Environmental
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004 An Evaluation of Native Harvest Survey Methodologies in Northern Canada

Canada

April 198

The Environmental Studies Revolving Funds are financed from special levies on the oil and gas industry and administered by the Canada Oil and Gas Lands Administration for the Minister of Energy, Mines and Resources, and by the Northern Affairs Program for the Minister of Indian Affairs and Northern Development.

Environmental Studies Revolving Funds
Report No. 004

April 1985

AN EVALUATION OF NATIVE HARVEST SURVEY METHODOLOGIES IN NORTHERN CANADA

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The correct citation for this report is:

Usher, P.J., DeLancey D., Wenzel G., Smith, M. and White P. 1985. An Evaluation of Native Harvest Survey Methodologies in Northern Canada. Environmental Studies Revolving Funds Report, No. 004. Ottawa, xii + 249p.

Published under the auspices
of the Environmental Studies
Revolving Funds
ISBN 0-920783-03-1

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ABBREVIATIONS

BRIA	-	Baffin Region Inuit Association
CWS	-	Canadian Wildlife Service (Department of Environment)
COPE	-	Committee for Original Peoples' Entitlement
DFO	-	Department of Fisheries and Oceans
DIAND	-	Department of Indian Affairs and Northern Development
DIZ	-	Development Impact Zone
DSS	-	Department of Supply and Services
GHL	-	General Hunting Licence
GNWT	-	Government of the Northwest Territories
HBC	-	Hudson's Bay Company
HTA	-	Hunters and Trappers Association
JBNQ	-	James Bay and Northern Quebec
JBNQNHRC	-	James Bay and Northern Quebec Native Harvesting Research Committee
KHTA	-	Kitikmeot Hunters and Trappers Association
KWF	-	Keewatin Wildlife Federation
NWT (N.W.T.)	-	Northwest Territories
RCMP	-	Royal Canadian Mounted Police

ACKNOWLEDGEMENTS

We are grateful to all of the individuals whom we interviewed (see Appendix A), and to the organizations they represent. Without their co-operation and assistance, we would not have been able to undertake this study. We would also like to thank the members of the ESRF program study committee for their assistance in identifying some appropriate individuals to interview in government and industry. We particularly wish to acknowledge the assistance of those individuals and agencies who, willingly answered our queries and supplied information: the federal Departments of Indian Affairs and Northern Development, Fisheries and Oceans, and Environment, as well as the GNWT Department of Renewable Resources. We thank the Keewatin Wildlife Federation survey, the Kitikmeot Hunters and Trappers Association survey, and the Fort Good Hope Band Council, for supplying data for analysis and experimentation.

Our thanks to Dan Patterson for assistance in the preparation of Appendix C, to Warren Lampitt for drafting the diagrams, to Jane Buckley for editing the text, and to Robert Pauly for the French résumé.

Lorraine Allison, Rick Cole, Fred McFarland, Roger Peet, Geoff Robins, and Bob Wolfe reviewed all or parts of the first draft, and we are grateful for their constructive criticism. However, the responsibility for any remaining errors of fact or interpretation are entirely our own.

PREFACE

The Environmental Studies Revolving Funds (ESRF) request for proposals on this study called for an assessment of the usefulness, for oil- and gas-related purposes, of fish and wildlife harvest studies undertaken to date in the North. As well, the report was to address the possible need for a simpler methodology and the question of geographic coverage.

Although the statistics obtained by harvest surveys are clearly useful for oil- and gas-related purposes, such surveys are ordinarily conducted neither by industry nor by those government agencies directly responsible for oil and gas development. Instead, they have usually been initiated by Native organizations, and have been undertaken with the assistance and co-operation chiefly of government agencies responsible for renewable resource management or for Native affairs. Consequently the authors considered it necessary to give substantial consideration, in this study, to the views and experience of those government agencies, and to Native organizations, although for the most part those bodies are not directly represented on the ESRF program study committee, and had no direct involvement in formulating the terms of reference for this study.

The authors began with the assumption that a co-operative approach to Native harvest surveys by all parties would result in the best and most useful data, and believe that their findings confirm this view. This report is therefore prepared so as to make it useful to all parties -- industry, government, Native organizations, and local hunters and trappers associations, and band councils -- that have been or are likely to be involved in Native harvest surveys.

The diversity of the North, from Labrador to the Yukon, is such that it is neither possible nor appropriate to provide a precise blueprint for any particular harvest survey. Instead, in addressing the issues identified by the ESRF, the authors wanted to prepare a manual that will be useful to all who design those precise blueprints for any particular region or location. They have tried to identify all of the issues in harvest surveys and to provide guidelines for their resolution, in a style as non-technical as possible so that the report may be useful to all parties. The authors believe that these guidelines apply to all Native harvest surveys, regardless of particular circumstance, and that future survey designs should satisfactorily address them.

The project team consisted of the following individuals: Peter J. Usher (P.J. Usher Consulting Services, Ottawa, Ont.), George Wenzel (Dept. Geography, McGill University, Montreal, Que.), Deborah DeLancey (Fee-Yee Consulting Ltd., Fort Good Hope, N.W.T.), Michael Smith (M.W. Smith Geosciences Ltd., Chelsea, Que.), Pamela White (P.M. White Social and Economic Research, Ottawa, Ont.), Christopher Hatfield (Hatfield Consultants Ltd., West Vancouver, B.C.), and Ian Robertson (Ian Robertson Consulting Ltd., Surrey, B.C.).

The project as a whole was designed by Usher, Wenzel, and DeLancey. These three met periodically during the project and are jointly responsible for its conduct, for the basic structure and contents of the report, and for the major conclusions and recommendations.

Usher conducted most of the interviews in the South with industry and government, as well as interviews in the Yukon and Mackenzie Delta. Wenzel conducted all of the interviews in the eastern and central Arctic, and some in Yellowknife. DeLancey conducted the remainder of the interviews in the Mackenzie Valley.

Usher was responsible for most of the main text, as well as for co-ordinating the entire report. However, Wenzel and DeLancey reviewed the entire text in draft. Wenzel and White contributed to the review of the NWT surveys. White prepared Appendix B, with the assistance of Usher and Smith prepared Appendix C, with the assistance of Patterson and White.

Hatfield and Robertson contributed critical advice and review at several stages, chiefly in the design of the interview guide, the review of the interview results, and the review of the first draft of the text and appendices.

SUMMARY

Native harvest statistics are counts, or estimates, of the numbers of each species of fish and wildlife taken over a specified time, in a specified area, by a particular group of Native people. This specialized form of fish and wildlife harvest statistics is akin to those counts or estimates taken by commercial and sport harvesters.

The purpose of this study is to evaluate the methodologies employed in counting and estimating Native harvests, to assess the utility of existing data, and to recommend improvements for future data collection, management, analysis, and use. The primary geographic focus of this study is the Northwest Territoires, where comprehensive surveys are currently underway. Special reference is made to northern Quebec, because earlier surveys there provided the model for current ones.

