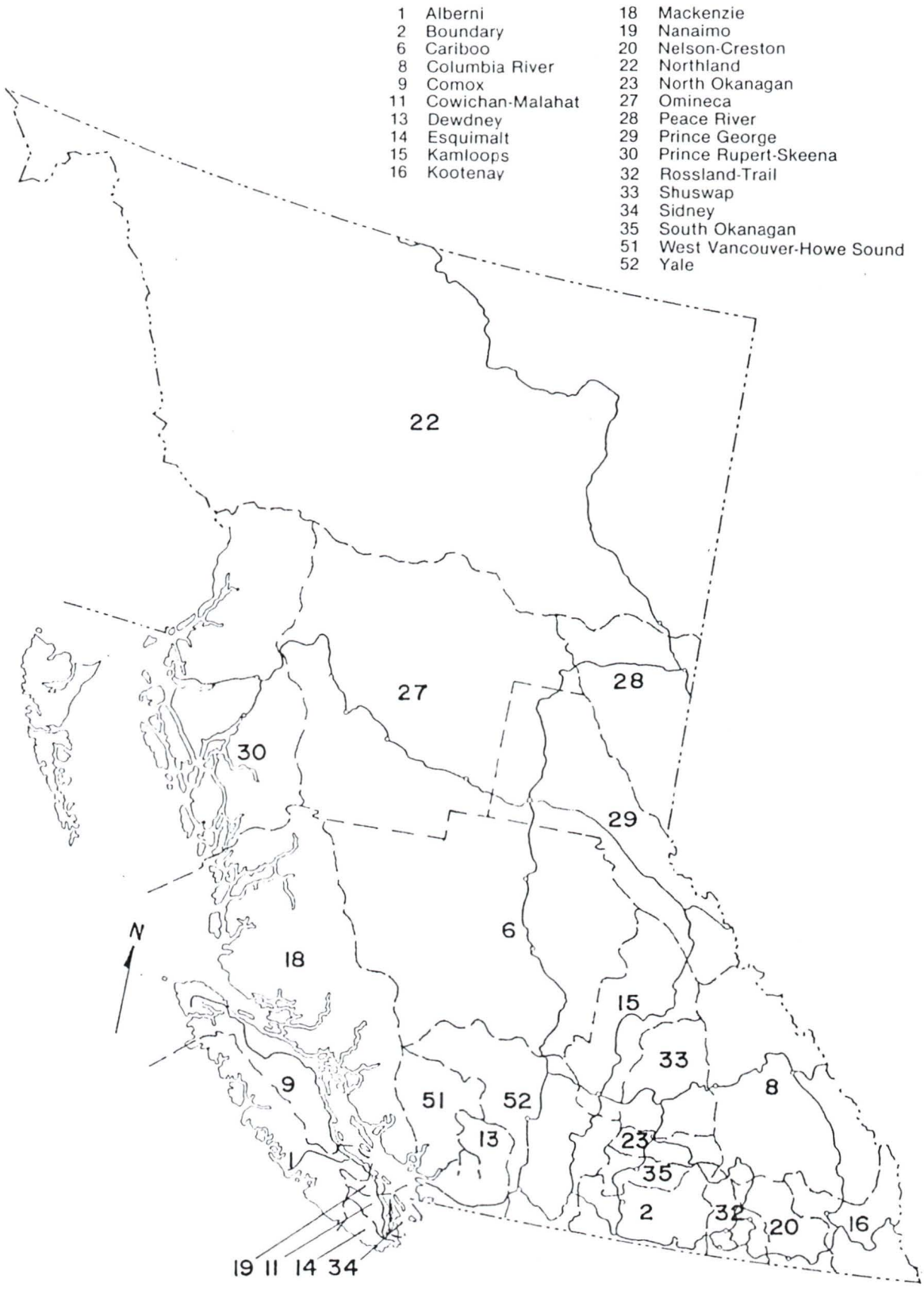
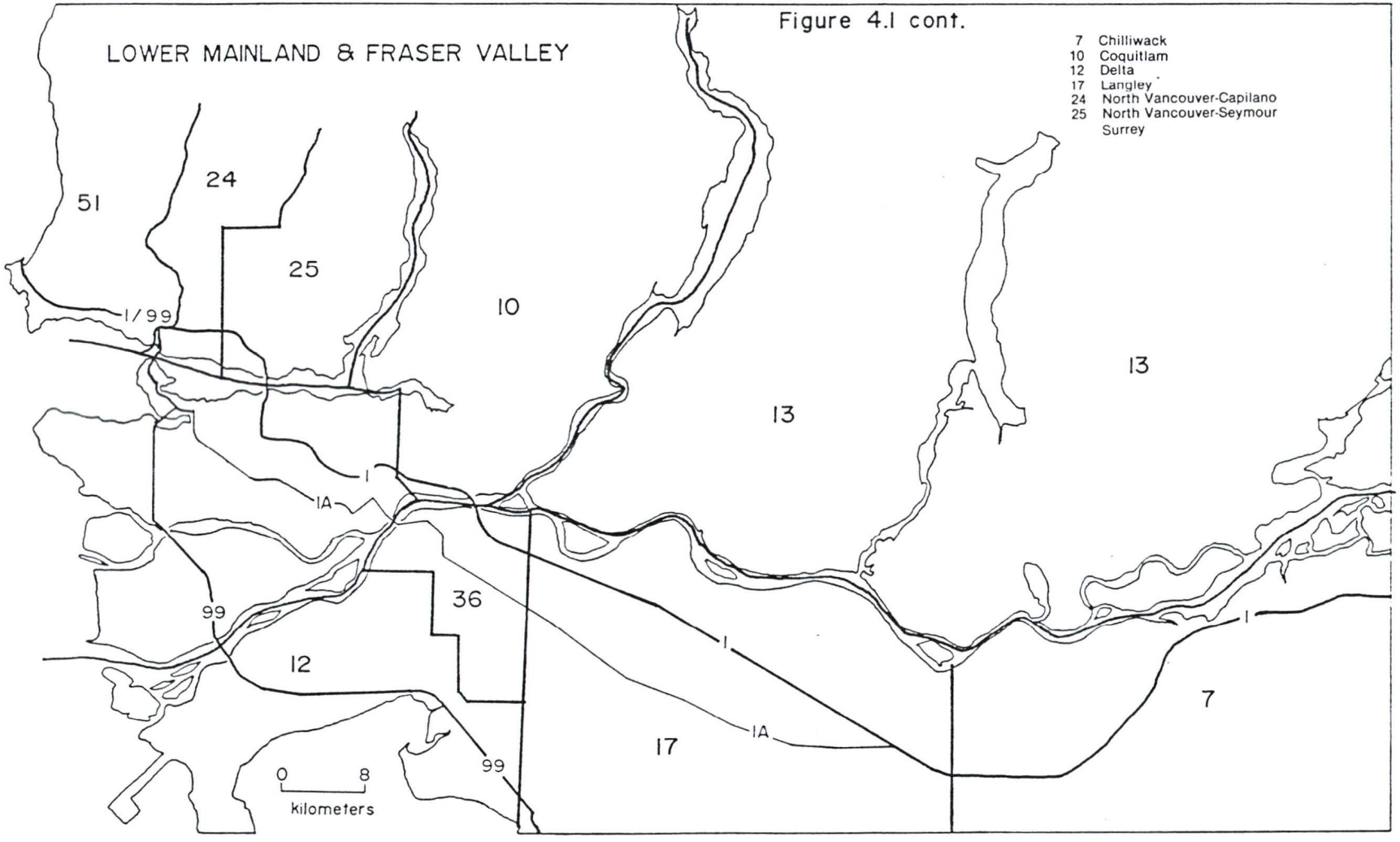


Figure 4.1 cont.



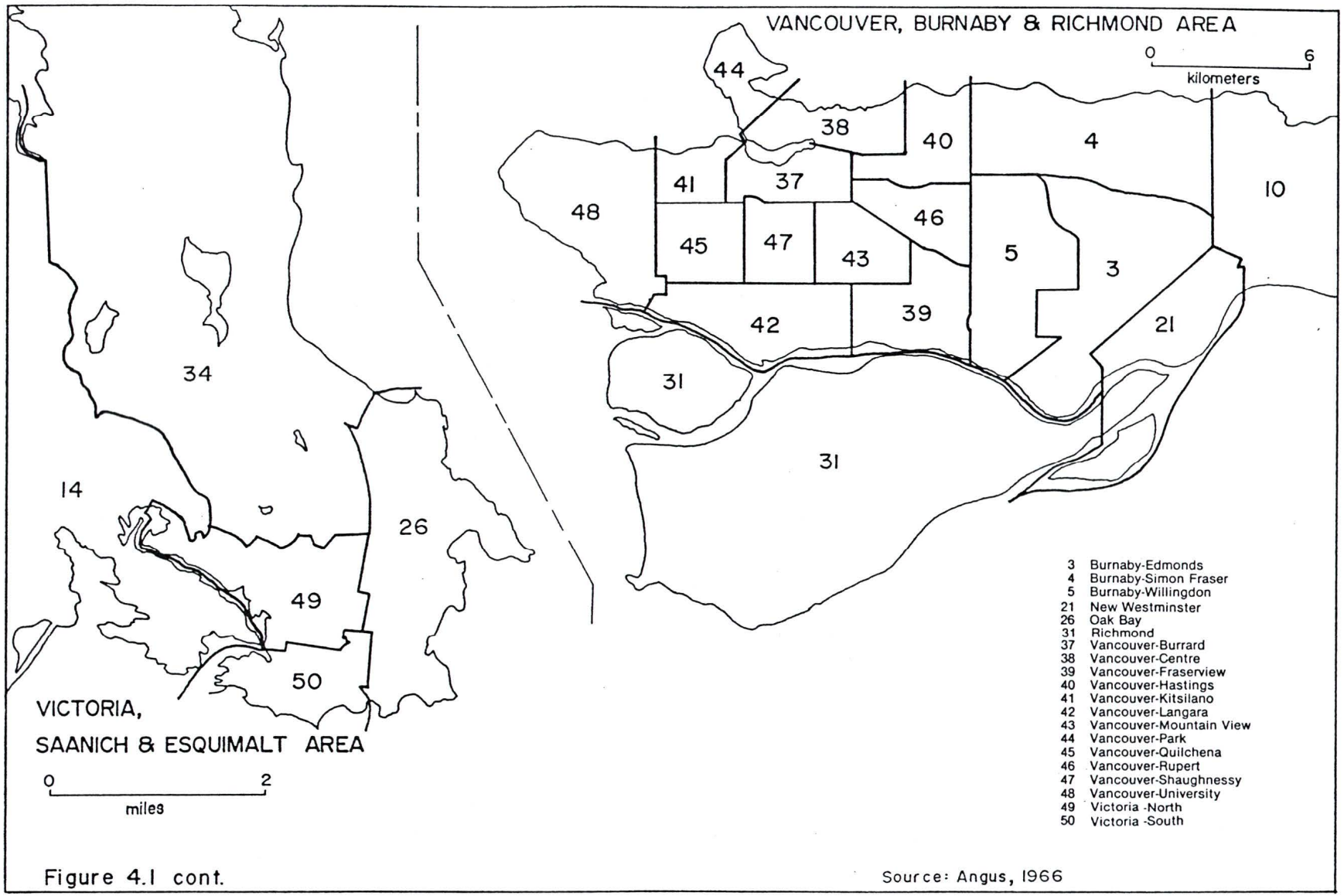


Figure 4.1 cont.

Source: Angus, 1966

The recommendations of the Angus Commission were not enacted by the legislation passed following the submission of the report (Greer, 1978; Fisher, 1988). Instead, the number of electoral districts was set at 48 not 52 as the Commission suggested, and the number of Members of the Legislative Assembly was raised from the Commission's recomendation of 52 to 55 (Goldberg, 1987). Instead of eliminating dual ridings their number was only moderately reduced from the ten that existed prior to 1966 to seven. The dual member districts were located in Metropolitan Vancouver and Victoria (Williston, 1969). The Commission also recommended that there be twelve Vancouver and two Victoria single member ridings. However, the 1966 redistribution combined the proposed new single member ridings of Vancouver-Park with Vancouver-Centre, Vancouver-Hastings with Vancouver-Rupert, Vancouver-Langara with Vancouver-Fraserview, Vancouver-University with Vancouver-Quilchena and part of Vancouver-Shaughnessy, the balance of Vancouver-Shaughnessy with Vancouver-Mountain View, Vancouver-Kitsilano with Vancouver-Burrard, and Victoria-North with Victoria-South to form the seven dual member constituencies of Vancouver-Centre, Vancouver-East, Vancouver-South, Vancouver-Point Grey, Vancouver-Little Mountain, Vancouver-Burrard, and Victoria respectively. Figure 4.1 shows the configurations of ridings proposed by the Commisssion.

Another major difference between the Commission's recommendations and the 1966 readjustment occurred in the northern and southeastern regions of the Province. The Commission proposed five single member ridings north of the MacKenzie, Cariboo, Kamloops, and Columbia River ridings (generally in the vicinity of the 53rd parallel), whereas the 1966 redistribution delineated eight

ridings (Williston, 1969). The Commission's constituencies of Prince George and part of Omineca were combined in the redistribution to form Fort George (Angus, 1966; Williston, 1969). The name of the proposed Peace River riding was changed to South Peace River while the large recommended riding of Northland was carved up to form the constituencies of North Peace River, the majority of a new riding named Atlin and the balance was added to the riding of Omineca. The Commission's riding of Prince Rupert-Skeena was split to form the ridings of Prince Rupert, Skeena and the southwest corner of Atlin. In addition, the 1966 redistribution split the suggested riding of Columbia River into the districts of Revelstoke-Slocan and Columbia River. As a result of the 1966 distribution, the Commission's attempts to reduce malapportionment in the northern and eastern regions of the Province and to eliminate dual member ridings were thwarted.

4.3.2 The Norris Commission

Nine years after the 1966 readjustment and during the last year of the N.D.P. government, the Norris Commission (1975) was established by an Order-in-Council. Its mandate was similar to that of the Angus Commission in that regional and historical claims for representation were to be regarded and that two member ridings were to be considered for densely populated urban areas. However, the mandates differed in that the Norris Commission was to recommend that the Legislature be increased to include between 55 and 62 members. Besides considering such criteria as natural geographic regions, regional rates of economic and population growth, social interests and the ease of access between communities, the Commission made use of two other measures. First, it adopted an electoral quota of 40,000, plus or minus 40 percent, per M.L.A. Second, it

employed the Dauer-Kelsay index which determines the minimum percentage of voters required to elect a majority of one in the Legislature (Norris, 1975). As noted in Chapter 3, an index value of 50 means that 50 percent of the voters could elect a simple majority government. The Commission's report was originally scheduled for submission to the Lieutenant Governor by October 31, 1975. However, an extension until November 8, 1975 was granted due to the dissolution of the Assembly prior to the provincial general election of November 5th.

The Commission's recommendations were regional in nature. The Northern region of the province was to retain its seven members although it was suggested that the riding boundaries be readjusted to allow for more equitable representation within the entire area (Norris, 1975). Had the Commission strictly applied the electoral quota of 40,000 to the Northern region, it would only have been allowed five members. The Kootenay region was to lose one member and the riding boundaries were to be adjusted accordingly. The Commission also recommended that the Central region of the province be granted an additional seat, bringing this region's total number of members to five.