Since 1980, at least $1.5 million has been invested in Native harvest surveys in the Northwest Territories, and the sponsoring agencies now seek to expand the coverage of these surveys and to provide a regular basis of funding for them. Yet, although these surveys have been modelled on the successful James Bay and northern Quebec (JBNQ) surveys, they have not produced the results that many had hoped for.

The authors found two fundamental reasons for this development. First, despite the apparently self-explanatory nature of the term, Native harvest statistics in fact mean different things to different parties. Each calls for a different type of survey, and each results in a different product. Although it has been tempting for sponsoring agencies to achieve a variety of goals through the single instrument of a harvest survey (in contrast to the James Bay and northern Quebec mandate), it is not feasible to do so, and the attempt has been detrimental to the NWT surveys. The first problem to be resolved is to clarify the objectives of Native harvest surveys, and on that basis, to choose among the several possible options for their design.

Secondly, there has been inadequate recognition, let alone resolution, of the question of who controls and directs these surveys and what is to be done with the results. The crucial difference between the JBNQ and the NWT surveys was that the former occurred as a consequence of a claims settlement, whereas the latter have occurred in anticipation of one. The negotiation of the terms of reference for the JBNQ surveys, their continuing conduct and modification, and the presentation

of data, all took place within certain already defined parameters, which included, not least, a funding formula that placed all parties on an equal footing, and a funding commitment for the entire life of the project.

In the Northwest Territories, harvest surveys were initiated in the context of what at least some of the participants perceived to be an adversarial situation with respect to both resource development and to the settlement of claims. Such basic issues as funding, organization, control of the surveys, and the release and interpretation of results, were never clearly defined and resolved. Instead of a co-operative approach among equals, there has been a highly unequal arrangement in at least some of the NWT surveys which has been to the detriment of their operation and results. Those questions, however, are for the participants to negotiate among themselves. This report simply lays out the issues and options in that process.

The authors drawn seven conclusions.

1. Recall surveys of the type undertaken to date in northern Quebec and the Northwest Territories are, for most species, the only feasible method of enumerating harvests. These are sociological, not biological, surveys, as they are based on information provided by people, not by animals.

2. Because harvesters themselves are necessarily the source of this information, effective surveys require their willingness to participate, and accordingly a substantial measure of trust and co-operation by all participants.

3. There are four basic models for harvest surveys. The first seeks to document solely the aggregate levels of harvest. The second seeks to obtain additional information including hunter effort, harvest location, and biological data useful for resource management. The third seeks additional socio-economic information on harvesters, useful for economic planning and development. The fourth seeks information on harvester effort, and the location, value, and significance of harvests, useful for impact assessment and compensation. Only the first survey model has actually been used (in northern Quebec), and whereas it is very specific in its objectives, it has a proven capability of delivering satisfactory results. Certain elements of the other models, especially for resource management, may be successfully added on to the first model, but it is impossible to serve all four objectives through a single model. In any event, some of the required information is better obtained through means other than a general survey.

4. With specific reference to compensation, the usefulness of harvest statistics as currently obtained will depend on the basic approach of the compensation regime. Available survey data may appropriately be used to identify and measure consequences to whole communities or to large, identifiable groups within them. The survey method, however, is inconsistent with the documentation of individual loss, which is perhaps better recorded by individuals themselves or in arrangement with local hunters and trappers associations. No existing surveys incorporate harvester effort data, which, in any event, is best documented by other means.

5. Despite the problems experienced with the NWT surveys to date, the recall survey method will provide better data than any other for most species, if it is properly used. However, it is not inappropriate to assume that a valid working model is already at hand and need only be implemented in the field. There should be a major reconsideration of the direction of the surveys, and in new areas, specific pilot projects involving substantial literature and design review, and harvester involvement in design, prior to the major surveys.

6. The usefulness and general acceptance of harvest survey results will be greatly enhanced by a more-standardized approach and an adherence to the basic principles of scientific method. This requirement must be harmonized, however, with adequate recognition of local practices, perceptions, and interests in the design and execution of harvest surveys.

7. Because the major issues that harvest surveys can most effectively address affect the relations between governments and Native harvesters, those two parties should bear primary responsibility for them. As well, the chief demands for a continuing flow of new data are for management purposes of a type for which governments are primarily responsible, in particular, renewable resource management. Consequently, whatever funding and administrative arrangements are worked out for future surveys, no direct or central involvement should be required of private industry.

RÉSUMÉ

Les statistiques sur la chasse autochtone représentent le calcul ou une estimation de chaque espèce faunique prise durant une période déterminée, à un endroit précis, par un groupe autochtone particulier. Il s'agit, tout simplement, de données spécialisées semblable aux statistiques sur les produits halieutiques et cynégétiques capturés par des chasseurs sportifs ou commerciaux.

Le but de cette étude est de déterminer la valeur des méthodologies utilisées pour le calcul et l'évaluation de la chasse autochtone, de déterminer l'utilité des données existantes et de faire des recommandations afin d'améliorer la collecte, l'administration, l'analyse et l'utilisation des futures données. Les Territoires du Nord-Ouest forment le point géographique principal de cette étude, à cause des recherches actuellement en cours dans cette région. On parlera surtout du Nord québécois car les études déjà entreprises dans cette région ont servi de modèle aux travaux en cours.

Depuis 1980, au moins 1,5 million de dollars ont été investis dans les études sur la chasse autochtone dans les Territoires du Nord-Ouest. Les organismes commanditaires veulent maintenant augmenter l'étendue de ces recherches et leur fournir une base financière régulière. Toutefois, bien que ces études s'appuient sur les travaux de la Baie James et du Nord québécois, elles n'ont pas donné les résultats escomptés.

Nous pensons qu'il y a deux raisons fondamentales à cette situation. Premièrement, même si l'expression "statistiques sur la chasse autochtone" semble évidente, elle ne veut pas dire la même chose pour tout le monde. Chacune requiert un type d'étude différent et aboutit à un produit différent. Les commanditaires seraient sans doute tentés de réaliser plusieurs objectifs au moyen d'une seule étude (contrairement au mandat de la Baie James et du Nord québécois) mais il ne semble guère pratique de le faire et la tentative qui a été amorcée à nui aux études réalisées dans les Territoires du Nord-Ouest. La première chose à faire est d'éclaircir les objectifs des études sur la chasse des autochtones et, à partir de là, choisir parmi les solutions possibles.

Deuxièmement, on a peu étudié et encore moins résolu la question de qui doit contrôler et diriger ces études. La différence cruciale entre les études de la Baie James et du Nord québécois et celles des Territoires du Nord-Ouest tient au fait que les premières ont été entreprises en fonction des règlements de revendications territoriales alors que les autres

l'ont été en prévision de règlements possibles. Les négociations portant sur le mandat des études de la Baie James et du Nord québécois, leur poursuite, leur modification, la présentation des données avaient certains paramètres déjà établis, notamment une formule de financement plaçant toutes les parties sur un pied d'égalité ainsi qu'un engagement financier pour la durée du projet.

Pour les études réalisées dans les Territoires du Nord-Ouest, certains des intervenants ont estimé que le contexte était déplorable tant pour le développement des ressources que pour le règlement des revendications. Les questions fondamentales en matière de financement, d'organisation et de contrôle des études ainsi que la publication et l'interprétation des résultats n'ont jamais été clairement définies et résolues. Au lieu d'une collaboration entre partenaires égaux, on a connu de grandes inégalités pour certaines des études en particulier, au détriment de leur déroulement et de leurs résultats. C'est aux participants de s'entendre sur ces différents points. Le présent rapport ne fait que dresser la liste des problèmes et des options.

Voici donc nos principales conclusions:

1. Les études rétroactives du type entrepris jusqu'à présent dans le Nord québécois et dans les Territoires du Nord-Ouest sont, pour la plupart des espèces fauniques, la seule méthode d'analyse possible. Ce sont des études sociologiques et non biologiques car elles sont basées sur des renseignements fournis par des gens et non sur les animaux.

2. Étant donné que les chasseurs sont la source de ces renseignements, des études sûres requièrent leur collaboration et, parallèlement, une certaine confiance et la coopération de tous les participants.

3. Il existe quatre modèles de base pour ces études. Le premier cherche à documenter le niveau d'ensemble seulement. Le second vise à accumuler des renseignements supplémentaires sur le travail du chasseur, l'emplacement de la chasse ainsi que des données biologiques utiles à la gestion des ressources. Le troisième cherche des renseignements socio-économiques sur les chasseurs qui seront utiles à la planification économique. Le quatrième recherche des renseignements sur le travail des chasseurs, sur l'emplacement, la valeur et l'importance des chasses qui serviront en matière de compensation et d'impact. Seul le premier modèle a été employé (dans le Nord québécois) et, quoiqu'il soit très précis dans ses objectifs, il a donné des résultats satisfaisants. Certains éléments des autres modèles pourront y être greffés

avec succès mais il est impossible d'atteindre tous les buts avec un seul modèle. De toute façons, on obtient plus facilement certains renseignements par d'autres moyens qu'une étude générale.

4. En ce qui concerne le problème de la compensation, l'utilité des statistiques telles qu'elles sont obtenues actuellement dépendra du régime de compensation. Les données actuelles peuvent être utilisées pour identifier et mesurer les conséquences et les pertes sur des communautés complètes ou de larges groupes identifiables à l'intérieur de celles-ci. Cette méthode est toutefois en contradiction avec la documentation sur les pertes individuelles qui seront plus facilement obtenues par les individus eux-mêmes ou par les associations locales de chasseurs et de trappeurs. Aucune étude existante n'incorpore de données concernant le travail des chasseurs qui, de toute façon, peut être documenté par d'autres moyens.

5. En dépit des problèmes rencontrés jusqu'à présent dans les études des Territoires du Nord-Ouest, la méthode d'étude rétroactive donnera les meilleurs résultats pour la plupart des espèces, à condition d'être employée convenablement. Toutefois, il ne faudrait pas croire que l'on ait un modèle valable qui puisse être utilisé sur le terrain. Il faudra réévaluer l'orientation à donner aux études et, avant de commencer des études majeures dans de nouvelles régions, penser à des projets pilotes particuliers impliquant une revue approfondie de la documentation et de la conception ainsi que la participation des chasseurs.

6. L'utilité et l'acceptation générale des résultats seront rehaussés de beaucoup par une approche plus uniforme et en respectant les principes de base d'une méthodologie scientifique. On retrouvera des recommandations techniques spécifiques sur ce sujet, au chapitre sept. En dépit de ces recommandations conditionnelles, il faut tenir compte des habitudes, des perceptions et des intérêts locaux, lors de la conception et de la réalisation des études.

7. Étant donné que les principaux points abordés par les études sur la chasse sont ceux qui influencent les rapports entre gouvernements et autochtones, les deux parties devraient en être responsables au premier chef. De plus, étant donné que la raison principale de la collecte de nouvelles données est la gestion de ressources, et plus particulièrement de ressources renouvelables qui sont généralement la responsabilité des gouvernements, les arrangements administratifs ou financiers nécessaires à de futures études ne devraient pas faire appel à une participation directe ou centrale de l'industrie privée.

INTRODUCTION

Native harvest statistics are counts, or estimates, of the number of each species of fish and wildlife taken over a specified period of time, in a specified area, by a particular group of Native people. They are simply a specialized form of fish and wildlife harvest statistics, akin to counts or estimates of the numbers of fish and wildlife taken by commercial or sport harvesters.

Commercial and sport harvest statistics have been collected in most North American jurisdictions for many years even, in some cases, for decades. The conventions for generating such statistics, and the often substantial limits on their reliability, are widely known among management agencies, which, nevertheless, view them increasingly as a useful and necessary management tool.

In contrast, Native harvest statistics are collected in few jurisdictions, for reasons that include: the small number of Native people and their supposedly inconsequential harvest in some jurisdictions; the assumption that existing systems for recording commercial and sport harvest statistics include the bulk of Native harvests; and the lack of any perceived need to manage wildlife in districts where Native people are significant users of the resource. Where Native harvest statistics are obtained, they are often so incomplete for many of the important species that the data are of very limited value for management purposes.

Yet the volume of Native harvests has from time-to-time been the subject of research and estimation by academic and government personnel in both the resource management and socio-economic fields, and as a result many data are on record. However, until very recently, little specification or standardization of methodology has existed for collecting data or for generating estimates, and consequently, the results are often unintelligable to other researchers. Although useful methods have recently been developed, several practical difficulties remain.

WHY NATIVE HARVEST SURVEYS?

Individual Native harvesters have a pretty good idea not only of what they themselves take, and from where, but also what their immediate social group -- their household or

extended family, their hunting party, their trapping or outpost camp, or perhaps even their village -- has harvested in recent times. They may even remember some harvest quantities from many years ago, especially if the numbers, species, or circumstances were unusual, or if they sold them commercially. Traditionally, however, Native harvesters have had no reason to keep permanent records of their harvests, and have rarely done so.

To speak of the need for harvest statistics is really to call for a standardized, repetitive, and continuing system for recording these harvests year after year over large areas, such as the range of an entire caribou herd, or a political jurisdiction such as the Northwest Territories. Such global statistics cannot be known by any one harvester, or by any local group of harvesters, on the basis of their own experience. They can only be compiled on the basis of the independent observations and reports of thousands of individuals (most of whom are unknown to each other) in many different places. The essence of any harvest survey methodology, therefore, is how to record these myriad observations in a standardized and therefore comparable fashion, and how to be reasonably sure that these records can be used to generate reliable estimates of total harvests for specified areas over specified periods of time.

There are many reasons why people want to know the numbers of animals taken by Native people, virtually all of which relate either to biological management or to socio-economic planning. Because few people thought those issues of much importance in the North until the 1950s, little information exists on Native harvests prior to that decade. No Canadian records match for detail and comprehensiveness, those of, for example, the Greenland Trading Company that date back to the eighteenth century. The Hudson's Bay Company (HBC) records deal chiefly with furs, and provide scarce and inconsistent reference to the domestic food production of Native people. Before 1950 a few researchers attempted to use HBC fur statistics to analyze the population cycles of fur bearers (e.g., Butler 1942; Dymond 1947; Elton 1942; MacLulich 1937). As there was no significant fur trade with the Inuit until the twentieth century, however, even these statistics provide only a relatively short record for most of the Northwest Territories.