There was to be no change in number for the Okanagan ridings, but internal boundaries were to be adjusted to achieve a more equal distribution of population within the four ridings of the region. The Commission suggested that the Fraser Valley region be allowed 13 seats instead of the eight it had in 1975. The rationale for this relatively large increase in seats was based on the fact that this region had experienced the greatest growth in population and that it had previously been the most under represented region of the Province (Norris, 1975). One riding, Burnaby, was to be added to the Greater Vancouver region, but the

Figure 4.2 Proposed Ridings of the Norris Commission

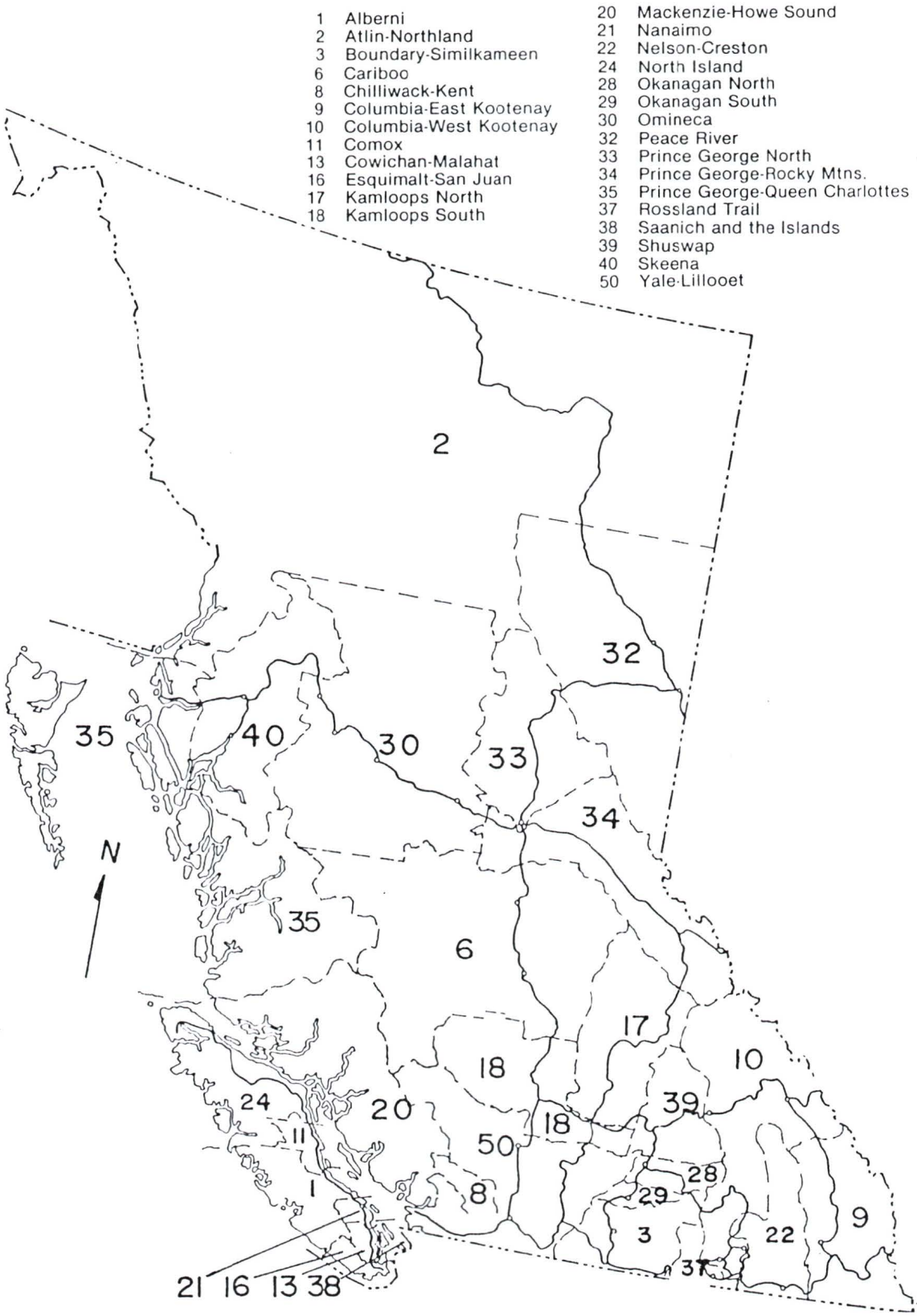
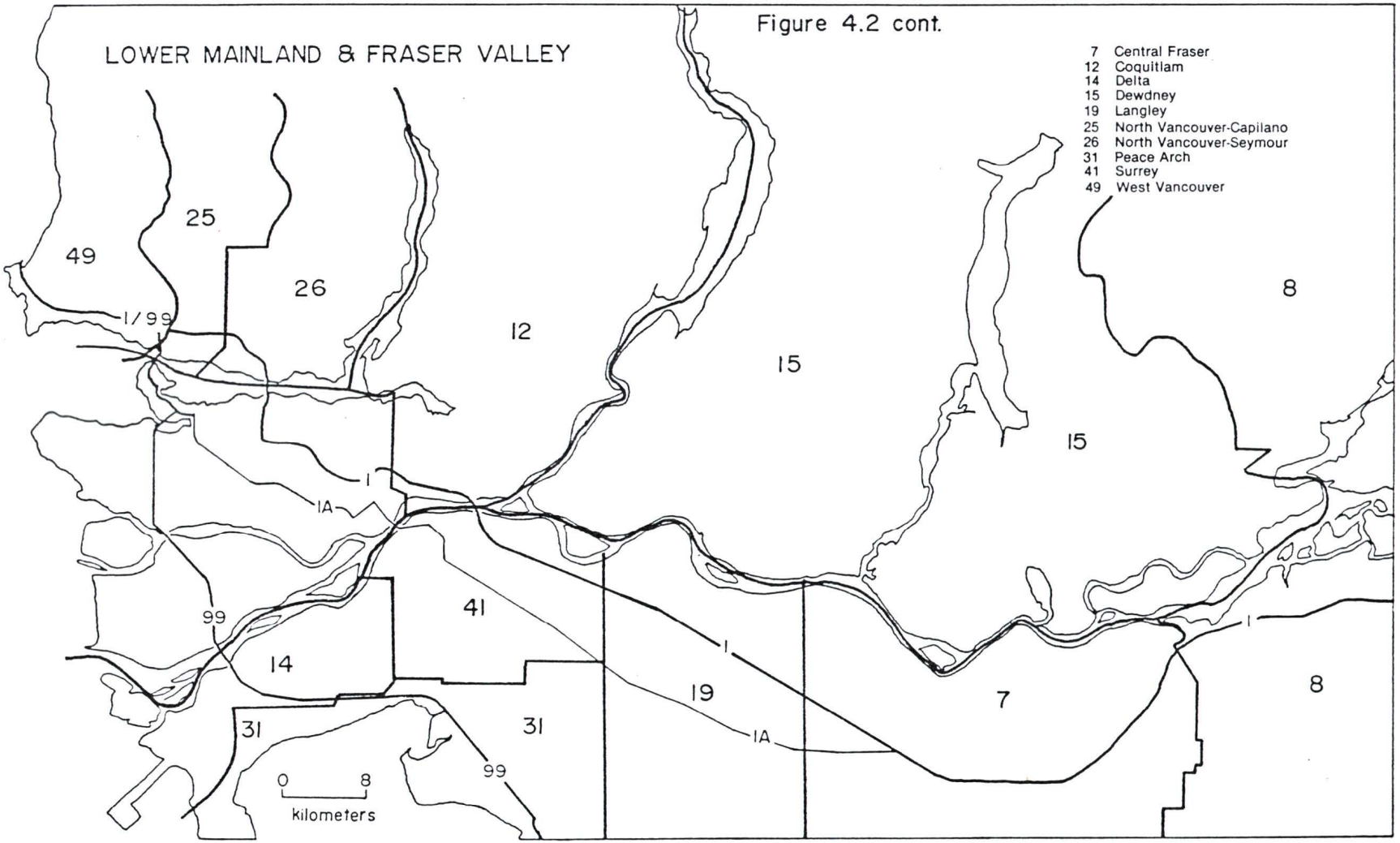


Figure 4.2 cont.



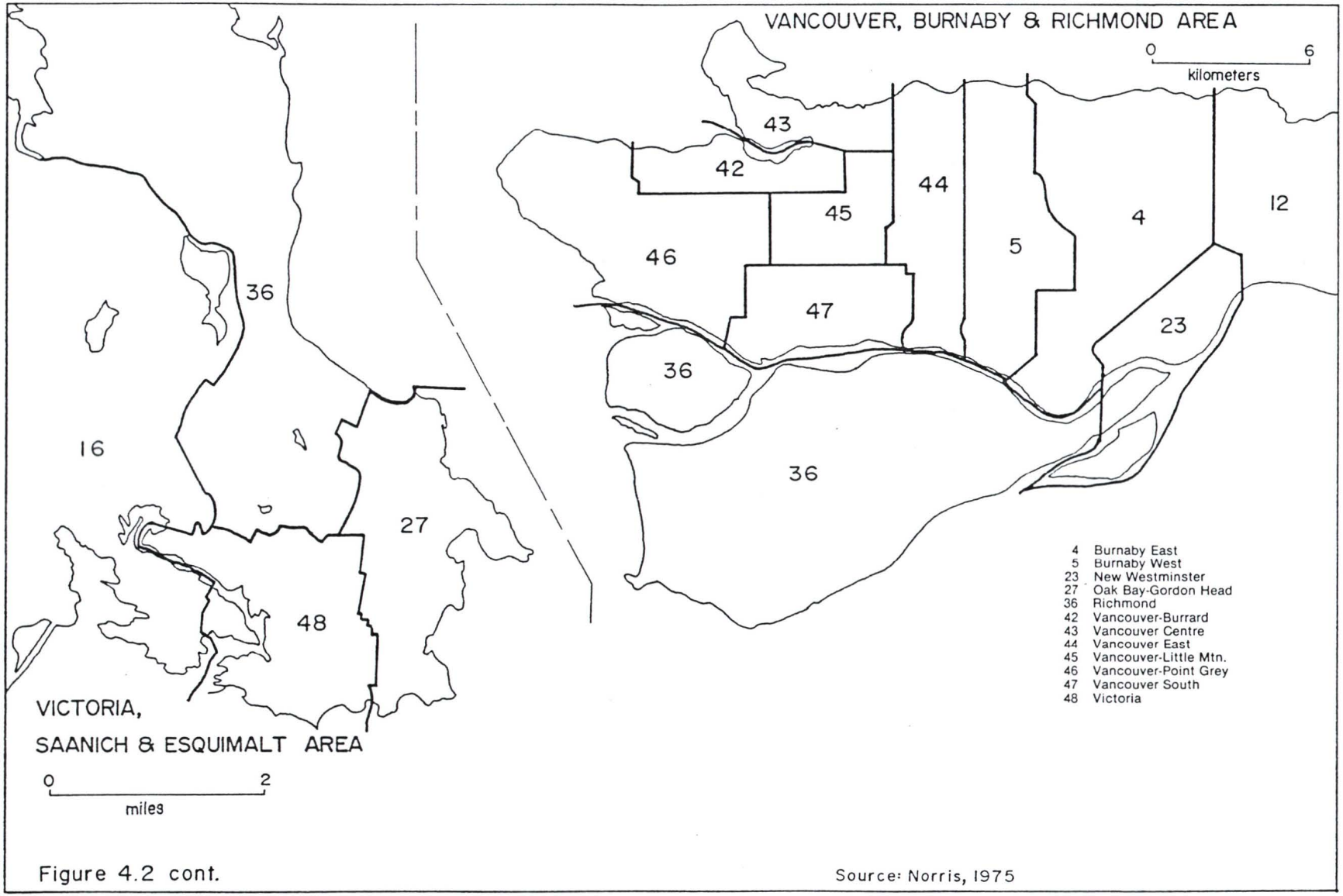


Figure 4.2 cont.

Source: Norris, 1975

Commission suggested that the internal boundaries of this region's ridings be modified in order to respect, as near as possible, the local communities of interest. The Commission also recommended that the Vancouver Island region be allowed a new seat. In the Commission's judgement, the population of the northern portion of the Island had grown to the point where it warranted its own riding. The Commission also recommended that the 12 ridings of Richmond, Surrey, Coquitlam, Victoria, Burnaby-East and -West, and the six Vancouver ridings all be double member districts.

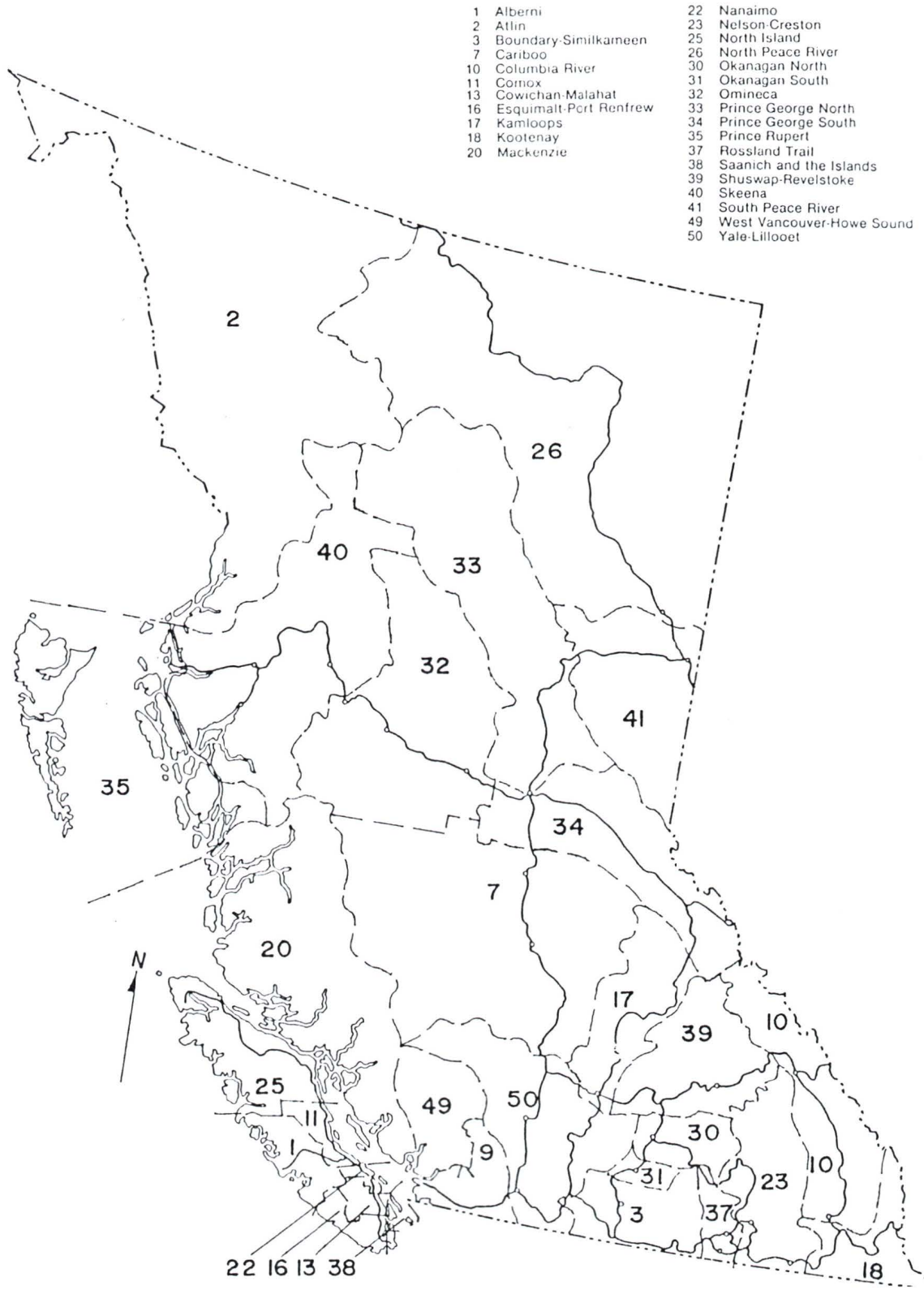
Had these recommendations been implemented, the Province would have been delineated into 50 ridings with population's ranging between 39.9 percent above and 29.3 percent below the adopted quota of 40,000. As well, the Dauer-Kelsay index for the recommended system of ridings would have increased from .359, for the existing set of electoral districts, to .431 (Norris, 1975; Greer, 1978). However, the N.D.P. government was defeated in the November 5th, 1975 provincial election and the new Social Credit Government did not adopt any of the Norris Commission's recommendations. As a result, the 1966 riding boundaries remained in effect until 1978 when the S.C. Government decided to appoint a Royal Commission on Electoral Reform. Although the recommendations of the Norris Commission were not implemented, the proposed ridings are shown in Figure 4.2.