The historical record of Native fur harvesting is, however, rich in comparison to the record of their domestic harvests of fish and game, despite the fact that the latter account for much greater biomass and, very often, economic value. Except for trapping and commercial fishing, virtually no Native fish and game harvests enter commercial circulation, and these

harvests thus fall through the net of commercial recording systems, such as export permits and sales or purchase records. As well, Native people in the North have generally been recognized to have aboriginal rights to hunt and fish. In many jurisdictions, there is no requirement for Native people (and especially for Treaty Indians) either to obtain a hunting or fishing licence, or to report their harvests. For this reason alone, quite apart from practical problems of research design, Native people have for the most part been omitted from post-season survey questionnaires mailed to a sample of licenced hunters (Cooch et al. 1978). Other survey methods common to recreational harvesting, such as bag checks or creel censuses in the bush or at highway check stations, are inappropriate and impractical in the North. Most Native game harvests never enter provincial or territorial highway systems, and no wildlife agency could afford patrols except at the sites of the most intensive hunting and fishing, even if they desired them. More important, however, all of the fish and wildlife agencies with operations in the territorial North (i.e., Northwest Territories and the Yukon) now prefer, as a matter of policy, a co-operative approach to the collection of harvest data in which Native harvesters take a positive and active role.

The systematic surveys now commonly referred to as Native harvest surveys are distinguished from other methods of estimating Native harvests chiefly by the following criteria. They seek to record the actual numbers of each species taken, by specific time period and geographic location, continuously over a period of years. In practice, harvesters have been asked, through interviews, to record and report their take of all species at regular intervals. These surveys have usually been conducted on a co-operative basis, with all parties interested in the results providing funds and being represented on a steering committee that oversees the project.

The term "Native harvest survey" appears to have come into common use in the context of the James Bay and Northern Québec Agreement[1], signed in 1975. Certain terms of that agreement

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1 The James Bay and Northern Québec Agreement: signed and executed in the City of Québec, P.Q., on 11 November 1975, between the Grand Council of the Crees (of Québec), the Northern Québec Inuit Association, the Government of Québec, the James Bay Development Corp., the Quebec Hydro-Electric Commission (Hydro-Québec), and the Government of Canada; published by Government of Québec, 1976, (hereafter cited as JBNQA, 1975.)

required the estimation of Native harvests on an agreed and reliable basis, because these data were not otherwise available at that time. The James Bay and northern Quebec (hereafter referred to as JBNQ) studies were easily the most ambitious and comprehensive ones of their type ever undertaken.

Since the late 1970s, there has been a widespread recognition of the need for Native harvest statistics, and many have called for an extension of the JBNQ survey model to other parts of the North, especially to the territorial North (e.g., such impact assessment panel or commission reports as Berger 1977b; Environmental Assessment Panel 1984; and Lysyk et al. 1977; such industry reports as Dome Petroleum et al. 1982b; and such resource management reports as Corkum and McCart 1981).

Since 1980, inspired in large measure by the aforementioned developments, surveys of the JBNQ model have been initiated in the Northwest Territories, specifically in the Baffin, Keewatin, and central Arctic (Kitikmeot) regions, and some results are now available. Figure 1 shows the areas covered to date by Native harvest surveys of this type. Harvest surveys have been proposed or are under consideration in other parts of Northern Canada (e.g., the Mackenzie Valley and Labrador), and indeed the possibility has been discussed for every part of the North, but no others are underway at present.

As a result of these studies, quantities of data have become available on a subject the knowledge of which, hitherto, was only fragmentary. As more and more people have become aware of these data, or the possibility of getting them, the demand for them has increased and become more varied. It is therefore timely indeed that the Environmental Studies Revolving Fund should have commissioned this study. The JBNQ research cost about $1 million over a five-year period, and the NWT surveys have cost substantially more than that to date. Before committing more resources to, and regularizing, the collection of these data, it makes sense to ask whether the results of these surveys meet the expectations of them, whether it is reasonable to expect them to do so, and how the surveys might be improved in future better to serve the needs and interests of both those who sponsor them, and Native harvesters themselves, without whose willing co-operation there can be no surveys.

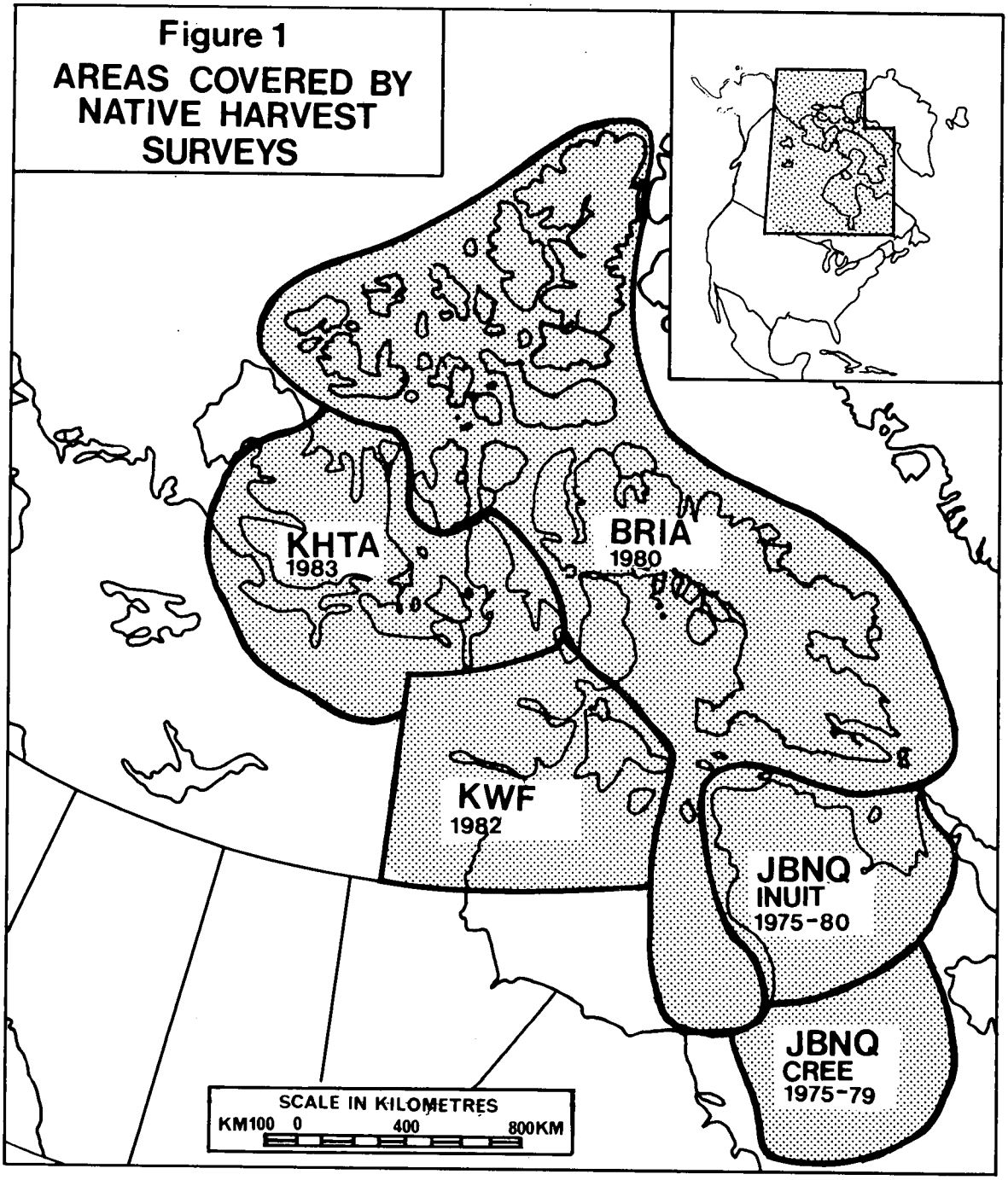
Figure 1
AREAS COVERED BY NATIVE HARVEST SURVEYS
KHTA
1983
BRIA
1980
KWF
1982
JBNQ
INUIT
1975-80
JBNQ
CREE
1975-79
SCALE IN KILOMETRES
KM100 0 400 800KM