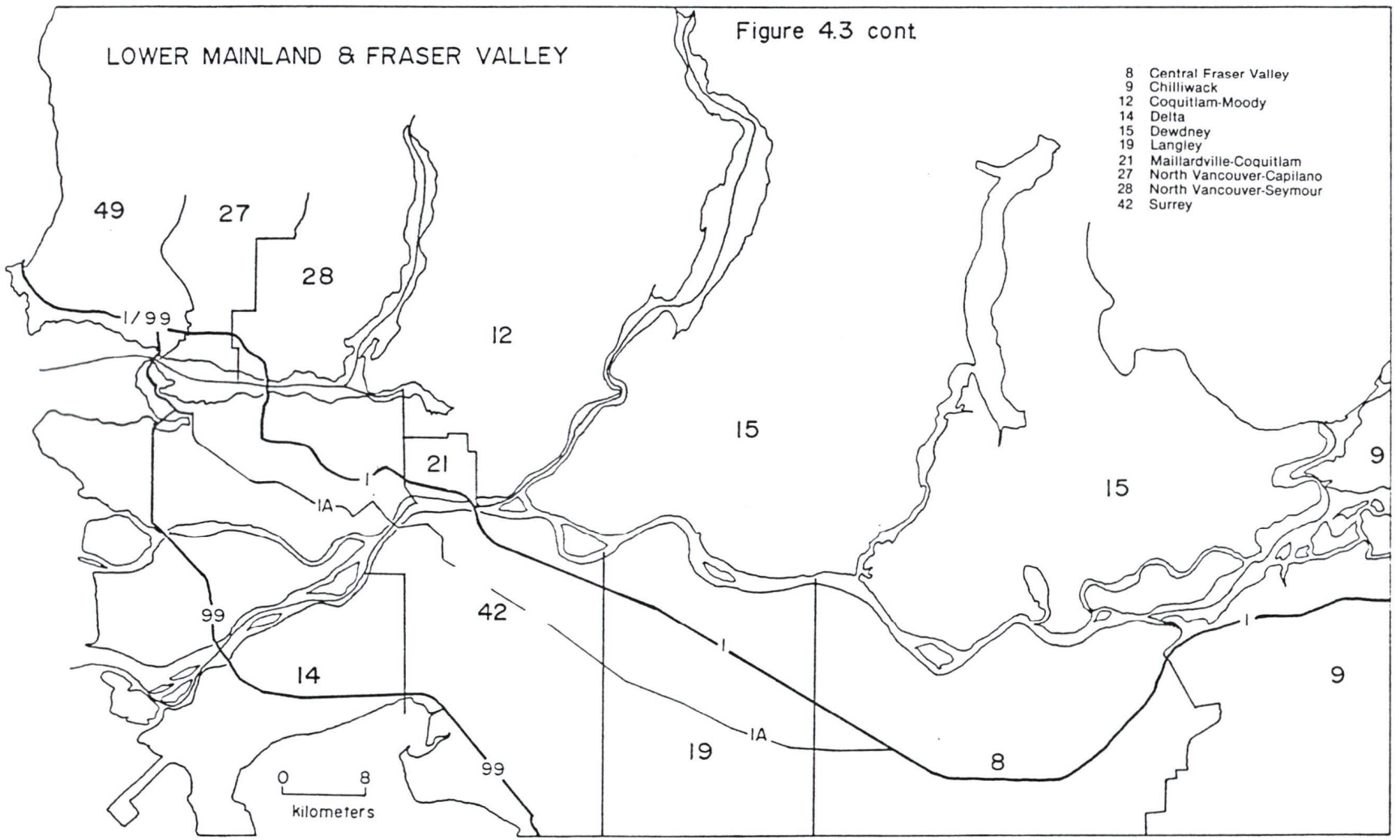
4.3.3 The Eckardt Commission

The Lieutenant-Governor of British Columbia approved Order-in-Council number 82 on January 12th, 1978 and the Royal Commission on Electoral Reform was established. This Commission was headed by Judge Lawrence S. Eckardt and was granted a very extensive mandate. It was to consider and make recommendations on: a) redefining electoral districts, b) alternative methods of voting, c) voter eligibility requirements, d) guidelines for the collection and expenditure of campaign funds, e) income tax deductions for financial contributions to such funds, and f) requirements for designating the status of political parties in the Assembly (Norris, 1978). In regards to redefining electoral boundaries, it was to ensure that proper and effective representation would be achieved while taking into account both historical and regional claims.

The Commission felt that it was more desirable to adjust many riding boundaries than it was to drastically increase the number of seats in the Legislature. As a result, it recommended that only two new members be added, but that boundaries of 40 of the 48 existing ridings be modified (Eckardt, 1978). Although the Commission further recommended that dual member ridings be maintained, one Vancouver dual member riding, Vancouver-Burrard, was to be eliminated and its population split between the three ridings of Vancouver-Centre, Vancouver-Point Grey, and Vancouver-Little Mountain. In addition, it was recommended that the Surrey riding become a two member riding. The Commission also offered an opinion that future redistributions be undertaken every ten years and that they be tied to the completion of the decennial census (Eckardt, 1978).

Figure 4.3 The Ridings Proposed by the Eckardt Commission




LOWER MAINLAND & FRASER VALLEY
Figure 4.3 cont.
8 Central Fraser Valley
9 Chilliwack
12 Coquitlam-Moody
14 Delta
15 Dewdney
19 Langley
21 Maillardville-Coquitlam
27 North Vancouver-Capilano
28 North Vancouver-Seymour
42 Surrey
49
27
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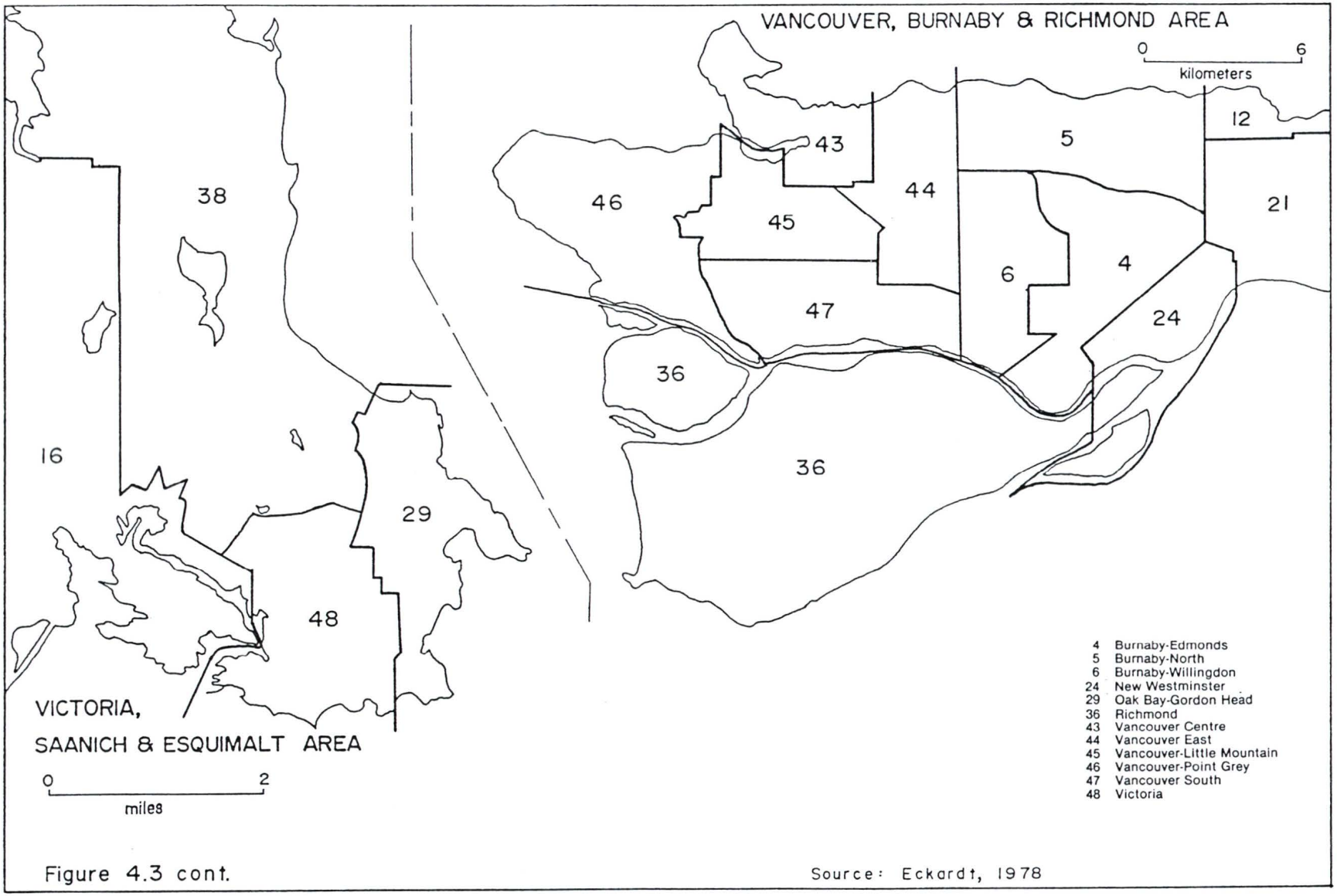


Figure 4.3 cont.

Source: Eckardt, 1978

All but one of the Commission's recommendations concerning the redefinition of riding boundaries were legislated into effect. The one suggestion that was not incoporated into the ensuing amendment to the Constitution Act concerned periodic redistribution. The riding boundaries that were implemented as a result of the Eckardt Commission are shown in Figure 4.3. Although the Eckardt Commission's mandate prescribed it to redefine riding boundaries to secure proper and effective representation for all British Columbians, the electoral map that resulted from implementing the Commission's recommendations delineated ridings in such a manner that the largest single member riding, Richmond, was 15.8 times larger than the smallest, Atlin (Eckardt, 1978; Fisher, 1988). The number of dual member ridings remained at seven including Surrey, Victoria and the five remaining Vancouver ridings.

4.3.4 The Warren Commission

The next British Columbia Royal Commission on Electoral Representation was a one man Commission headed by Derril T. Warren in 1982. Again, this Commisssion was appointed by an Order-in-Council. Mr. Warren's task was to inquire as to the need of amending the Constitution Act in order to secure equitable and effective representation for the people of the province in the Legislative Assembly. In addressing his mandate, Commissioner Warren was to consider 1981 Census population data, the distribution of the population over urban, suburban, rural and remote regions, the geography of the province, additional representation for existing electoral districts depending upon population, geographic and historical factors, and the division of dual member ridings that would otherwise warrant a third member. His recommendations were

also based on the criterion that the Legislature contain between 57 and 71 members (Warren, 1982).

The Commission made use of a quantitative mathematical model developed and calibrated by Mr. Trevor Braem, to determine the number of seats to be added to the Legislature. Supposedly the model logically and consistently applied geographic and population criteria while achieving the objective of designing an equitable distribtuion of representation (Warren, 1982). Basically, the model would allocate an additional member to a riding if the area of the riding exceeded 34,000 square miles.

Using both an average riding population of 42,882 per legislative member and the geographic area criteria, Commissioner Warren recommended that the Legislature be expanded by seven new seats. The representatives that were to be added to the Cariboo and North Peace River ridings were the result of applying the geographic criterion. The other new seats were based on the population criterion and a second seat was to be granted to the ridings of Delta, Kamloops, Richmond, Surrey, and Okanagan South. Each of these seven proposed seats would have resulted in creating a new dual member riding (Warren, 1982).

Only one boundary change was recommended. The Commission suggested that a section of the Vancouver-Little Mountain riding be transferred to the electoral district of Vancouver-Point Grey. Although this suggestion had the effect of defusing the gerrymandering claims that were associated with the post 1978 "lobe" found on the western boundary of the Vancouver-Little Mountain riding, it was based on two other criteria. First, prior to the 1978 readjustment the area to be transferred had historically been included in the Vancouver-Point Grey district

and second, the population of each of the ridings would become more equal following this change. Commissioner Warren was not in favour of maintaining dual member ridings in the Province. He recommended that they be allowed to stand for the iterim but suggested that their elimination be part of the mandate of a subsequent Commission. Tied to this last recommendation, was a strong advocacy for the establishment of a independent permanent Electoral Commission for British Columbia (Warren, 1982). Mr. Warren suggested that such a permanent Commission readjust many riding boundaries while eradicating all two member ridings.

The establishment of a permanent Electoral Commission was the only recommendation of the Warren Commission that was implemented (Fisher, 1988). Chapter 12 of the 1984 amendment to the Constitution Act both instituted the new Commission and specified its mandate (Statutes of British Columbia, 1984). However, the prescribed mandate did not follow Mr. Warren's suggestion that electoral representation be reapportioned over the entire province while eliminating dual member ridings. Instead, the Commission was required to determine the electoral base for both the Mainland and Vancouver Island, as well as calculating the number of residents in each riding of the Province before making recommendations that would either transform a single member riding into a dual member district, or split an existing two member riding into three equally populated single member ridings.

The criteria for performing these tasks were clearly laid out in the enabling legislation as was a formula for calculating each riding's electoral quota. The first step in determining the electoral quota for a particular riding involved

determining whether the riding was located on the Mainland or Vancouver Island. A distinct electoral base was prescribed for each of these regions. Within each region, ridings were further classified into settlement density categories and an electoral base percentage was assigned to each category. The effect of these classification percentages was that the historical pattern of over representation in remote and rural ridings was maintained. The five settlement density categories of the Mainland were labelled as Metropolitan, Suburban, Urban-rural, Interior-coastal and Remote, and the respective classification percentages were 200, 100, 90, 85, and 80 percent. The Island ridings were divided into three groups, Metropolitan, Urban-rural and Interior-coastal and the classification percentages largely reflected those of similarly labelled Mainland ridings (Statutes of British Columbia, 1984). The electoral quota for each riding was then to be calculated by multiplying the regional electoral base by the classification percentage that was prescribed in the amended Constitution Act.

When a riding's population was found to be at least 60 percent higher than its calculated electoral quota, one of two paths was to be followed depending on whether the district was a single or double member riding. In the former case, the electoral district was to be allowed a second member. However, in the case of an existing two member riding, the Commission was to split the district into three new equally populated ridings with each having its own member.

4.3.5 The McAdam Commission

The first permanent Electoral Commission was established May 15, 1984 with Judge D. Kennedy McAdam as Chairman. Following its prescribed mandate, the Commission determined that the Mainland and Vancouver Island electoral bases were 42,562 and 42,285 respectively (McAdam, 1984). These electoral bases were multiplied by each riding classification percentage and these compared to the population of each riding to determine if any exceeded the electoral quota by more than 60 percent.

The Commission found that eleven single and one double member ridings had 1984 populations that excessed the 60 percent limit (McAdam, 1984). As a result, the Commission recommended that the eleven single member ridings of Delta, Dewdney, Kamloops, Langley, Richmond, Cariboo, Nanaimo, Okanagan South, Central Fraser Valley, Saanich and the Islands, and Boundary-Similkameen each become two member districts. In addition, it also recommended that the two member riding of Surrey be split into three distinct single member ridings of Surrey-Newton, Surrey-Guilford-Whalley, and Surrey-WhiteRock-Cloverdale. These recommendations were adopted by the Legislature and the Assembly increased in size to include 69 members representing 52 constituencies (Goldberg, 1987). Apart from the changes to the Surrey riding, shown in Figure 4.4, the system of ridings currently in place is based on Eckardt's recommendations (Figure 4.3).

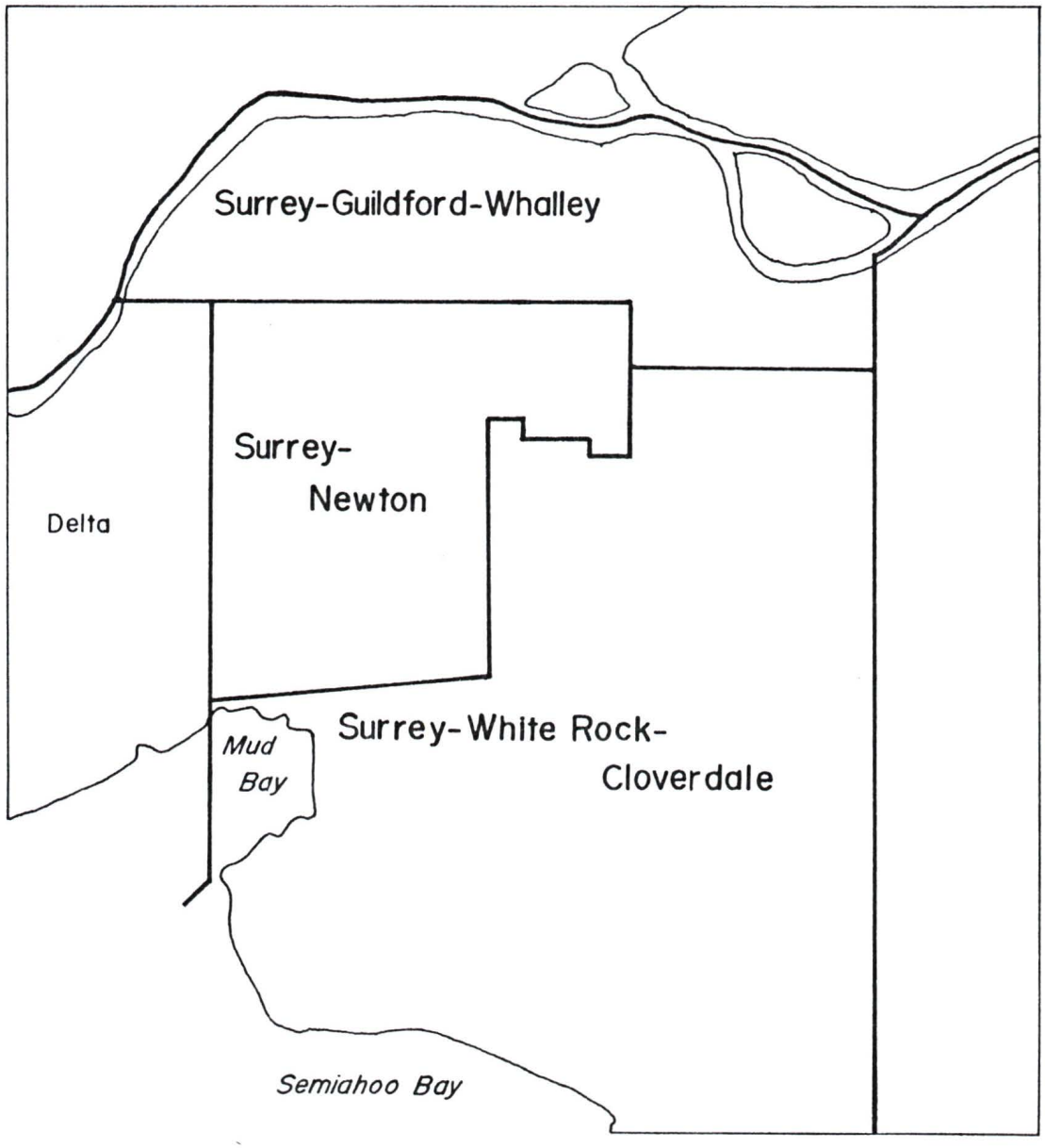


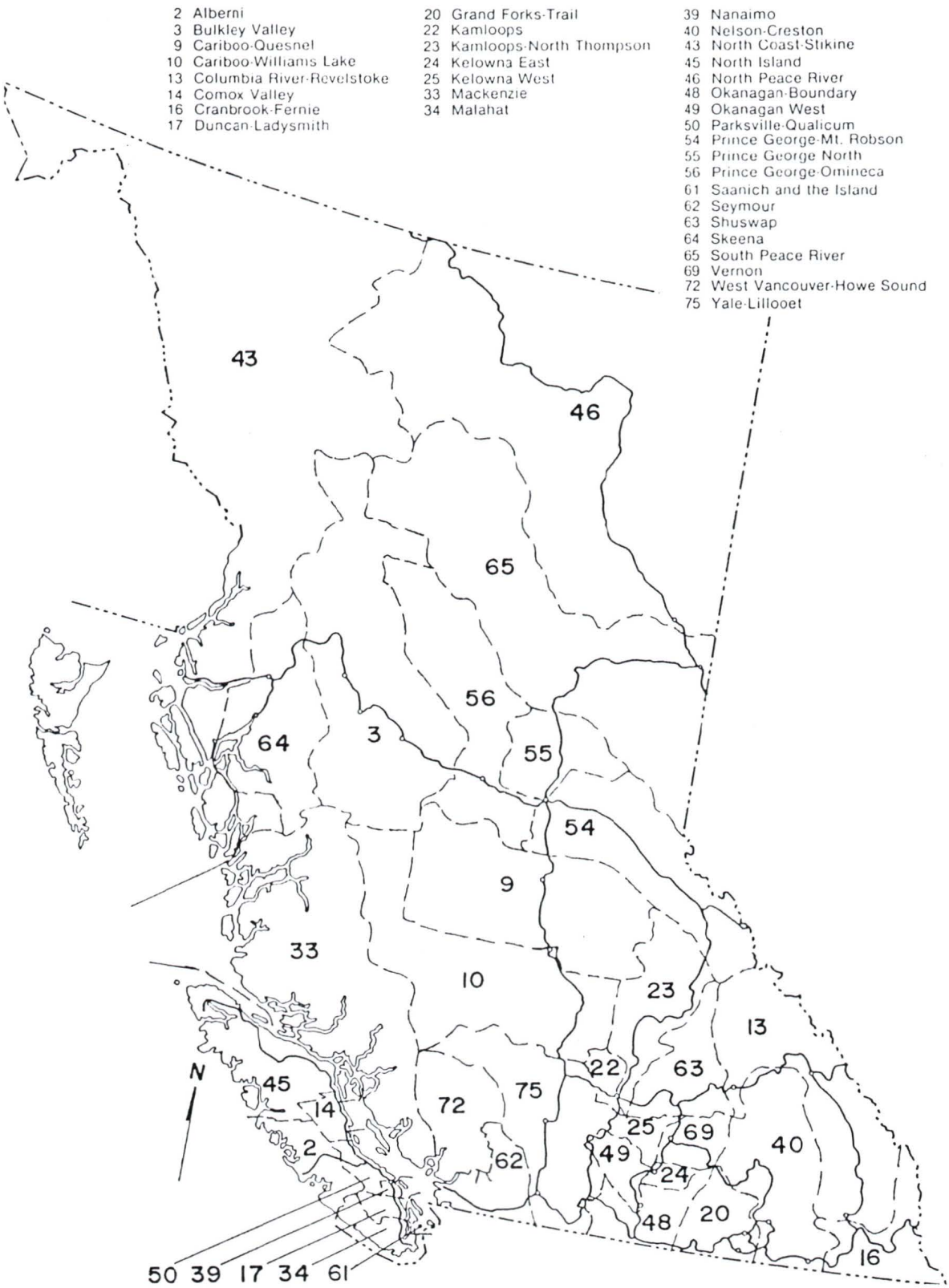
Figure 4.4 The Three Surrey Ridings as Proposed by the McAdam Commission

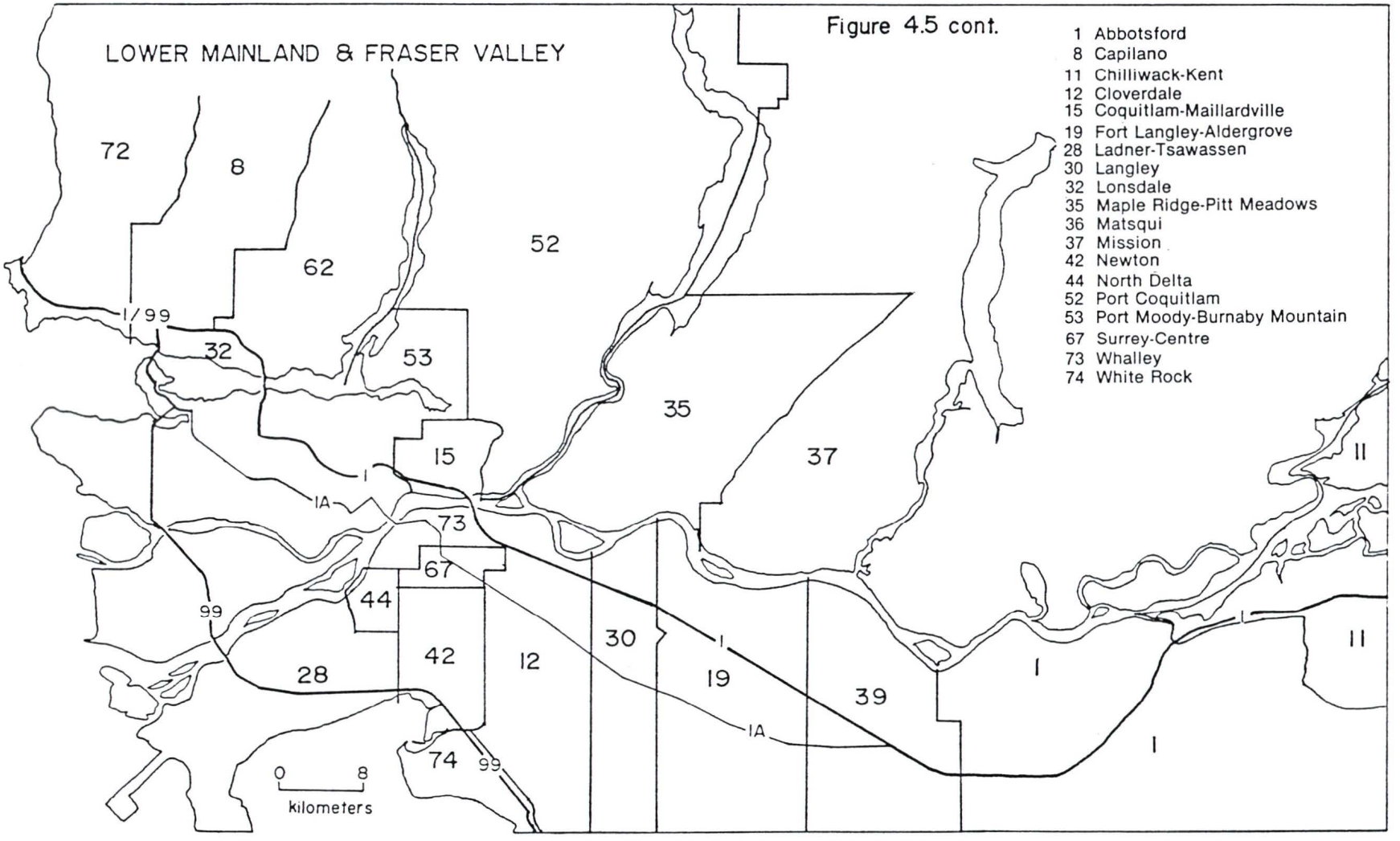
4.3.6 The Fisher Commission

The Fisher Commission, appointed through an Order in Council on April 8, 1987, was charged with a task that differed greatly from that of the permanent Electoral Commission. The original mandate of the Fisher Commission required that it make the necessary recommendations that would allow all existing two member electoral districts to be replaced by single member ridings. It was also required to consider readjusting the boundaries of all ridings that were "contiguous" to the two member constituencies. The Commission was also given several criteria to apply in carrying out its mandate. First, it was to establish one electoral quota for the entire Province. This was to be determined by dividing the population of the province by the number of seats in the Legislature. Second, historical and regional claims for representation were to be considered. A set of geographic criteria, including the sparsity or density of a region's population, accessibility to each region, and the size or shape of the region were also to be regarded. Finally, special community interests were to be respected while balancing the interests of all communities (Fisher, 1988).

It was suggested that the Commission hold public hearings in carrying out its task. During the initial set of hearings, the Commission became aware of the fact that the number of ridings affected by its mandate was ambiguous. Subsequently, Judge Fisher applied to the Provincial Secretary on August 12, 1987, for permission to consider each electoral district of the Province. On September 17, 1987 the Commission's mandate was modified by way of a second Order in Council. The first requirement of the new mandate was for the Commission to determine the appropriate number of ridings for the Province. The second

Figure 4.5 The Ridings Proposed by the Fisher Commission




LOWER MAINLAND & FRASER VALLEY
Figure 4.5 cont.
1 Abbotsford
8 Capilano
11 Chilliwack-Kent
12 Cloverdale
15 Coquitlam-Maillardville
19 Fort Langley-Aldergrove
28 Ladner-Tsawassen
30 Langley
32 Lonsdale
35 Maple Ridge-Pitt Meadows
36 Matsqui
37 Mission
42 Newton
44 North Delta
52 Port Coquitlam
53 Port Moody-Burnaby Mountain
67 Surrey-Centre
73 Whalley
74 White Rock
72
8
62
52
1/99
32
53
35
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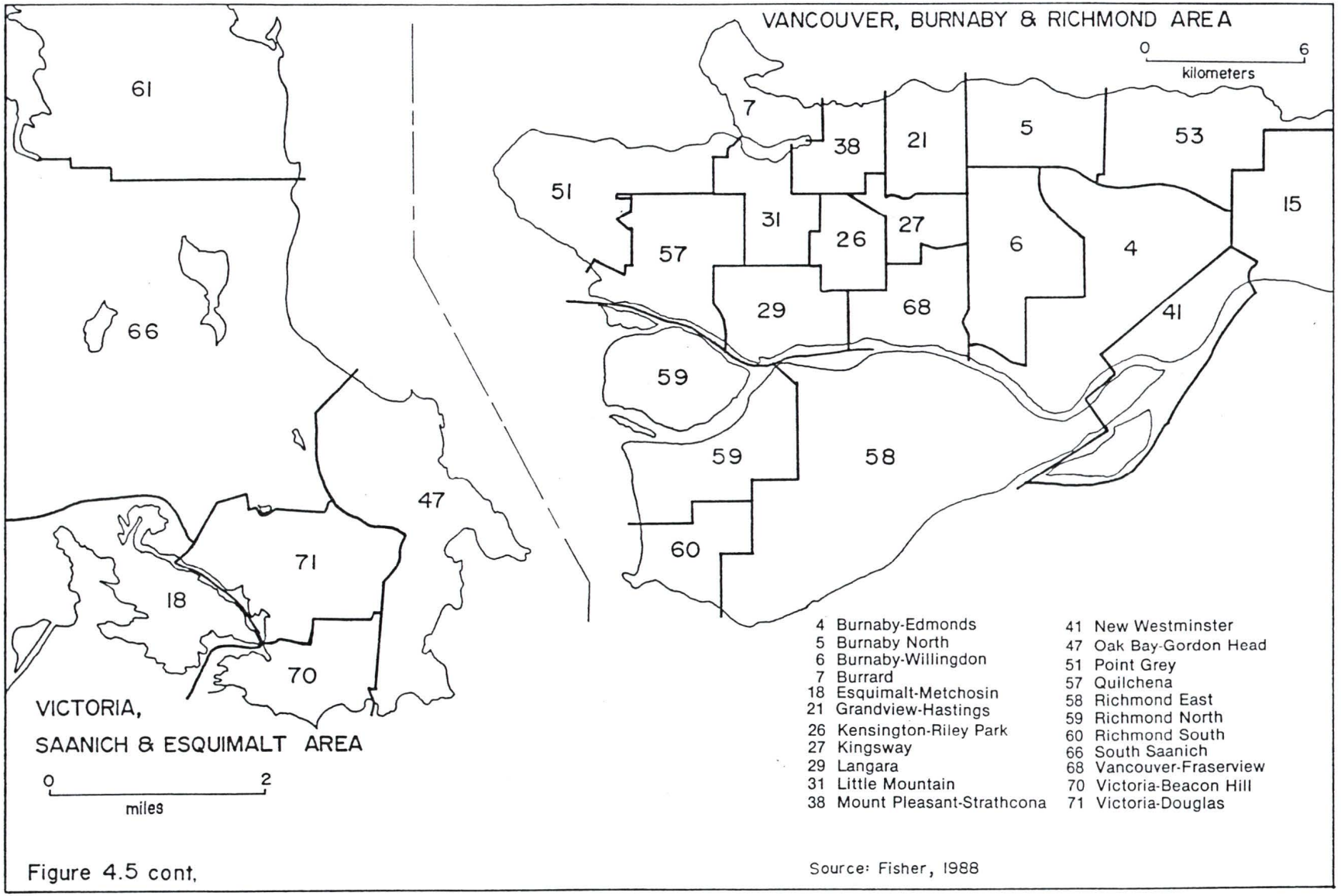


Figure 4.5 cont.

Source: Fisher, 1988

requirement, was for the Commission to suggest boundaries for each electoral district. The prescribed criteria for completing its task were not changed (Fisher, 1988). The Fisher Commission's mandate differred from those of previous British Columbia electoral Commissions in two major ways. First, it was charged with the task of eliminating all two member ridings. Second, it was required to acheive population equity among all electoral districts in the province (Fisher, 1988).

After receiving and studying the new mandate, the Commission made a preliminary ruling on December 9, 1987 that the Legislature be increased in size to include 75 members. The public was advised that any brief or submission should be based on this figure. A second round of hearings were held between January 18, 1988 and April 15, 1988 during which the Commission received over 670 verbal and written submissions.

Complicating the Commission's task is the existing system of ridings. There are currently 52 electoral districts in the Province, seventeen of which are dual member constituencies. Due to previous redistributions, and the one recommended by the McAdam Commission in particular, seven distinct population quotas can be found within the current electoral map of the Province (Fisher, 1988). The largest riding in terms of population, Surrey-Newton, is 12.4 times as large as the smallest, Atlin (Goldberg, 1987). If the 1986 population of the province is divided by the number of members in the current Legislature, an electoral quota of 41,873 is obtained (Fisher, 1988). Applying this quota to the existing ridings, 18, or 35 percent, are found to have populations that deviate from this quota by more than 25 percent.

The Commission released its Preliminary Report in May of 1988. It contains three basic recommendations. First, British Columbia should have 75 electoral districts. Second, all two member ridings should be eliminated. Third, no riding should have a population that varies by more than 25 percent above or below the electoral quota of 38,523, based on the 1986 Census (Fisher, 1988). The Commission further recommended that the North retain its current allocation of eight seats. However, Atlin would become part of the new constituency of North Coast-Stikine. As well, it recommended that Vancouver Island receive an additional seat while the Lower Mainland gain five new seats. In order to fulfill its mandate, the Commission has recommended that the boundaries of most of the existing ridings be adjusted. The proposed ridings are shown in Figure 4.5. It is this system of proposed ridings that will form the basis of the empirical test of the methods and criteria selected in the preceeding Chapter. The effectiveness of these criteria in determining malapportionment and possible instances of gerrymandering will be evaluated by applying them to the Fisher Commission's Preliminary Report in the following chapter. This process will identify limitations in the sensitivity of the criteria and shortcomings in the proposed set of electoral districts.

4.4 Summary

This chapter provided the rationale for selecting British Columbia and the Preliminary Report of the Fisher Commission as the case study. As well, the redistribution process in British Columbia was reviewed and a brief explanation of each independent Commission's mandate and recommendations were presented.

The methods of detecting non-compact districts and malapportionment, that were selected in Chapter 3, are evaluated in the next chapter as are the Fisher Commission's proposed ridings.

Chapter 5

ASSESSING THE PROPOSED RIDINGS OF THE FISHER REPORT

5.1 Introduction

This chapter applies the criteria identified in Chapter 3 for assessing the degree of fairness in a set of proposed ridings to the Preliminary Report of the Fisher Commission and presents the results of this analysis. Ridings that fail each criterion are identified in each section. As well, one of the criteria is relaxed and reapplied in a sensitivity analysis.

5.2 Applying the Population Criterion

The first step in assessing the fairness of the proposed ridings of the Fisher Commission is to apply the equal population criterion. In this analysis, the population of each riding is compared to the electoral quota to determine whether or not it is a malapportioned constituency. If an electoral district has a population that differs from the electoral quota by more than ten percent, it is classified as being malapportioned. The rationale for this tolerance limit was set in Chapter 3. In addition to identifying specific cases of malapportionment, the spatial arrangement of these ridings is examined to determine if there is a regional concentration of malapportioned ridings in the province. The Dauer-Kellsey (D-K) index for the entire system of ridings is computed as a further test for malapportionment.