PURPOSE AND OBJECTIVES

The purpose of this study is to review and evaluate the methods employed in counting and estimating Native harvests; to assess the utility of the existing data; and to recommend improvements for future data collection, management, analysis, and use. The primary geographic focus of this study is the Northwest Territories (NWT), where comprehensive surveys are currently underway. Special reference is made to northern Quebec because earlier surveys there provided the model for the current ones. In principle, this analysis and its conclusions apply to all areas in which Native people harvest fish and wildlife in quantity from an extensive land base, which is to say, all of North America north of continuous agricultural settlement. The literature reviewed therefore draws on examples from central Newfoundland to western Alaska.

The collection of data for their own sake is an expensive and often futile exercise. The usefulness and reliability of a data base can be evaluated only in terms of what those who use the statistics need from them, and the purposes for and the manner in which the statistics have actually been used. Therefore a large part of this study is devoted to ascertaining and assessing users needs, and to evaluating both how effectively these needs have been met by existing data, and how effectively they might be met by modifying existing procedures.

As one objective of this project, the authors interviewed 123 individuals across Canada who had already participated in, sponsored, or conducted harvest surveys, or who had used harvest statistics, or were interested in doing so in the near future. These interviews were for the most part based on an interview guide that was developed early in the project (see Appendix A).

The authors made an extensive review of Native harvest statistics with the objective of finding out why and how they have been obtained, their subsequent use or misuse, and an evaluation of the problems encountered, with the objective of providing direct comparisons of the major studies. A thorough review of the literature, with additional documentation provided by agencies which have participated in, or sponsored, harvest surveys, was augmented by interviews with individuals involved in harvest studies in the Northwest Territories and northern Quebec, with individual Native harvesters who have participated in these studies (or might do so in future), and with government and industry personnel who have used the results of these studies.

As a further objective, based chiefly on the results of the user interviews, the authors examine what actual or potential users want Native harvest studies for, and evaluate the utility of the results of existing studies for those purposes.

The authors' objective, in examining the major problem areas that must be negotiated among participants in Native harvest surveys to ensure the general acceptance and reliability of the results, is to suggest an optimum strategy for obtaining these results on a continuing basis, to make proposals for obtaining important supplementary information required for interpreting them, and finally, to evaluate the costs and benefits of this strategy against a continuation of the status quo, and against reverting to earlier, less costly, but also less reliable methods. This evaluation is made in light of the respective demands and interests of users (industry, government, and Native organizations) and of the willingness of harvesters to participate based on the perceived credibility and usefulness of harvest surveys to them.

Finally, the authors examine key administrative and technical problems in developing a reliable method of generating Native harvest statistics on a broad and continuing basis, with the objective of providing specific recommendations for improvements with respect to each. They also outline the basic methodology and standards to which future surveys should adhere.

TERMINOLOGY

For the sake of brevity and style, the following terms are used as indicated.

Wildlife. Unless the context indicates otherwise, the term "wildlife" is always used inclusively to mean fish and wildlife, including marine mammals and birds, whether the authors are referring to the resources themselves or to the agencies that manage them.

Harvesting. The term "harvesting" includes hunting, fishing, and trapping by all methods.

Harvesters. The term "harvesters" is also used interchangeably with hunters, trappers, and fishermen.

Territorial North. This term is used to denote those parts of northern Canada having the political status of territories rather than provinces, i.e., the Northwest Territories and the Yukon.

GOVERNMENT RECORDS AND SPECIAL PURPOSE STUDIES: THE DEVELOPMENT OF A METHODOLOGY

Three stages can be identified in the development of a methodology for the collection of Native harvest statistics. Rather than a succession, these three stages are different levels of methodological development in data collection chronological all of which continue to be used, depending on the circumstances.

The first stage consists of the routine collection of statistics by wildlife management agencies on the basis of various permit returns, originally for the purposes of bureaucratic record-keeping but, in more recent years, with specific objectives for wildlife management. These kinds of statistics have been collected since about 1930 in the Northwest Territories, and since about 1950 in the Yukon. (Strictly speaking, the HBC trade records provide the earliest data base, but they have never been compiled and interpreted for the North as a whole, and have not been used for management purposes for many years).

The second stage began in the late 1950s, when a growing need was perceived for more accurate and detailed statistics on Native harvests than government agencies then maintained, for the purposes of wildlife management and for economic development and impact assessment. Occasional surveys were conducted in various communities, which relied on individual recall of harvests over a specified time and area. In some cases, recall data were augmented by direct observation. Some surveys were undertaken in the context of studies with more comprehensive objectives; in others, documentation of Native harvests was the sole objective.

The third stage began with the James Bay and Northern Québec Agreement[1] in 1975, and involved comprehensive and continuing recall surveys over large areas. The recent harvest surveys in the Northwest Territories are based on this third method.

The purpose of this section is to document the development of the first two levels of obtaining Native harvest statistics. The following two sections examine the comprehensive surveys in northern Quebec and in the Northwest Territories.

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1 JBNQA, 1975, Op. cit.

GOVERNMENT STATISTICAL RECORDS

The Record-Keeping System

Until the late 1950s, the only information on the volume of Native harvests anywhere in Canada was collected solely by fish and wildlife agencies (with the exception of the HBC fur-trade records). These records (like those of commercial and sport harvests by non-Natives) were based chiefly on permit reporting requirements. Most fish and wildlife harvesting in Canada occurs under authority of a permit issued by a fish and wildlife agency. It is a common requirement that to maintain or renew a permit the holder report all fish and game taken under authority of such a permit.