Table 5.1 PROPOSED ELECTORAL DISTRICTS, POPULATIONS AND DEVIATIONS FROM ELECTORAL QUOTA

		Population (1986)	Deviation from Quota (in per cent)
1	Abbotsford	35,640	−7.5
2	Alberni	30,341	−21.2
3	Bulkley Valley	31,541	−18.1
4	Burnaby-Edmonds	43,689	13.4
5	Burnaby North	40,849	6.0
6	Burnaby-Willingdon	44,825	16.4
7	Burrard	42,962	11.5
8	Capilano	42,777	11.0
9	Cariboo-Quesnel	30,479	−20.9
10	Cariboo-Williams Lake	32,123	−16.6
11	Chilliwack-Kent	44,227	14.8
12	Cloverdale	35,761	−7.2
13	Columbia River-Revelstoke	32,074	−16.7
14	Comox Valley	42,769	11.0
15	Coquitlam-Maillardville	44,468	15.4
16	Cranbrook-Fernie	37,123	−3.6
17	Duncan-Ladysmith	41,000	6.4
18	Esquimalt-Metchosin	43,189	12.1
19	Fort Langley-Aldergrove	35,123	−8.8
20	Grand Forks-Trail	39,589	2.8
21	Grandview-Hastings	42,632	10.7
22	Kamloops	41,677	8.2
23	Kamloops-North Thompson	33,083	−14.1
24	Kelowna East	35,570	−7.7
25	Kelowna West	38,032	−1.3
26	Kensington-Riley Park	44,645	15.9
27	Kingsway	44,196	14.7
28	Ladner-Tsawassen	36,043	−6.4
29	Langara	43,698	13.4
30	Langley	35,334	−8.3
31	Little Mountain	43,831	13.8
32	Lonsdale	40,551	5.3
33	Mackenzie	38,206	−0.8
34	Malahat	33,269	−13.6
35	Maple Ridge-Pitt Meadows	37,185	−3.5
36	Matsqui	37,402	−2.9
37	Mission	32,490	−15.7
38	Mount Pleasant-Strathcona	44,372	15.2
39	Nanaimo	41,899	8.8
40	Nelson-Creston	38,012	−1.3
41	New Westminster	39,973	3.8
42	Newton	41,101	6.7
43	North Coast-Stikine	29,606	−23.1
44	North Delta	43,745	13.6
45	North Island	40,651	5.5
46	North Peace River	29,529	−23.3

Table 5.1 (Continued)

		Population (1986)	Deviation from Quota (in per cent)
47	Oak Bay-Gordon Head	42,145	9.4
48	Okanagan-Boundary	35,671	−7.4
49	Okanagan West	37,075	−3.8
50	Parksville-Qualicum	40,465	5.0
51	Point Grey	43,635	13.3
52	Port Coquitlam	42,692	10.8
53	Port Moody-Burnaby Mountain	44,143	14.6
54	Prince George-Mt. Robson	30,559	−20.7
55	Prince George North	34,238	−11.1
56	Prince George-Omineca	30,108	−21.8
57	Quilchena	43,114	11.9
58	Richmond East	36,410	−5.5
59	Richmond North	36,977	−4.0
60	Richmond South	35,105	−8.9
61	Saanich and the Island	37,956	−1.5
62	Seymour	41,124	6.8
63	Shuswap	40,931	6.3
64	Skeena	29,920	−22.3
65	South Peace River	33,162	−13.9
66	South Saanich	38,302	−0.6
67	Surrey-Centre	40,140	4.2
68	Vancouver-Fraserview	42,906	11.4
69	Vernon	41,893	8.7
70	Victoria-Beacon Hill	41,588	8.0
71	Victoria-Douglas	42,850	11.2
72	West Vancouver-Howe Sound	35,769	−7.1
73	Whalley	37,803	−1.9
74	White Rock	41,402	7.5
75	Yale-Lillooet	33,834	−12.2

The Fisher Commission recommended that the province be divided into 75 electoral districts and that the electoral quota be set at 38,523 people (Fisher, 1988). This quota was obtained by dividing British Columbia's 1986 population of 2,889,207 by 75. The population of the proposed ridings, and the extent to which each riding deviates from the quota, is shown in Table 5.1. It is apparent that 37, or 49.3 percent, of the proposed ridings have populations that exceed the ten percent tolerance limit. Sixteen of the malapportioned ridings have fewer than 34,671 constituents (the lower limit), while 21 have populations ranging between 10 and 16.4 percent above the electoral quota. This means that voters living in malapportioned ridings with populations below the electoral quota have more voting strength per individual than other voters in British Columbia. This point can be illustrated by comparing the proposed riding of North Peace River, the smallest in terms of population, to the largest constituency, Burnaby-Willingdon. Assuming a two party contest and a 100 percent voter turnout, 14,765 votes would be required in order of elect a M.L.A. in North Peace River. In comparison, 22,413 votes would be needed to elect the M.L.A. from Burnaby-Willingdon. This indicates that an individual vote in North Peace River is worth 1.5 times as much as a vote in Burnaby-Willingdon. When this comparison is made to a proposed riding with a population very near the electoral quota, such as South Saanich (38,302), a vote in North Peace River is worth approximately 1.3 times as much.

One of the Fisher Commission's goals was to readjust riding boundaries so that every constituency had a population that was within plus or minus 25 percent of the electoral quota. The Commission set both the tolerance limit and the quota and it achieved this goal. However, the range between the smallest riding and the

electoral quota is not equal to the range between the quota and the largest riding. For example, the ten proposed ridings of Alberni, Bulkley Valley, Cariboo-Quesnel, Cariboo-Williams Lake, Columbia River-Revelstoke, North Coast-Stikine, North Peace River, Prince George-Mt. Robson, Prince George-Omineca, and Skeena each have a population that is more than 16.4 percent below the electoral quota, while no riding has a population that exceeds the quota by this amount. Seven of these proposed ridings have population's that deviate by more than 20 percent from the quota.

While the Commission's goal of delimiting the Province's population to form ridings that are within plus or minus 25 percent of the quota is achieved, it actually proposes a set of ridings that deviate from the quota by minus 23.3 to plus 16.4 percent. This unbalanced tolerance range allows the Commission to grant more representation per voter to the less populous ridings. As well, the total range in proposed riding populations implies the existence of an electoral quota that differs from 38,523. The largest riding, Burnaby-Willingdon, has 15,296 more people than the smallest, North Peace River. The midpoint in riding population between these two extremes is 37,177. The Commission's proposed ridings deviate from this midpoint by plus or minus 20.6 percent. Although this midpoint only differs from the electoral quota by 1,346 people, if it were used in the calculation of the size of the legislature instead of the quota, the proposed legislature would be increased by three to include 78 members.

A measure that can be used with the electoral quota, or the mean riding population, to determine if the proposed system of ridings is affected by either the large or small ridings is the median riding population. One half of the ridings

will have populations larger than the median value and one half smaller. If riding populations deviate equally above and below the electoral quota, both in number of constituencies and by total population, then the electoral quota and the median population will be equal. If, however, the number of people delimited into ridings above the electoral quota is not equal to the number below it, then it will not be equal to the median. Whichever group, above or below the electoral quota, is larger in total population will cause the mean riding population to move away from the median value toward the larger of the two groups. The mean population can be affected by extreme high or low populations. It can also be affected by a concentration of ridings with populations near one of the acceptable tolerance limits if a similar aggregation does not occur near the opposite limit. An unequal distribution of people throughout the tolerance range will result in the electoral quota, or mean, not equalling the median riding population.

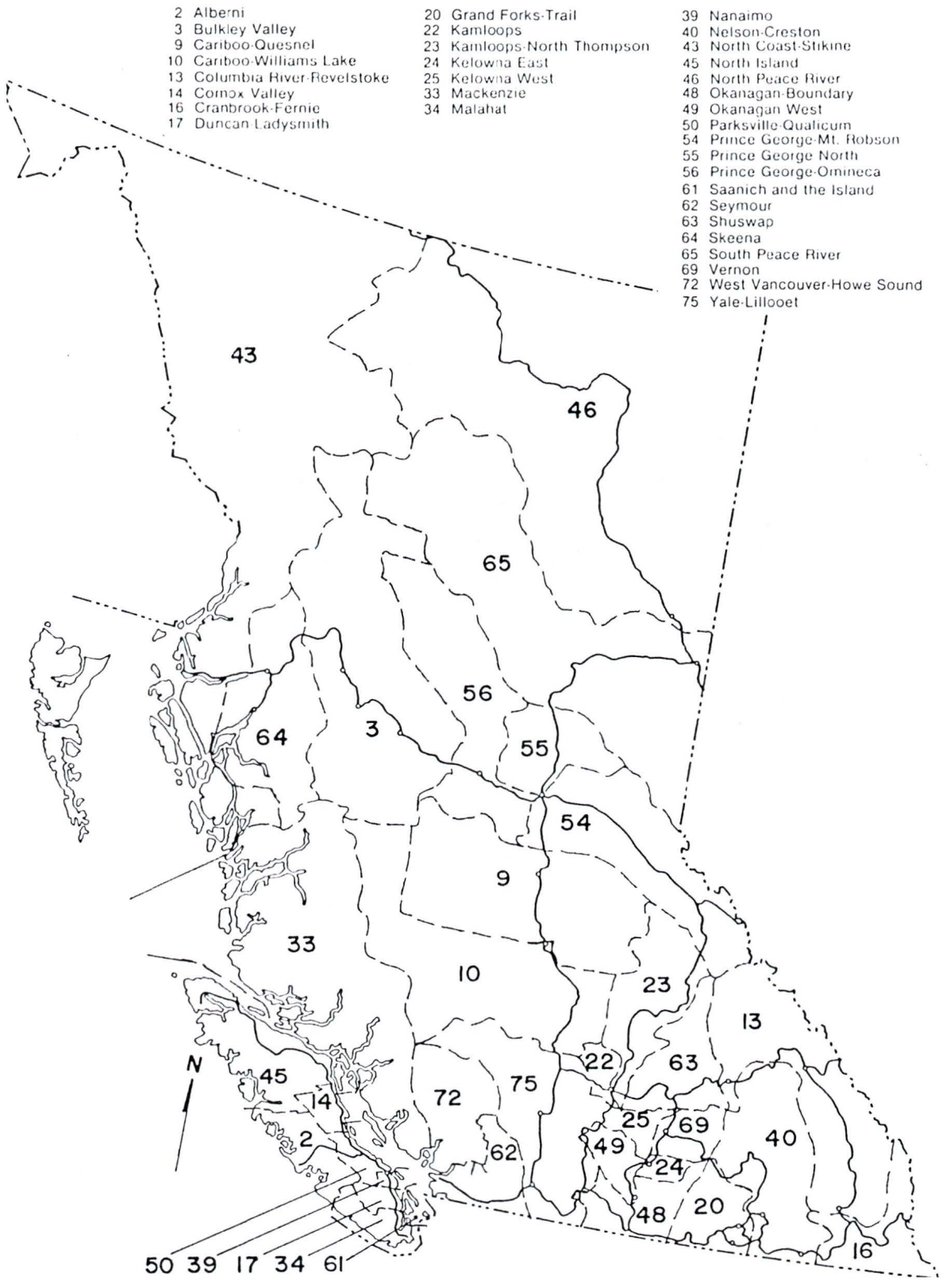
The constituency of Grand Forks-Trail is the median riding with a population of 39,589. This median is larger than the electoral quota and indicates that the number of people in ridings smaller than the electoral quota exceed the number above it. This implies that the proposed system has either more small ridings than large, or that the number of very small ridings over compensates for the existence of a few larger constituencies. From this analysis, it is clear that the Commission's Preliminary Report is slightly biased toward creating and/or retaining ridings that are below the electoral quota.

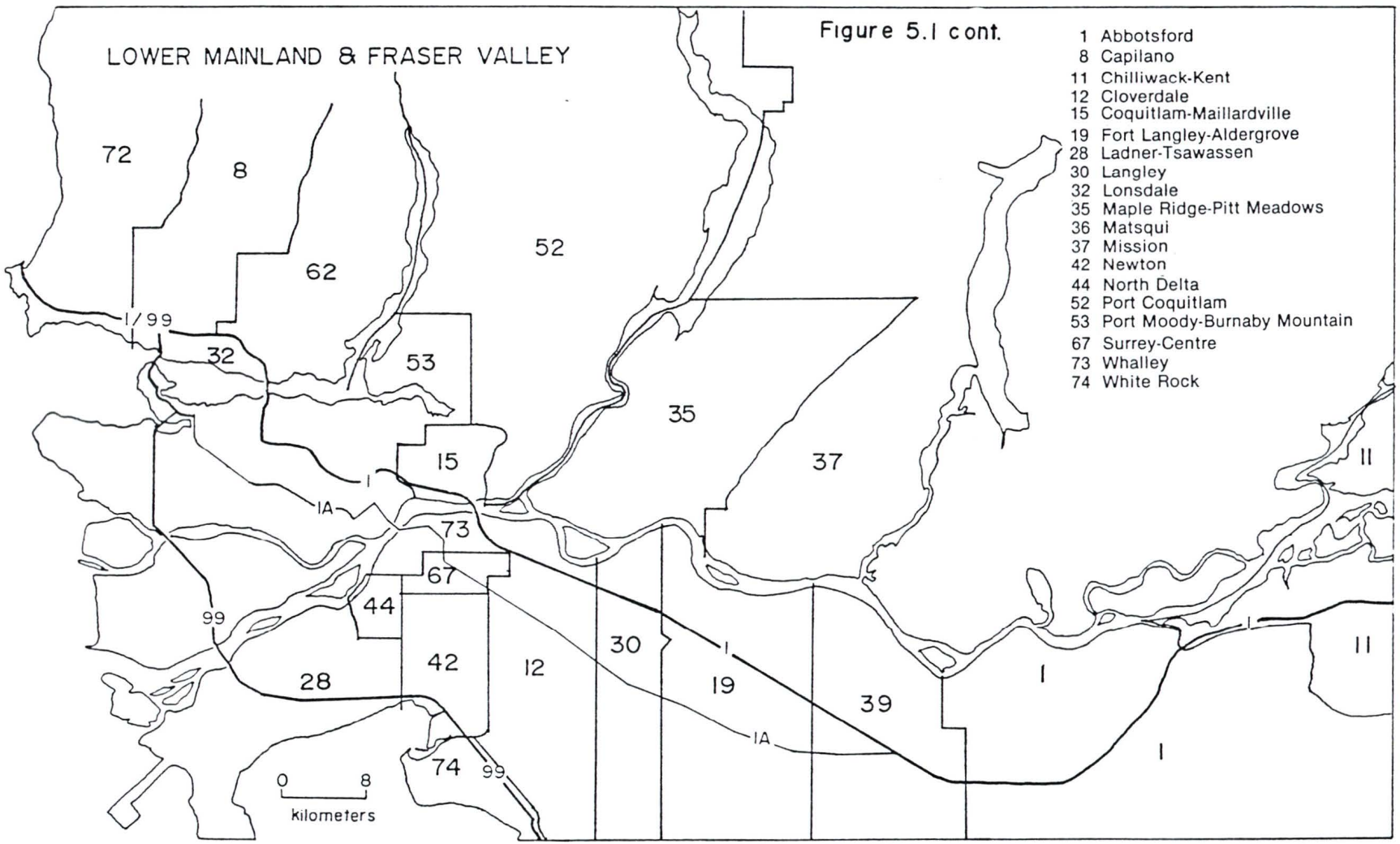
If the small ridings were randomly spread throughout the entire Province, then no region would be over represented at the expense of another. However, this is not the case in the Commission's proposed system of ridings. Figure 5.1 shows

that there is regional concentration of both small and large ridings. Excluding the region of Vancouver Island, the small malapportioned districts are basically grouped together in the northern portion of the Province, while the large under represented constituencies are primarily located in Vancouver and the Lower Mainland. Any riding that is either severed by the 51st parallel or is completely north of it is classified as belonging to the over represented region. The riding boundaries that form the southern limit of this region, from west to east include Mckenzie, Cariboo-Williams Lake, Kamloops, Kamloops-North Thompson, Shuswap, and Columbia River-Revelstoke. The total population of this region is 497,225 and by applying the electoral quota it is entitled to thirteen seats. The total population of the under represented region, not including the Vancouver Island ridings is 786,557. This region is entitled to 20 seats by strict application of the electoral quota. The Commission's Preliminary Report, however, gives the "northern" region fifteen seats, two more than its population warrants. These two seats have been effectively transferred from the Vancouver and Lower Mainland regions because the Commission's recommendations only award it eighteen seats, two less than its population entitlement.