Recording systems for commercial and sport harvests are designed to catch all harvesters, or a representative sample of them, in theory at least. The recording of Native harvests (the bulk of which are intended for domestic consumption) by government agencies has been complicated by the aboriginal hunting and fishing rights of Native harvesters. By virtue of these rights, most Native people do not require a permit to take fish and game for domestic use and, consequently, there can be no enforceable reporting requirement for them. In the Yukon, for example, status Indians are not required to obtain a hunting licence. There is a nominal requirement to obtain a food fishing permit, but few Native people do so and the requirement has never been enforced. All trappers and commercial fishermen must obtain licences, and these requirements are strictly enforced because of the commercial nature of the activity. The statutory basis of this regime is section 17(3) of the Yukon Act[1], which states that no territorial ordinance shall restrict or prohibit "Indians or Eskimos from hunting for food, on unoccupied Crown lands, game other than game declared by the Governor in Council to be game in danger of becoming extinct."

There are various arrangements in the provinces, but most are similar to the Yukon in that status Indians do not require licences to hunt or fish for domestic purposes (except, in some cases, if they are using recreational gear). For the purposes of this report, we can ignore the legal complexities about some of these requirements.

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1 The Yukon Act. Revised Statutes of Canada, 1970, chapter N-22.

The situation in the Northwest Territories is somewhat different, however. Although the Northwest Territories Act[1] contains a protective clause [14(3)] similar to the Yukon Act, a nominal reporting requirement has existed for Native harvesters since 1929. Under the regulations of the Northwest Game Act[2] of that year, all Native hunters were required to report annually the numbers they took of specified fur and game species. When the Northwest Game Act was replaced by the Northwest Territories Game Ordinance[3] in 1949, a further requirement was established for all Native people to obtain a general hunting licence (GHL) at no cost. This licence became the basis for annual affidavit reporting of all game species taken under its authority. This system has no parallel elsewhere in Canada. These reporting requirements were only nominal, however, as there was no legal penalty for failing to do so. It appears, however, that many Native people simply assumed they had a legal obligation to report their harvests, and many actually did so.

The result has been that, of all North American jurisdictions, the Northwest Territories has maintained by far the most complete record of Native harvests. Whatever deficiencies exist, its data bases are assuredly greater with those of other jurisdictions. Two series of records are of particular importance: the kill statistics from GHL returns, and the fur export tax returns. (The Northwest Game Act required all persons exporting furs from the Northwest Territories to obtain permits, which recorded the number of pelts in each shipment, by species, and usually, by the area in which they were taken. Both of these series date back to 1929, and consequently there is an unusually long data run in the Northwest Territories by comparison with most other jurisdictions. There have been other permit-based record-keeping systems in the Northwest Territories, which provide somewhat different details but add little to the totals produced by the two main systems.

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1 The Northwest Territories Act. Revised Statutes of Canada, 1970, Chapter N-22.

2 Northwest Game Act (1929); see footnote 3.

3 Northwest Territories Game Ordinance. Revised Ordinances of the Northwest Territories, 1974, Volume I, chapter G-1.

A third significant source of data has been the annual game reports which estimate Native harvests by district, and are compiled by local game officers. Although these have often been based in part on the fur export and GHL returns, they contain additional estimates based on the officer's personal knowledge. These reports date back to at least the early 1940s, when the responsibility for their compilation was delegated to the Royal Canadian Mounted Police, in the absence of game officers. Since the early 1970s, however, the GNWT Wildlife Service has taken over full responsibility for this task. Since the discontinuation of the kill statistics from GHL returns series in 1978, the Wildlife Service has depended entirely on its officers' field reports for Native big-game harvests in most districts.

In the Northwest Territories and Yukon, the only species for which wildlife management agencies have a near-complete record of Native harvests, based on permit reporting, are the fur-bearers, based on export permits, and (in the Northwest Territories only) the few big-game and marine mammal species for which there are quotas, and to which access is controlled by tags; polar bears, muskoxen, and narwhals. For uncontrolled species taken for domestic use, there is either no record at all, or only a partial one (Table 1).

TABLE 1

Native harvests recorded through permit reporting systems, Northwest Territories and Yukon

Harvest	N.W.T.	Yukon
Fur-bearers	Near complete record	Near complete record
Big game	Complete for polar bear, muskoxen, no record for other species*	No record
Small game	No record	No record
Large marine mammals	Near complete for narwhal, partial record for other species	Not applicable
Seals	Partial record	Not applicable
Birds	No record	No record
Fish	Commercial record only	Commercial record only

* Since discontinuation of GHL reporting in 1978.

With the exception of the Northwest Territories, then, Native harvest statistics in Canada have typically been limited to the commercial take by Native peoples from trapping and commercial fishing, based on purchase records, export permits, or nominal harvester reporting requirements.

Government Commercial and Sport Harvest Records

A variety of systems have been in place to measure the commercial and sport harvests of fish and wildlife in North American jurisdictions. Although wildlife personnel do make actual counts such as bag and creel checks, hail counts, and checkpoint counts, these are more for purposes of enforcement rather than for measurement.

Two basic systems are used for actual measurement. One is the recording of commercial transactions, based on mandatory sales, purchase or export records. These apply chiefly to fish and to fur-bearers, and are generally considered to cover virtually all non-Native catches and the bulk of Native ones.

The other is the permit-based reporting system which is, for the most part, voluntary, and is intended to cover the sport or recreational harvest of fish and wildlife. Although certain big game harvests occur under the aegis of commercial outfitting and guiding operations, which have separate reporting requirements, most North American recreational harvests are taken by individual permit holders on a non-commercial basis. The standard method of estimating these harvests is to survey a sample of these individual harvesters. There are a variety of systems in place for sport fisheries (see for example Falk 1981, Jacobson et al. 1983, for the Northwest Territories). The estimation of non-Native big game kills in northern jurisdictions is based on outfitter reports (for non-residents) and licence returns (for residents). In the Yukon, resident kills are estimated on the basis of a mailed questionnaire, which has a response rate of about 25-40% (e.g., Lortie 1973, 1976; Lortie and McDonald 1977; Olson and Hoefs 1978). The survey results have not been tabulated since 1979, because of staff shortages. These surveys are similar to those undertaken in other jurisdictions. (It is generally acknowledged, however, that Native harvests are largely unrecorded by this means). A national survey is in place for waterfowl, as described below.

Many of these systems are no older than the Native harvest survey systems. Questionnaire surveys of permit holders date back only to the 1960s in Canada. The National Harvest Survey of waterfowl began in 1967, and has undergone continuous refinement since. It is probably the most sophisticated system of its type in Canada and has drawn heavily on the expertise of biometricians and social scientists for its design, interpretation, and evaluation.

The following brief description is based chiefly on Cooch et al. (1978).