Vancouver Island, has one riding with more than 10 percent below and three with more than 10 percent above the electoral quota (see Figure 5.1). Dividing the Island's total population of 516,424 by the electoral quota, this region is entitled to thirteen seats, which matches the Commission's recommendations. However, although the Island's representation as a whole would not be jeopardized in the Legislature, the ridings of Comox Valley, Esquimalt-Metchosin, and Victoria-Beacon Hill would be under represented while the Alberni constituency would be over represented according to a plus or minus ten percent range.

Figure 5.1 British Columbia's Proposed Electoral Districts




LOWER MAINLAND & FRASER VALLEY
Figure 5.1 cont.
1 Abbotsford
8 Capilano
11 Chilliwack-Kent
12 Cloverdale
15 Coquitlam-Maillardville
19 Fort Langley-Aldergrove
28 Ladner-Tsawassen
30 Langley
32 Lonsdale
35 Maple Ridge-Pitt Meadows
36 Matsqui
37 Mission
42 Newton
44 North Delta
52 Port Coquitlam
53 Port Moody-Burnaby Mountain
67 Surrey-Centre
73 Whalley
74 White Rock
72
8
62
52
1/99
32
53
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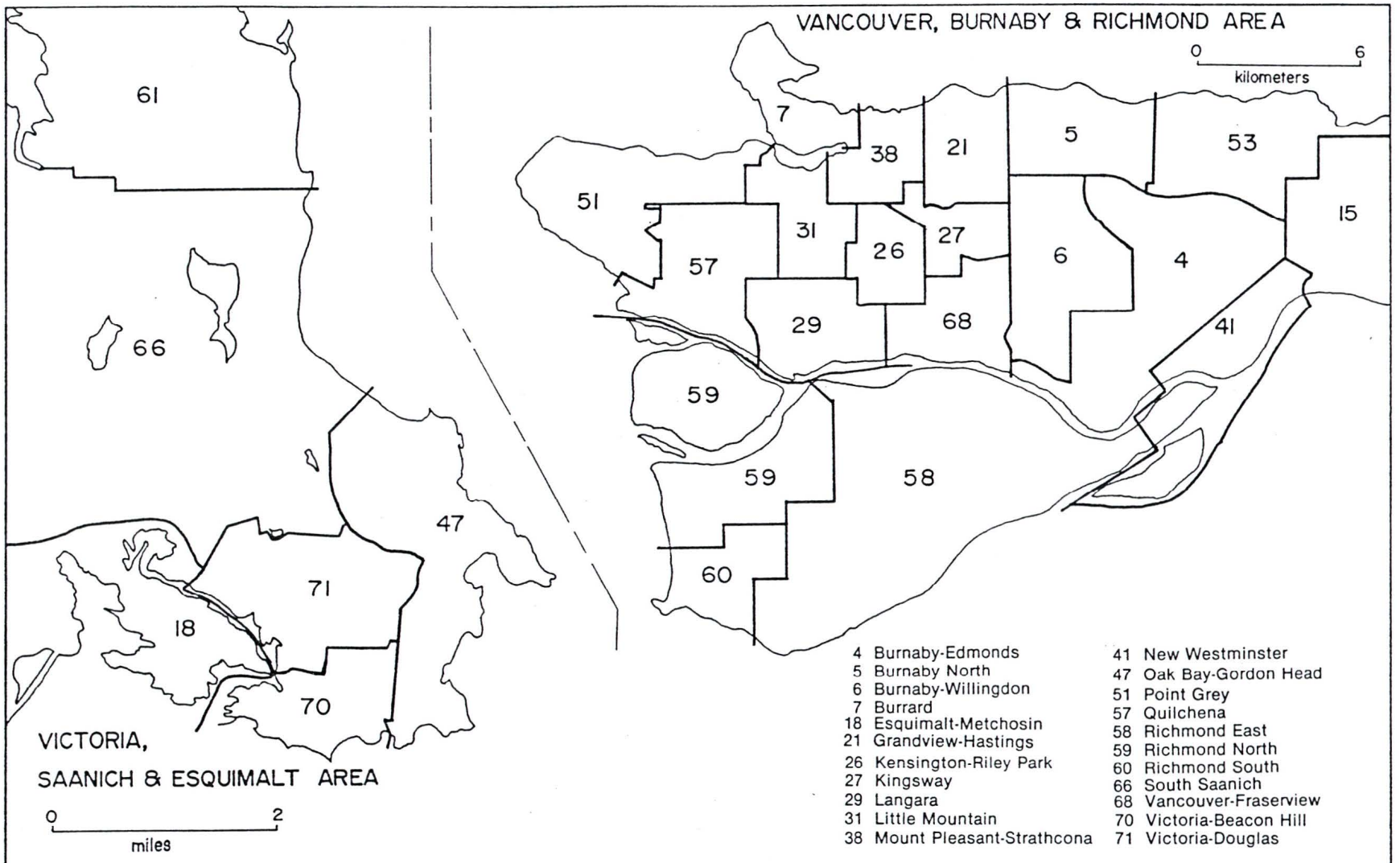

Figure 5.1 cont.

Source: Fisher, 1988

Another measure that can be applied to the Commission's proposed ridings to determine the degree of malapportionment is the Dauer-Kellsey (D-K) index. The proposed set of ridings has a D-K index value of 0.456. This is an improvement of 0.043 over the index value for the existing set of ridings. However, if the proposed ridings were to be used in a two party election and assuming 100 percent voter turnout, 54 percent of the population could support one party and not elect the government. This bias is due to the existence of several ridings that have populations that are substantially less than the electoral quota.

5.3 Preservation of Communities of Common Interest

The second step in assessing the Commission's proposed electoral districts involves determining if the riding boundaries cleave cultural and/or ethnic communities. One of the most obvious cultural/ethnic communities in British Columbia are Indian reservations. Although less than three percent of the Province's population is composed of indigenous people, there are dozens of Indian reservations spread throughout the Province (Statistics Canada, 1988). In order to determine whether such communities are split by proposed riding boundaries, the legal description of each riding has been scrutinized wherever reservation boundaries served in part as riding borders. Seven constituencies, namely Kamloops, Vernon, Malahat, Kelowna West, Yale-Lillooet, Okanagan West, and Prince George-Omineca, satisfy this condition (Fisher, 1988). In each case the reservations have been left intact.

Both Vancouver and Victoria have large Chinese communities. Although people of Chinese descent live in most parts of these cities, each has a Chinatown.

The Victoria Chinatown is limited to a few city blocks and is completely within the boundary of the proposed Victoria-Douglas riding. Vancouver's Chinatown, however, is split by the Main Street boundary that separates the two ridings of Burrard and Mount Pleasant-Strathcona. According to the 1986 Census, approximately seven percent of Vancouver's population is of Chinese descent (Statistics Canada, 1988a). The high profile portion of this community is found within the area bounded by Carrall Street on the west, Hastings Street on the north, Gore Avenue on the east, and Keefer Street on the south (Rand McNally, 1988). The Chinese Cultural Centre is located in the south west corner of the area near the intersection of Pender and Carrall Streets (Rand McNally, 1988). This is about two blocks west of the Commission's proposed Main Street boundary. In addition, several Chinese nursing homes are located on Union Street east of Main Street. The Burrard-Mount Pleasant boundary effectively severs this distinct community. During discussions with a former Dispatcher for the Vancouver City Police Department (Mallory, 1989), it was learned that Carrall Street forms the boundary between Police Districts 1 and 2. District 1 is an area that is approximately equal to the proposed Burrard riding. A Carrall Street boundary between these two Vancouver electoral districts would prevent the Chinese community from being split into two parts. Splitting the community along Main Street could have the effect of duplicating and/or possibly diluting community concerns.

When equalizing riding populations is a major redistribution criterion, it is sometimes necessary for the new electoral district to cross some other administrative boundaries. For example, if a large rural region surrounds a

relatively highly populated urban centre, it is next to impossible to respect municipal boundaries while designing contiguous ridings of equal population. Invariably trade-offs must be made between the criteria. Preserving municipal boundaries is generally viewed as being less important than equalizing riding populations (Morrill, 1981; Cain, 1984; Ruff and Ross, 1988b). The Commission encountered this situation several times in the interior of the Province. It was consistent in its approach to solving this problem. Rather than suggesting a doughnut solution which would create a central urban riding and surround it with one or two large, low density, rural electoral districts, it suggested riding configurations that combined urban with rural residents. Examples of these compromises include the two riding solutions of Kamloops, Kelowna, and Penticton and the three Prince George constituencies.

The Kamloops solution is the weakest of these due to the fact that the ridings have very different populations. The proposed Kamloops and Kamloops-North Thompson constituencies have 41,677 and 33,083 people respectively, which means that the North Thompson district is approximately 26 percent larger. The differences between the smallest and largest Kelowna, Penticton and Prince George ridings are 7, 4, and 14 percent, respectively. The total population of the two Kamloops constituencies is 74,760. It would be possible to delineate two electoral districts of equal population that would each be approximately three percent less than the electoral quota. Since the Kamloops municipal boundaries are going to be crossed in any redistribution of this region, the resulting ridings should be much closer in total population than those proposed by the Commission for two reasons. First, due to their smaller total population, individual

constituents in the proposed Kamloops-North Thompson riding have more voting strength. Second, the major justification for crossing municipal boundaries is to create electoral districts with equal total populations.

Although the Commission was consistant in its approach to crossing municipal boundaries in the interior of the Province, it addressed this problem differently on Vancouver Island. Instead of dividing urban populations to form the basis of two or three regional ridings, the Commission used small portions of urban residents to equalize the population of neighbouring constituencies. The electoral districts of North Island and Parksville-Qualicum include a small percentage of the residents of Campbell River and Nanaimo, respectively. North of the proposed Malahat riding, the Commission has delineated the electoral districts on the north and east sides of the Island to equalize their total population. This set of five constituencies includes North Island, Nanaimo, Comox Valley, Duncan-Ladysmith, and Parksville-Qualicum. The populations range from 40,465, for Parksville-Qualicum, to 42,769 for Comox Valley.

In order to equalize riding populations, crossing Island municipal boundaries is unavoidable. However, population parity was not achieved for the seven Island constituencies outside of the Greater Victoria Area. The two proposed ridings of Alberni and Malahat have respective populations of 30,341 and 33,264. The Parksville-Qualicum electoral district, the smallest of the other five ridings, has approximately 10,000 more people than the Alberni and 7,200 more than the Malahat constituencies. As seen from Figure 5.1, the Alberni riding shares borders with all other electoral districts in this group except Nanaimo. The Malahat constituency is adjacent to both the Alberni and Duncan-Ladysmith districts.

Several factors suggest that these ridings could be delineated to have populations that are more equal in numbers. First, the Nanaimo and Campbell River municipal limits are crossed by boundaries of several proposed electoral districts. Since crossing them was unavoidable, the urban residents could have been assigned in such a manner as to equalize the population of all seven ridings. Second, the small communities associated with Denman and Hornby Islands were apportioned to the Parksville-Qualicum electoral district. Although the connecting ferry route between these Islands and Vancouver Island was respected by the Commission, the fact that these people are closely tied to the communities of Comox and Courtenay, due to their proximity, was not. Third, each of these proposed ridings shares borders with several of the others.

As far as the criterion of respecting communities of interest is concerned, the Commission's set of proposed ridings has several shortcomings. Granted, it did not cleave Indian reservations and it was consistent in its approach to crossing municipal boundaries in the interior of the Province. In summary, however, the Commission's Preliminary Report is found to contain the following weaknesses:

a. Kamloops is divided into two unequally populated electoral districts;

b. Vancouver's Chinatown is split between the ridings of Burrard and Mount Pleasant; and

c. population

parity among the seven Vancouver Island ridings outside of the Greater Victoria Area is not achieved even though several municipal boundaries were crossed and the people from Denman and Hornby Islands were assigned to the more distant Parksville-Qualicum riding.

5.4 Natural Boundaries

In order to discern whether natural barriers, such as mountain ridges and water bodies, were respected or ignored as riding boundaries in the Commission's Preliminary Report, several map sources were cross referenced with the legal descriptions of the proposed ridings. This cross referencing was necessary for several reasons. First, the maps that the Commission included in its Report were based on unscaled and unidentified projections that did not include a latitude-longitude reference grid or frame. This was complicated by the fact that some legal descriptions referred to the intersection of physical or man-made features and lines of latitude or longitude. Second, the Commission's maps did not include many rivers or the major tributaries of large rivers. Third, the rugged terrain of the Province was not depicted in the Commission's maps, and without an extensive drainage pattern shown on the map, neither slope direction nor degree of slope could be inferred. Thus it was not possible to use the Commission's maps to determine if mountain ridges or major water bodies were followed or transversed by the proposed riding boundaries.

The legal description of the proposed ridings, particularly those outside the Lower Mainland and the Fraser Valley, illustrated that many sections of the existing electoral district boundaries were retained by the Commission. In some cases, including the ridings of Alberni, Mackenzie, New Westminster, North Peace River, and Cranbrook-Fernie (currently known as the Kootenay electoral district), no changes were made to the existing boundaries at all. Due to these observations, the proposed ridings were superimposed onto a map of the existing electoral districts that also included an extensive drainage network, the latitude-

longitude grid, and all major highways. This map was prepared by the Ministry of Environment and Elections British Columbia (1985). This was accomplished by cross referencing the legal descriptions and the maps provided in the Preliminary Report with the existing system of ridings.

This exercise revealed that the Commission made extensive use of mountain ranges or watershed limits and centre lines of rivers and lakes to delimit ridings. For example, the north-south boundary between the proposed Grand Forks-Trail and Okanagan-Boundary constituencies follows the summit of the Midway Range, while the western limit of the Columbia River watershed forms the boundary between the proposed Shuswap and Columbia River-Revelstoke ridings.

Once the boundaries of the Commission's proposed ridings were superimposed on the Ministry of the Environment and Elections British Columbia map (1985), they were inspected for cases of severing mountain ranges and water bodies thereby imposing an administrative barrier between people living in an otherwise physically distinct region. No case of ignoring a physical barrier could be found other than the occasional use of a short section of a line of latitude or longtitude to delimit a riding in an unpopulated region. These cases were not seen to impose hardship onto either constituents or M.L.A.s since few, if any, people would be affected.

5.5 Transportion and Communication Linkages

Constituents and M.L.A.s alike believe that contact between the elected and their respective electorate is a vital component of representative democracy (Qualter, 1970; Taylor and Johnston, 1979; Morrill, 1981; O'Loughlin, 1987;

Courtney, 1988; Fisher, 1988). This contact generally follows one of two major types, instantaneous and interactive, that is face-to-face or by telephone or non-instantaneous and one-way, such as using the mail. Riding boundaries do not constrain interaction by mail or telephone because these forms of communication are virtually available to every British Columbian. However, face-to-face contact can be constrained by riding boundaries that do not respect transportation networks. Constituencies should, therefore, be delimited to allow easy and direct access between the M.L.A. and the voter. In order to meet face-to-face, neither should be expected to travel through another riding. This is particularly true where there are limited routing options as in remote or rural ridings.

The methodology used in the preceding section was replicated in order to assess the Preliminary Report of the Fisher Commission on the basis of respecting transportation and communication routes. In this analysis, a transportation or communication route and/or link is defined to include public roads, highways, and ferry service. Electoral district boundaries that cross major roads or highways in urban and suburban regions do not have a major negative impact on face-to-face M.L.A.-constituent relations. This is primarily due to two reasons. First, there are a multitude of transportation routes available in these areas that allow easy road access between any two points in an urban or suburban riding. Second, compared to their rural or remote counter parts, urban and suburban electoral districts are relatively small in area. Depending upon factors such as traffic congestion and point of origin, voters can choose the most convenient route to visit their M.L.A.'s constituency office. In addition, a voter is not far from the M.L.A.'s office. Since boundaries that traverse major roads are not seen to

restrict interaction between M.L.A.s and constituents in urban and sub-urban districts, the analysis in this section concentrated on rural and remote ridings.

Riding boundries delimiting islands were analyzed for respecting the ferry routes linking them to either the mainland or Vancouver Island. Without exception, the Preliminary Report of the Fisher Commission respected ferry links when assigning island populations to mainland or Vancouver Island constituencies. For example, the ferry service between Prince Rupert and Queen Charlotte is used to include the Queen Charlotte Islands in the North Coast-Stikine riding while the service between Swartz Bay and Mayne, Salt Spring, Prevost, Saturna, Galiano, and North and South Pender Islands is used to assign these Islands to the electoral district of Saanich and the Islands.

This analysis identified a number of riding boundaries that intersect the road and highway network. The first concerns the west coast communities of Bella Coola and Hagensborg of the Mackenzie electoral district. These two communities are linked by Highway 20 to many communities in the Cariboo-Williams Lake riding. A case could be made on the basis of this connection for assigning the population of these two communities to the Cariboo-Williams Lake constituency. However, the Commission elected not to do so, likely due to the fact that both these communities have more in common with the other small communities in the Mackenzie riding than they do with those of the interior electoral district. In addition, they are part of the westcoast waterway which gives the people of these communities access to all other Mackenzie electoral district communities.