The population from which hunters are selected for survey is formed by holders of permits for waterfowl hunting, of which 400-500,000 have been issued annually in recent years. Sampling intensity is about 9%, and the response rate (to a mail questionnaire) is about 50%. The survey identifies the number of permit holders who hunted, the number who hunted successfully, and the numbers of each species of waterfowl taken. The questionnaire requests precise geographic identification of the single location at which the respondent does most of his or her hunting, and also requests identification of specific days spent hunting, by means of a calendar. A supplementary Species Composition Survey provides a more precise taxonomic breakdown of the total waterfowl harvest. A number of estimates are derived from the National Survey, such as total waterfowl taken, by region and by time period, and total time expended by hunters, based on estimator formulas which attempt to weight for certain factors and to correct for biases. For 1981 and 1982 (the most recent years reported), the precision of the estimates at the 90% confidence level fell within the following ranges, by region: $\pm$4.08 to $\pm$15.54 for the number of active hunters, $\pm$9.23 to $\pm$29.32 for duck harvests, and $\pm$11.77 to $\pm$62.45 for goose harvests (Metras 1984). However, these figures do not include the Northwest Territories and Yukon, for which the variances are much greater. These are estimates of sampling error alone, and do not account for such factors as response and non-response bias.

The National Survey is not stratified by hunter experience or effort, despite the fact that it has been shown that a small proportion of recreational waterfowl hunters take a substantial proportion of the harvest (Sen 1984). The National Survey does not account for crippling and non-retrieval, for illegal kills, or for kills by Native hunters. These are estimated on the basis of separate surveys and observations.

The National Survey is undertaken by a single sponsor, the Canadian Wildlife Service, at a cost of about $85,000 annually, or about $4 per response, to provide data useful for waterfowl management purposes. It is generally considered that the Survey accomplishes this goal, despite the many sources of error and uncertainty in the data. The Survey has also provided information useful for economic planning, as an input to studies on the economic significance of waterfowl harvesting. However, that topic has been the subject of entirely separate surveys which cover topics that the National Survey does not (e.g., Filion et al. 1983).

There is no comparable system for collecting uniform data at the national level for recreational harvests either of fish (although periodic surveys have been undertaken) or of big game.

The quality of both commercial and recreational harvest estimates varies substantially not only among jurisdictions but also by species. Substantial sources of error in them have led to some controversy over their use. These facts are useful to keep in mind when evaluating Native harvest surveys.

Status and Use of Government Records

Most Native harvest records, where they still exist, date back several decades. In almost every jurisdiction, the records have been gathered and maintained in a haphazard way, and rarely tabulated or analysed except in gross (e.g., to provide statistics for agency annual reports, or for submission to Statistics Canada for national tabulations such as the annual Fur Production of Canada). In some cases statistics were a byproduct of revenue collection, such as the fur export tax in the Northwest Territories.

Until very recently, most agencies have had little idea either of the extent and content of the records gathering dust in their warehouses, or of how they might be put to use. Indeed some of the original records have been lost without ever having been tabulated. The chief reason has probably been the lack of any urgent need to manage wildlife actively, as opposed to simply "keep an eye" on trends. Thus, there is a lack of funds and manpower to process these records (some agencies have not a single biometrician on staff). Further, although wildlife managers have long known in principle that catch statistics are a necessary management tool, they have had considerable doubts about the reliability, for that purpose, of the data they have been gathering routinely for decades.

The manner in which statistics were collected, compiled, recorded, and maintained has varied over time. An early review of the record-keeping system in the Northwest Territories is given by Robinson and Robinson (1946). The most definitive discussions of the basis and maintenance of these data series are found in Berger (1977b) and Usher (1975, 1977), for the Northwest Territories, and Usher (1979) for the Yukon.

The historical statistics for the Northwest Territories have been used by many researchers for both biological and economic analysis within the last 30 years. In some cases researchers have relied on the annual totals by community, available from the summary tables compiled without explanatory text by the GNWT each year. In other cases, they have gone back to the original individual permit records or hunter declarations, which were made readily available to bona fide researchers by the GNWT Wildlife Service.

During the 1960s and early 1970s, these data were often used uncritically in economic analyses, for example, in some of the Area Economic Surveys and in impact assessments (e.g., DIAND/MPS 1973; Gemini North 1974). Critiques of this abuse are found in Berger (1977) and Usher (1978).

Until recently, these data have seldom been used for management purposes in the Northwest Territories. Probably the first example was the muskrat management program begun in the Mackenzie Delta in the late 1940s. Another example was the establishment of polar bear quotas in 1967, which were set for each community at 60% of the mean recorded harvest of the three previous years. Commentaries on the limitations of these data for the biological management of particular species are found in Kelsall (1968) and Smith and Taylor (1977).

Problems with the Use of Government Records

The problems commonly observed in using "official" harvest statistics in the Northwest Territories include the absence of any reporting requirement for certain species; lack of incentive or interest on the part of Native harvesters to report their take; inconsistent, and frequently unrecorded, reporting rates; the lack of species differentiation (e.g., among geese, ducks, and caribou); the unreliability of hunter recall over long periods for certain species, especially of birds; the possibility of deliberate misrepresentation of catch; and, in the case of furs, the systematic omission of domestically retained or unsaleable pelts from the records.

The net effect of all these difficulties is that official records underestimate the volume of the Native harvest, in many cases, substantially. For some species or areas, the degree of underestimation can be estimated and corrected for, whereas for others it cannot. Thus, although harvest statistics are useful for reconstructing trends in Native harvesting of some species, the numbers themselves must be treated with substantial caution. Similar conclusions have been reached with respect to other Canadian jurisdictions, including the Yukon (Usher 1979), Saskatchewan (Kelly 1978), Ontario (Rogers 1966; Usher et al. in prep.), Quebec (Feit 1975; Weinstein 1975; Cree Regional Authority 1979), and Labrador (Usher 1982).

Additional problems arise with the use of annual game reports. One is that they have never been assembled and aggregated in a comprehensive fashion (see, however, Smith and Taylor 1977 on seal catch statistics). Instead, researchers have relied on them for particular locations or species, and the overall record is therefore fragmented. More importantly, such records are by nature inconsistent and cannot be compared reliably over time and place. The officer responsible for the annual report needs a sound knowledge of the hunting activities in that detachment or district, which necessitates enjoying a substantial degree of trust from Native hunters. This trust is gained rarely and with difficulty, because with the obligation to gather statistics is coupled with an obligation to enforce the game laws. The officer cannot personally observe all harvests in the district, and thus relies on peoples' willingness to share information. Even with this trust, the officer must also have some reliable basis for generalizing and extrapolating from limited and incomplete information, and the time and interest to prepare a thorough report. Yet, because these annual reports are not intended as scientific documents, the methodology and assumptions (which certainly varied from one reporter to another) have never been stated.

To summarize, government Native harvest record-keeping systems have been based primarily on a permit reporting system maintained by the fish and wildlife management agencies responsible. These systems have historically been developed in-house, for administrative convenience, and have not usually been subject to any critical or peer review. The agencies responsible have rarely used these data for management purposes, or indeed even compiled the raw data in a form useful and accessible for reseach and analysis, partly because they have not until recently perceived much need to, and partly because of the limitations of the data. More recently, the data have been used less critically for the purposes of economic planning and social impact assessment. However, comprehensive critiques of these data bases, and of their use

and abuse, which document their limited reliability for wildlife management, economic planning, and social impact assessment, are now on record.