Second, several instances of riding boundaries severing local roads exist in non-urban ridings. For example, the road that runs along the west side of Williams Lake in the South Peace River riding, the only one in the area, is crossed twice by the boundary between this constituency and that of Prince George-Omineca at approximately 56 degrees 10 minutes north and 124 degrees 30 minutes west. The road is severed because the boundary is based on the Osilinka and Omineca River watersheds, which meet just west of the Lake and drain into it. Another example of a boundary intersecting a road can be found along the northern section of the Cariboo-Williams Lake riding at approximately 52 degrees 30 minutes north and 124 degrees 10 minutes west. In this case, sections of two roads are severed by the boundary. However, in each of these occurrences the roadways in question are labelled as private logging roads on the 1988 Road Map (Ministry of Tourism, 1988). Since these points of intersection occur on private logging roads, and no people live in the remote areas beyond the road-boundary line intersection, they are not seen as examples of violating the criterion of respecting transportation routes. As a result, no cases of constraining M.L.A. constituent interaction, due to the proposed riding boundaries severing transportation routes were found.

5.6 Riding Contiguity and Compactness

The last step in assessing the Commission's proposed ridings consists of examining their compactness and contiguity. A riding is contiguous if its entire area is delimited within one boundary. Electoral districts that include islands are contiguous if physical links between islands and/or the mainland, such as bridges, tunnels and ferry routes, exist and are respected.

Compactness indices for ridings that are completely within a C.M.A. are calculated using the two methods selected Chapter 3. The first measure, index D, involves dividing the radius of a circle that has the same area as the riding by the radius of a circle that circumscribes the constituency. The second, index G, is the quotient obtained by dividing the minimum riding diameter by the maximum. Index D provides a relative measure of a riding's compactness by comparing it to that of a circle, while index G furnishes a relative measure of a constituency's amount of boundary indentation or dissection. As noted in Chapter 3, a riding is considered to be non-compact if the calculated index values are below 0.685 and 0.50 for methods D and G respectively. As well, a riding is of questionable or moderate compactness if it generates respective index values less than 0.707 and 0.50.

In order to measure the compactness and contiguity of the Vancouver, Victoria, and Fraser Valley constituencies, the legal descriptions included in the Commission's Report were used to locate the actual boundaries on maps of scale 1: 46,000, 1: 33,600, and 1: 121,400 respectively (Rand McNally, 1988). This was necessary because the Commission's maps are not detailed enough to accurately measure the riding parameters needed to compute the compactness indices. This process led to the discovery of a couple of discrepancies between the legal and mapped boundaries of the Preliminary Report other than those corrected in the July addendum to the Report (Royal Commission on Electoral Boundaries, 1988). The most serious oversight concerns a small area of land between the Vancouver ridings of Point Grey and Quilchena. The area south of 16th Avenue bounded by Discovery Drive, on the west, Camosun Street, on the east and the limits of the

City of Vancouver on the south is not included in either riding. This parcel of land includes Camosun Park and is completely inside the limits of the City of Vancouver (Chief Electoral Office, 1985; Bulman Group, 1986; Rand McNally, 1988). However, the Commission excluded this small City area from the proposed system of ridings by having the boundary of the Quilchena riding begin at the intersection of 16th Avenue and Camosun Street and proceed south from this point to the intersection of Camosun Street and the western boundary of the City limits. From this junction, the boundary between the two ridings follows the City limits to the North Arm of the Fraser River. The boundary of the Point Grey riding runs west along 16th Avenue from Arbutus Street, on the east, past Camosun Street to Discovery Road where it meets and follows the western limit of the City of Vancouver to the North Arm of the Fraser River. For the purposes of calculating compactness indices, this piece of real estate was included in the Point Grey riding.

The other discrepancy is in the legal description of the Vancouver Island riding of South Saanich. The Commission's Map I delineates this constituency from its northern neighbour, the Saanich and the Islands electoral district, using the northern border of the Saanich District Municipality. This border runs east-west across the Saanich Peninsula from a point located on the eastern edge of the Peninsula at approximately 48 degrees 33 minutes north to its western terminus in Todd Inlet (Statistics Canada, 1986b). Both the legal description and the mapped boundary of this proposed riding coincide until the point of intersection between the present eastern limit of the electoral district of Saanich and the Islands and the eastern end of the northern boundary of the Saanich District Municipality. At

this point, the legal description states that the Municipal boundary be followed eastward to the Todd Inlet (Fisher, 1988). However, the Todd Inlet is west of this point, not east, and an eastern route would trace the proposed electoral district boundary into the Haro Strait toward San Juan Island. For the purposes of calculating compactness index values for this riding, the boundary was assumed to proceed west along the Saanich District Municipality border to the Todd Inlet.

Once all the proposed riding boundaries were located on the 1: 46,000, 1: 33,600, and the 1: 121,400 scaled maps, for Vancouver, Victoria, and the Fraser Valley respectively, each electoral district was examined to ensure that it was contiguous. Apart from the foregoing errata in the legal descriptions, all other parts of the Province are assigned to one and only one of the Commission's proposed constituencies. This process revealed that electoral districts that included island populations with either mainland or other island populations did so by respecting bridge connections or ferry routes. No examples of non-contiguous ridings were found in the Commission's Preliminary Report. Assuming the forementioned errata in the legal descriptions of the proposed ridings are corrected, the Fisher Commission's proposed set of constituencies will fulfill the contiguity criterion.

The next criterion applied to the Preliminary Report involved calculating the compactness of each of the proposed ridings that was completely within either of the Province's two C.M.A.s. Before making these calculations, however, it was necessary to make certain assumptions and complete several preliminary tasks. This involved determining which proposed ridings were within the Vancouver and Victoria C.M.A.s by cross-referencing Statistics Canada maps (1986a; 1986b) with

the large scale constituency maps (Rand McNalley, 1988). The C.M.A.s of Vancouver and Victoria contain 29 and 5 complete electoral districts respectively. Table 5.2 lists each of these proposed ridings in alphabetical order, by C.M.A.

Second, since 30 of these electoral districts are adjacent to water bodies, and a portion of their boundaries are demarcated some distance from the land and water junction, a decision had to be reached regarding whether the centre of the water channel or the water-land interface would mark the termination of the riding. If the midpoints of water channels are used, riding areas would be dependent, to some degree, upon the actual width of the water body concerned. This in turn would result in exaggerating the riding areas, by an amount equal to the surface area of the peripheral water, in the compactness calculations. As well, the Commission cannot control the width of water bodies and the proposed ridings should not be measured for compactness using a variable that is beyond the control of the Commission. Therefore, riding measurements were determined using land based boundaries and the intersection of these boundaries with coast lines or river banks.

Third, three riding parameters had to be obtained from each of the 34 constituencies in order to compute the compactness indices. The measurements needed are the minimum and maximum riding diameters and riding area. Minimum and maximum riding diameters are the shortest and longest axes, respectively, that can be drawn between any two sections of a riding boundary. Measurements of constituency diameters and area were made directly from the large scale maps that included the proposed electoral district boundaries (Rand McNalley, 1988). The area was determined by tracing the outline of each of the

Table 5.2 COMPACTNESS SCORES FOR PROPOSED RIDINGS IN VANCOUVER AND VICTORIA C.M.A.'s

	Riding Name	D Score	D Rating	G Score	G Rating	G' Score*	G' Rating	Overall Compactness Rating
18	Esquimalt-Metchosin	0.540	F	0.012	F	0.053	F	F
47	Oak Bay-Gordon Head	0.561	F	0.022	F	0.030	F	F
66	South Saanich	0.826	P	0.063	F	0.097	F	F
70	Victoria-Beacon Hill	0.656	F	0.084	F			F
71	Victoria-Douglas	0.735	P	0.053	F			F
4	Burnaby-Edmonds	0.621	F	0.052	F			F
5	Burnaby-North	0.715	P	0.022	F	0.381	M	M
6	Burnaby-Willingdon	0.746	P	0.314	F			F
7	Burrard	0.613	F	0.177	F	N/A		F
12	Cloverdale	0.600	F	0.047	F			F
15	Coquitlam-Maillardville	0.766	P	0.289	F			F
19	Fort Langley-Aldergrove	0.668	F	0.096	F	0.465	M	F
21	Grandview-Hastings	0.753	P	0.018	F			F

Table 5.2 (Continued)

	Riding Name	D Score	D Rating	G Score	G Rating	G' Score*	G' Rating	Overall Compactness Rating
26	Kensington-Riley Park	0.735	P	0.179	F			F
27	Kingsway	0.666	F	0.099	F			F
28	Ladner-Tsawassen	0.616	F	0.123	F	0.754	P	F
29	Langara	0.747	P	0.098	F			F
30	Langley	0.457	F	0.042	F			F
31	Little Mountain	0.721	P	0.084	F	0.225	F	F
32	Lonsdale	0.570	F	0.169	F	0.518	P	F
38	Mt. Pleasant-Strathcona	0.723	P	0.327	F			F
41	New Westminster	0.479	F	0.169	F			F
42	Newton	0.697	M	0.332	F	0.507	P	M
44	North Delta	0.696	M	0.311	F	0.417	M	M
51	Point Grey	0.587	F	0.047	F	0.050	F	F
53	Port Moody-Burnaby Mt.	0.711	P	0.018	F			F

Table 5.2 (Continued)

	Riding Name	D Score	D Rating	G Score	G Rating	G^1 Score*	G^1 Rating	Overall Compactness Rating
57	Quilchena	0.737	P	0.053	F	0.068	F	F
58	Richmond East	0.563	F	0.091	F	0.668	P	F
59	Richmond North	0.0802	P	0.166	F	0.354	M	M
60	Richmond South	0.742	P	0.299	F			F
67	Surrey-Centre	0.623	F	0.174	F			F
68	Vancouver-Fraserview	0.705	M	0.155	F			F
73	Whalley	0.532	F	0.013	F			F
74	White Rock	0.595	F	0.053	F	0.575	P	F

Rating Codes	D Index Ratings	G Index Ratings	G^1 Index Ratings
F: Non-Compact	D score < 0.685	G score < 0.50	G score < 0.333
M: Moderately Compact	0.685 < D score < 0.707		0.333 < G score < 0.50
P: Compact	D score > 0.707	G score > 0.50	G score > 0.50

*G^1 scores computed with relaxed definition for minimum diameter

proposed ridings with a Keuffel and Esser planimeter, model number 62-0005. Since this model calculates map area in square centimeters, the diameters were also measured in centimeters. As a result, there was no need to convert these map measurements to kilometers, because they were all made using the same unit of measure. This method also eliminates the possibility of committing mathematical conversion errors. In order to reduce the chance of making an error in using or reading the planimeter, each of the mapped ridings was traced twice, once clockwise and once counterclockwise, and the average was used in further calculations. If, however, there was a difference of more than five percent between the planimeter readings, two additional tracings were made and the average was calculated using the three readings that were most similar to each other.

Once the measurements were made for each of the mapped ridings, the two indices were calculated for each electoral district. Each riding, along with its respective index values, is shown in Table 5.2. In order to be classified as compact, as described in Chapter 3, a riding must produce index ratios of the appropriate value for each measure.

Table 5.2 indicates that only 14 of the 34 ridings in Vancouver and Victoria have index values for method D that indicate compactness. Three additional districts have ratios that are indicative of questionable compactness, while all the other ridings, 50 percent, are non-compact. In addition, the calculated index values for method G for each of the 34 constituencies suggest that all ridings have an unacceptable amount of boundary identation. In order to be defined as compact, a riding must generate an acceptable index score using each method.

Therefore, all of the proposed ridings are judged to be non-compact based on the foregoing assumptions.

This result was not expected. Since no riding generated an acceptable G index, it was thought that the assumptions made in calculating this index should be reviewed to identify possible shortcomings. However, before reviewing the assumptions, the G index values, shown in table 5.2, were scrutinized for trends. The first major observation concerned the amount of difference between the calculated index values and the 0.50 limit. Not one riding scored higher than 0.332. Each proposed electoral district had a minimum diameter that was less than one third of its major axis. Twenty of the ridings had G scores of less than 0.10. This indicates that almost 59 percent of the proposed districts in the two C.M.A.s had minimum diameters that were less than ten percent of their maximum axis. Nine of these had a maximum axis that was at least 95 percent longer than its shortest. These ridings are grossly indented. Of the other fourteen electoral districts, eight have scores between 0.25 and 0.10 while six have index values that falling within the 0.333 to 0.25 range.

The facts that each riding failed this measure and that no riding's G index was close to the 0.50 limit, combine to suggest that the electoral districts proposed by the Fisher Commission are not delineated well in terms of overall compactness. One way of interpreting this result is to consider the 0.50 limit as being conservatively set. However, it is a limit that satisfies both Morrill (1981) and Rumley (1985). There is one other assumption, however, that can significantly affect the calculated G index. This is the definition of the minimum diameter. This index is derived by dividing the minimum riding diameter by the maximum.

Therefore, a riding with an extremely short minimum axis relative to its maximum axis would easily fail this criterion. In addition, 30 of the ridings have boundaries that are in part composed of the interface between land and water. The Commission has no control over the location of these natural boundaries. It is possible that such a natural boundary served as a terminal point for the shortest axis of some of these electoral districts. As a result, this measure may not fairly represent the amount of riding indentation that is under the direct control of the Commission.

In order to compensate for the fact that the Commission may have to delineate a riding by using at least one section of given boundary, the definition of the minimum diameter was relaxed and new G index values were calculated. The revised definition specifies that the minimum diameter be the shortest distance between two sections of the riding boundary that are not based on shorelines or river banks. The definition of the maximum riding diameter is not relaxed, however, since the Commission has a high degree of freedom to select the remaining boundaries once the first section has been determined. In most cases, the Commission has substantial control over the final shape, size, and maximum diameter of the riding.

Only fifteen of the ridings have different minimum diameters due to the revised definition (see Table 5.2). However, due to this new definition, a minimum diameter can not be located for the proposed Burrard electoral district. This is due to the fact that this riding consists of a peninsula and the only portion of the boundary that the Commission had control over was the straight line section that separated it from the Mount Pleasant riding. As a result, a revised G score could

not be calculated for the Burrard constituency. However, five ridings have index values in excess of the 0.50 limit. Four others have index scores ranging between 0.333 and 0.50. It is important to note that even with the relaxed definition, fifteen of the proposed electoral districts have index values ranging between 0.012 and 0.099, while seven of these ranged between 0.012 and 0.050. Six constituencies generated index scores in the 0.10 to 0.25 range and five more had G ratios between 0.25 and 0.33. Excluding the Burrard district, 24, or approximately 70 percent, of these C.M.A. based ridings still produced G index values less than 0.33. Twenty, or 58.8 percent, generated G scores less than 0.25. These results clearly indicate that the boundaries of these proposed ridings can be modified to drastically reduce their amount of indentation. It is interesting to note that although fourteen of the proposed electoral districts produced index values for method D that indicated they were relatively compact, none of these ridings scored well enough on either G test to pass the indentation criterion. As a result, they do not satisfy the shape criteria. Only the proposed riding of Newton scored sucessfully on the G index and scored reasonably well for method D. However, its D index value of 0.697 placed it within the questionable range so it barely satisfies the overall shape criteria.

Two sets of observations can be made as the result of this analysis. The first set concerns the 34 proposed ridings that are located within the two C.M.A.s. The electoral districts that have acceptable index values for method D, yet failed method G, were visually examined and two major trends emerged. First, many of these relatively compact ridings have small triangular and/or rectangular protrusions extending from their boundaries. Closer inspection revealed that the

small triangular lobes were the result of the Commission using, as a boundary, major roads that severed the grid pattern of streets at approximately 45 degrees. The reason for the small rectangular protrusions is not apparent from visual inspection of the maps. Perhaps these small blocks are the result of the Commission equalizing the population as much as possible in the C.M.A. constituencies.

Second, the shape of these 'compact' electoral districts results from the grouping together of three or four large rectangles that are slightly offset from each other. The visual effect of this design is that portions of riding boundaries appear to have one or more 'steps', a horizontal section followed by a vertical section then another horizontal. The relatively compact riding of Richmond-North, for example, has two such steps that join its southern limit to its eastern border. Since method D is not sensitive to small protrusions or a small series of large steps, these ridings produced acceptable D index values. However, method G is quite sensitive to these designs because these protrusions or steps frequently serve as a terminus for the minimum diameter. This observation is supported by the fact that twelve of the fourteen 'compact' ridings achieved G index scores of less than 0.300.

Ridings that have satisfactory G values yet failed method D were also examined for trends. When the definition of the minimum diameter is relaxed, five electoral districts have satisfactory G index values. Two additional constituencies produced G scores of .417 and .465 which are quite close to the 0.50 limit. In all seven cases, these ridings produced near acceptable scores for index D. Two were in the questionable range of 0.685 to 0.707 while the other

five values ranged between 0.563 to 0.668. This implies that if a proposed riding is not grossly indented, it may be somewhat compact. However, none of the ridings that scored satisfactorily on the G index were judged to be reasonably compact according to their respective D scores. These points illustrate that none of the proposed electoral districts are unquestionably compact in shape. All but one, Newton, are definitely judged to be non-compact according to the index values calculated for methods D and G.

The second set of observations concern the methods used to measure riding compactness. Each method performed well. Method D has identified fourteen constituencies that are compact and three that are of questionable compactness. The index scores for this method with this set of ridings ranged between 0.457 and 0.826 with a mean of 0.662. This range suggests that method D is capable of generating a wide variety of compactness scores for a sample of 34 electoral districts. If, however, the calculated index values had been tightly grouped in a narrow range, an arguement could be made that this method is not sensitive enough to distinguish between different riding shapes. As well, if the calculated index scores were clustered in a narrow range just below the cutoff values with very few, if any, scoring satisfactorily, it could be argued that the cutoff points of 0.685 and 0.707 are too conservative. Since the range in calculated index values is large and the mean value is less than the 'questionable' range, method D has the ability to generate a different index value for a multitude of shapes and is reasonably calibrated.

Method G has proven to be effective at identifying electoral districts that are highly indented. However, the definition of the minimum diameter proposed in

Chapter 3 has proved to be very strict for this set of ridings. Thirty of the 34 electoral districts in the case study border at least partly on water. One terminus of the minimum diameter, for 50 percent of the ridings exists at such a water barrier. In addition, every riding is highly indented, according to method G, using the original definition for minimum riding diameter. These results and the existence of the water barriers combine to illustrate that no boundary setting authority has complete control over the selection of each section of each riding border. Consequently, the definition of the minimum diameter has been relaxed and a second set of G index values calculated.

The second set of G scores identified five ridings that have an acceptable degree of indentation. However, the range in calculated values, from 0.013 to 0.754 is large. This illustrates that this method is sensitive to varying degrees of indentation. Its real strength lies in its ability to identify constituencies that have small lobes or protrusions on the edge of their borders. This is an important trait because a small lobe consisting of a dozen city blocks can, depending upon residential density, house thousands of people. A riding boundary that meandered through an urban area including polling divisions of traditional party support would likely have similar small lobes or stepped sections. Protrusions of this sort could, as a result, attract accusations of gerrymandering. Providing the other criteria of this method have been satisfied, ridings that pass this shape index would not likely attract such gerrymandering claims.

With method G any riding with a score lower than 0.50 is classed as being too indented to be compact. This cutoff point was derived from Morrill's (1981) suggestion that any riding that has a maximum diameter more than twice as large

as its minimum is non-compact. Presumably this suggestion is based on the relationship between these two parameters in a hexagon; a shape that is nearly as compact as a circle (Bunge, 1966). Perfect hexagons, however, do not fit neatly into political regions, especially those that are located within major river deltas. This cutoff point, established by Morrill, may be too conservative for redistributing any region other than a flat homogeneous plain. It is suggested, therefore, that a middle or 'questionable' range be defined for this method. However, this range must be defined so that ridings with small protrusions or 'step' type boundaries would still be classified as being highly indented. This is important because these shape characteristics are not readily identified by method D.

Introducing a lower G index limit would involve relaxing Morrill's (1981) 2:1 maximum-to-minimum diameter ratio. Two possible limits include 2.5:1 and 3.0:1. The respective G index values for these ratios are 0.40 and 0.333. Visual inspection of the large scale mapped riding boundaries reveals that electoral districts that have small lobes, such as Grandview-Hastings, Kennsington-Riley Park, and Vancouver-Fraser View have G scores less than 0.200. As well, electoral districts with 'step' type boundaries, such as Little Mountain, Burnaby-Willingdon, and Mount Pleasant, have G values less than 0.333. Since these shape characteristics would still be identified by index values below 0.333, it is recommended that the lower limit of the 'questionably' or 'moderately' indented range be set at 0.333. This would allow boundary setting authorities more latitude in delimiting ridings, especially when electoral districts are located on islands, peninsulas, or river deltas. It is further recommended that a riding be classed as

being of acceptable compactness if its respective D and G scores are greater than or equal to 0.685 and 0.333. Otherwise ridings would be defined to be non-compact.

Several of the Commission's proposed electoral districts are reclassified as a result of re-evaluating them according to this new recommendation. Four ridings now satisfy the relaxed criteria and are, therefore, judged to be compact. These ridings are Newton, North Delta, Richmond North, and Burnaby North. Although they do not pass the criteria test, the boundaries of three other proposed constituencies can be rationalized due to the fact that a vast majority of their respective bounding perimeter's are delineated by shoreline. It would be difficult to achieve higher compactness scores in these three cases due to their location next to major water bodies. These ridings are Burrard, White Rock, and Ladner-Tsawassen. The balance of the Commission's proposed ridings are clearly non-compact. The fact that these ridings are judged to be non-compact does not infer that they have been gerrymandered. However, the chances of simultaneously creating politically safe constituencies while satisfying all the criteria of this method are significantly reduced.

5.7 Summary

This chapter has applied the criteria for assessing the degree of fairness to the Fisher Commission's proposed electoral districts for British Columbia. The analysis has identified the following shortcomings in the Commission's Report. First, malapportionment is found to exist. Second, the common boundary of two Vancouver ridings severs a community of common interest. Third, examples are

found of electoral district boundaries crossing municipal limits, without equalizing the population among these districts. In addition, the natural link between two small island communities and two larger ones on Vancouver Island is ignored. Fifth, only 4 of the 34 proposed C.M.A. constituencies are found to be compact. Finally, this analysis discovered some remaining errata in the legal descriptions of several proposed ridings. As well, this exercise demonstrated that one of the methods of measuring compactness, index G, was too strict given certain geographic conditions. The following chapter discusses the implications of these findings and presents the study's conclusions.

Chapter 6

IMPLICATIONS AND CONCLUSIONS

6.1 Implications

This study has several important implications for the process of electoral redistribution in general, the use of the selected indices for detecting malapportionment, contiguous and non-compact districts, and the Fisher Commission's proposed ridings. In regards to the general process of redistribution, general observation reveals that both the mandate and the terms of reference for any electoral readjustment authority must be clear. In the case of the Fisher Commission, after completing 13 public hearings, it became evident that the mandate was open to two different interpretations. As a result, on August 12, 1987 the Commission requested that its mandate be clarified and expanded to allow it to consider each electoral district as opposed to just the dual member ridings and those constituencies "contiguous" to them. Although the request was granted on September 17, 1987, the Commission was delayed a little over a month in completing its task.

This study has also revealed that the indices used to detect malapportionment and non-compact districts are effective. Their inclusion in the mandate of a readjustment authority could result in the reduction of malapportionment and claims of gerrymandering. Although they do not conclusively detect constituencies that are designed to benefit one party at the expense of the

other(s), combining them with the other criteria included in the method used in this study significantly reduces the chances of gerrymandering. This is the case because it would be extremely difficult to satisfy each criterion and still design ridings that favour one particular party.

The Fisher Commission achieved one of its prime objectives in that it eliminated dual member ridings in its Preliminary Report. However, it was allowed to choose two of its own terms of reference. These included prescribing both the number of members that would form the legislature and the tolerence levels for riding populations. As noted in Chapter 2, these are two of the fundamental issues in electoral redistribution and should be addressed by the respective legislature and set out in any commission's mandate. The fact that the Fisher Commission was allowed to set these two terms of reference may affect whether its recommendations are enacted. The Government could decide that these measures were unreasonably set. Such a decision could allow it to reject the suggestions proposed in the Preliminary Report on procedural grounds instead of basing the decision to accept or reject the Report on the merits of the recommendations. It is not possible to determine if the Government will veto the Preliminary Report on these grounds, but the option does exist.

As well, the Commission may have set these measures with the goal of simplifying its task. This could result in the legislature being larger than needed and/or riding populations deviating more widely from the electoral quota than is desirable. With regard to the size of the proposed legislature, the Commission's recommendation of 75 seats does not seem unreasonable when compared to the per capita size of the other provincial legislatures (Fisher, 1988). However, there

are major differences in opinion regarding riding population tolerance limits. Acceptable limits range from plus or minus 1 to 25 percent. The Fisher Commission opted for the maximum range of plus or minus 25 percent. Without the benefit of a precedent setting Supreme Court judgement, the use of such an extreme tolerence range may allow the Commission's ridings to be challenged in court using Sections 3 and/or 15 of the Canadian Charter of Rights and Freedoms.

The existence of malapportionment suggests that a very strict population tolerance level should be included in any commission's mandate in order to eliminate the occurrence of this redistribution malady. The fact that malapportionment exists also implies that certain British Columbians are given more relative voting strength and political clout than others. The smallest ridings, in terms of total population, are found in the remote and/or rural part of the Province. This implies that the Commission's Preliminary Report is slightly biased in favour of these regions over the urban and sub-urban areas. Historically, there has been a tradition of allowing malapportionment to exist in British Columbia. Although the Commission's recommendations would not eliminate malapportionment, if implemented they would improve the current situation by proposing a total of six additional seats, one for Vancouver Island and five for the Lower Mainland.

The analysis in Chapter 5 identified several discrepancies in the design of the Fisher Commission's proposed ridings. There is obvious room for improving the Commission's preliminary recommendations. The Commission could eliminate malapportionment from its preliminary report by readjusting the boundaries of the "northern" seats of the Province with the goal of removing two ridings. It should

then redistribute the population in Vancouver and the Lower Mainland to include two more electoral districts. In addition, the boundaries of every riding should be adjusted in order to delimit populations that deviate by no more than plus or minus 10 percent around the electoral quota. These two suggestions would drastically reduce the malapportionment present in the proposed ridings.

As far as the criterion of respecting communities of common interest is concerned, the Commission's set of proposed ridings has a few shortcomings. Granted, it does not cleave Indian reservations and it is consistent in its approach to crossing municipal boundaries in the interior of the Province. However, Vancouver's Chinatown community is split by the boundary between the Burrard and Mount Pleasant-Strathcona constituencies. Splitting this community in this manner may adversely effect its ability to raise community based issues. Informing 2 M.L.A.s of community concerns would require more effort than informing 1 M.L.A. This would be particularly true if the community had a limited amount of people and financial resources available for such lobbying. Dividing the community would effectively dilute these resources through the duplication of effort necessary to inform 2 M.L.A.s of the issues. Therefore, the boundary between the electoral districts of Burrard and Mount Pleasant-Strathcona should be adjusted so that Vancouver's Chinatown is not divided between two constituencies.

The two Kamloops electoral districts are found to have vastly different numbers of population. This results in the strength of a Kamloops-North Thompson vote being worth over 25 percent more than a vote in Kamloops. The populations of the two Kamloops ridings should be much closer in number to allow

all voters of the Kamloops area to have relatively equal political strength. This would likely be achieved with the implementation of a plus or minus 10 percent tolerance range.

The other problem area concerns the seven northern Vancouver Island ridings. Disregarding municipal boundaries is not viewed as being as important as creating districts with equal populations. However, the municipal boundaries of Nanaimo and Campbell River, and the natural link between the people of Denman and Hornby Islands and the communities of Comox and Courtenay are severed without achieving relatively equal total populations between these seven adjacent ridings. In addition to delineating these ridings to have total populations within plus or minus 10 percent of the electoral quota, it is also recommended that the Denman and Hornby Island communities be re-associated with the riding that contains Comox and Courtenay. It is also important that the errata in the legal descriptions, concerning the South Saanich riding and the Camosun Park area of Vancouver, be corrected so that each area of the Province is assigned to one distinct electoral district. Had the Commission's mandate been more explicit and included more exacting criteria, these shortcomings may have been avoided.

The criteria selected in Chapter 3 are able to detect readjustment weaknesses that may otherwise have been overlooked. This is particularly true of indices D and G which together identify non-compact constituencies. Method D calculates an index value by dividing the radius of a circle of equal riding area by the radius of the circle that circumscribes the constituency. This ratio relates the compactness of the riding to that of a circle. A D index score of 1.0 indicates that a riding is as compact as possible. Index G is the quotient obtained by

dividing the electoral district's minimum diameter by its maximum. This method measures the amount of indentation that is present in a riding.

Of the 34 proposed C.M.A. ridings, only four, Newton, North Delta, Richmond North, and North Burnaby are found to be compact. The boundaries of 27 of the other C.M.A. constituencies enclose very small lobes and protrusions, or are composed of 'step' type sections. These sort of boundary configurations can attract claims of gerrymandering. The non-compact shapes of the other three ridings in this sub-set can be rationalized due to the fact that the majority of their perimeter is delineated by major water bodies.

The fact that some ridings satisfied one measure but not the other implies that at least two index scores are needed to adequately assess riding compactness. However, due to the number of riding boundaries that are in part delineated by water, the definition of the minimum diameter for the G index was relaxed. This was also due in part to the observation that the Commission does not have complete control over selecting every section of each riding boundary. These modifications suggest that designing compact electoral districts is difficult in certain geographical locations, such as river deltas and peninsulas.

Although a riding may be judged to be non-compact, this does not infer that it is gerrymandered. There are two benefits, however, in developing a set of compactness scores. First, any boundary setting authority is able to objectively and consistently measure constituency shape. Second, because it is more difficult to create compact politically safe electoral districts than it is to design non-compact ones, the opportunity to gerrymander is reduced. Gerrymandering is even more difficult to accomplish if a set of ridings is required to be delineated so

that each riding generates acceptable compactness scores and has a total population that is within the prescribed tolerance range.

Should the Fisher Commission's Preliminary Report be adopted, there would be serious implications regarding both the Province's permanent Electoral Commission and its prescribed mandate as outlined in the 1984 ammendment to the Constitution Act. As noted in Chapter 4, the Act requires that the permanent Electoral Commission determine electoral quotas for both Vancouver Island and the mainland. It also dictates the criteria that the permanent Commission use to either add a member to a single member riding, or split an existing dual member district into three distinct constituencies. Since implementing the Fisher Commission's Report would eliminate dual member electoral districts and differential electoral quotas, the mandate of the permanent Electoral Commission would no longer be appropriate. As a result, the enabling legislation that created the permanent Commission may be revoked. Assuming that the Fisher Report is implemented, it is hoped that the mandate of the permanent Commission will be changed, rather than rescinded, to allow its function to more closely match those of the Quebec or Federal Commissions.

A final note concerning a factor outside of the control of this study is that the Government of British Columbia has traditionally enacted very few recommendations proposed by independent electoral boundary commissions. The likelihood of the Fisher Commission's Preliminary Report being accepted is not known. Yet Governments in the past have not been receptive to enacting wide scale changes to the system of ridings.

6.2 Conclusions

The purpose of this study was to develop a framework that could be employed to either aid in the process of electoral boundary readjustment, or assess a particular redistribution. The method that was evaluated consists of several criteria that allow for consistent and objective riding measurements to be made. They also provide standards that can be compared to these riding measurements to identify malapportionment, non-compactness, and instances of disregarding natural barriers, distinct communities, or municipal boundaries. As a result, the method could serve in several redistribution functions. The criteria of this method could be included in the mandate of a readjustment authority to assist it in designing a fair electoral system. This set of criteria could also be used to compare and evaluate several different redistribution proposals in order to select the fairest. In a similar capacity, this method could form the basis for assessing a proposed system of electoral districts.

Although each of these criteria is important to the overall method, it should be noted that their relative importance is expressed in the following rank ordering. The criteria necessary to assess rural and/or remote constituencies, in hierarchical order, include the malapportionment measures, and those that determine if communities of common interest, natural barriers, and transportation and communication routes are respected. For the assessment of urban and/or suburban electoral districts, the foregoing order is unchanged, however, the criteria that measure compactness are added to the bottom of the list.

This set of criteria was used in this study to assess the Fisher Commission's Preliminary Report and it identified several shortcomings that may otherwise

have been overlooked. Since this method was able to detect these shortcomings, it is felt that it is well suited for analyzing a proposed system of electoral districts. It could easily be applied to two or more proposed sets of ridings in order to determine which is likely to be the most fair. In such an application, the fairest system would be the one that contained the least amount of malapportionment, the fewest instances of severing community or municipal boundaries, and the greatest number of compact C.M.A. constituencies. Since this method allows for consistency in both measuring and evaluating various electoral district parameters, it would also assist any redistribution authority in completing its mandate.

There is a limitation to this study, however. Although the selected method can assess the degree of fairness in a system of ridings or assist a commission in creating a fair set of constituencies, it is unable categorically to detect gerrymandered electoral districts. Despite this limitation, it would be extremely difficult to satisfy each criteria of this method and successfully gerrymander.

There are two possible directions for future research. The first is an applied approach. The criteria of this method could be used and re-evaluated in an actual readjustment case study. Such an application could provide pragmatic insight regarding the limits suggested for identifying malapportionment and non-compactness. The second approach is more theoretical in nature. There appears to be a need to set 'non-compact', 'moderately compact', and 'compact' limits for the moment of inertia shape measurement methods. Both Forlov (1975) and MacEachren (1985) judge these methods to be superior to those used in this study, however, no such limits have been developed or suggested.

Finally, a recommendation is offered regarding accepting or rejecting the Fisher Commission's Preliminary Report. The fact that the current system of ridings is over 10 years old and is based on outdated population statistics suggests the need for a new set of electoral districts to be enacted in British Columbia. The Fisher Commission's Preliminary Report would eliminate the Province's dual member ridings and it would reduce malapportionment. However, it is felt that the interests of the British Columbia electorate can best be served if the Fisher Commission's Preliminary Report is modified to include the aforementioned changes before being implemented.

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