No management agency has devised a system other than one based on permit reporting for obtaining comprehensive harvest reports directly from Native harvesters on a continuing basis.

SPECIAL-PURPOSE STUDIES

In the post-war years, there arose a growing recognition of both the impending scarcity of certain species (especially caribou) and an economic problem among Native people. For the most part, however, those who sought to document these problems (e.g., Buckley 1962; Cantley 1950; Jenness 1964; Kelsall 1957) had no alternative but to rely on government records. They and others did not always do so uncritically, but it became obvious that the existing data were simply inadequate to meet the tasks of either biological management or economic planning.

Researchers therefore began to develop independent methods of obtaining harvest statistics, most of which derived from the standard techniques of anthropology and sociology; participant observation, flexible or open-ended interviews, and standardized questionnaires.

The authors reviewed studies of several types; government economic planning reports, academic social scientific studies, social and economic impact assessments, nutritional studies, and wildlife status and management studies. Some of these studies have served more than one purpose. There has been substantial "cross-fertilization" among the first three categories especially, as some of the central figures in the development of the methodology were involved in all three.

Among the earliest special-purpose studies were Honigmann's (1961) study of the social basis of malnutrition in northeastern Ontario in the late 1940s, and Rogers' (1973) study of the Cree of central Quebec in the early 1950s. Another early example was the geographical research undertaken by Foote and Williamson (1966) in northwest Alaska in the late 1950s, which substantially influenced that which soon followed in the Canadian North. Parenthetically, this study was also a socio-economic impact assessment (of a proposal to create a harbour by atomic blasting), although that term was not then in use. No further socio-economic impact studies incorporating Native harvest data were conducted again in the North until nearly 15 years later.

Government Planning Studies

In the late 1950s, the Industrial Division of the federal Department of Northern Affairs and National Resources began a series of Area Economic Surveys, which during the ensuing decade covered the entire Northwest Territories, northern Yukon, and Arctic Quebec. The purpose of these surveys was to document the contemporary economic situation of the Native people and to recommend measures to improve it. Many of these studies carried forward the methods of Foote and Williamson (both of whom in fact participated in some of them), and provided the first comprehensive documentation of Native harvest levels in the Northwest Territories (e.g., Abrahamson 1963; Abrahamson et al. 1964; Bissett 1968a,b; Brack 1962; Brack and McIntosh 1963; Haller et al. 1968; Usher 1966). The other reports relied on the government statistical summaries, although not always uncritically (e.g., Higgins 1968), and obtained no independent data in the course of the research. Lotz (1976) reviewed these studies for the Inuit regions of the North.

Neither before nor since has any other Canadian government agency, federal, territorial, or provincial, undertaken such a comprehensive and innovative review of the economic status and resource base of Native peoples. The Industrial Division relied entirely on its own staff, which consisted of experienced field officers, some of whom had university experience but were not academics, and summer students who were still in graduate training. Much of the information for the area surveys was obtained through interviews with individual hunters and their households. Among other things, each hunter was asked to recall the numbers of each species he had taken over the last year. Verification or quality control was based chiefly on intuition borne of experience, and sometimes on a casual rather than systematic comparison of the results with government statistical records, where available. The survey methods, though innovative, were mostly ad hoc, and were modified from one year to the next chiefly on previous experience rather than on any wide reading of the social scientific literature. Although some of the reports have since been cited widely in the literature, in the early years they were intended merely as internal information for departmental programs which were to be implemented by the field officers themselves, and were not written for an academic or scientific audience.

Somewhat analagous studies have been undertaken recently in Alaska by the Subsistence Division (established in 1978) of the Alaska Department of Fish and Game. As in most Canadian jurisdictions, there are no reliable government record-keeping

systems there that track subsistence production by Native people. The Subsistence Division surveys are intended to establish the general levels of subsistence use of resources in any particular locale, and are not designed as annual surveys. The surveys are intended to provide data of the type necessary to resolve particular resource issues, such as allocation and habitat protection, but are not intended to provide harvest data for year-to-year management of species by state biologists. The harvest data generated are part of larger descriptions of the social and economic patterns of communities. The surveys involve hunter recall for specified periods, usually a year, by means of questionnaires or guided interviews, sometimes aided by harvest calendars (e.g., Behnke 1982; Foster 1982; Sherrod 1982; Thomas 1982; Wolfe 1981; Wolfe et al. 1984). These studies are, for the most part, conducted by teams of researchers which include social scientists with graduate degrees. In the reports, the survey methodology is discussed and evaluated with more rigour than was the case with the Area Economic Surveys. The reports are prepared and released with both the interested professional audience and the communities themselves in mind.

Academic Social Scientific Studies

During the 1960s and 1970s, a number of scholarly studies, including graduate theses, appeared that described and analysed the hunting and trapping economies of Native northerners. Several provided harvest statistics based on direct interviews (usually combined with participant observation), rather than relying solely on government statistical series (e.g., Berkes 1977; Bodden 1981; Feit 1978; Haller 1967; Muller-Wille 1974; Rogers 1962, 1973; Rushforth 1977; Treude 1977; Usher 1965, 1971; Williamson 1964).

Some of these authors had also been involved in the Area Economic Surveys, and some would later become involved in the socio-economic impact assessment work. Most were trained as anthropologists or geographers, and shared a common interest in cultural ecology. Many of them sought to apply and elucidate the principles of cultural ecology by documenting the resource harvesting practices of hunting peoples. A few had some training in wildlife biology as well. Consequently many of their studies provided a bridge between the purely economic and the purely biological approaches to the question of harvest statistics. Although some of these studies obtained harvest data through questionnaire surveys, none were based entirely on the survey method, but rather relied on participant observation techniques made possible by extended residence in the field.

In most cases the primary interest of these authors was not to produce harvest statistics as such, but to develop reliable quantitative estimates of hunter production which could be compared with other data pertaining to such matters as social organization; cultural change including the relationship of harvesting to employment, cash income, and welfare; and hunter effort, investment, and productivity. Many of these authors were also interested in the relationship between human social groups and their resource base, and consequently, the relationship of harvest practices and levels to resource abundance and availability were also central research concerns.

Because these studies were innovative in the 1960s, there was no well-developed methodology for the collection and analysis of harvest data. Most authors relied on their previous field experience and their "feel" for the data, rather than on textbook survey methodologies, if for no other reason than that the latter were assumed to be inappropriate in a cross-cultural setting. The novelty of these studies resulted in little peer or committee review of the detailed methodologies. Because the issue of harvest statistics as such was rarely central to these studies, the actual methods of collection and interpretation were seldom laid out in detail. However, most of the results are accepted as reliable for the purpose intended and are commonly cited in the literature.

Most of the work in this tradition was based on graduate thesis research and first appeared as university theses. Much of it subsequently appeared as monographs or articles in refereed series or journals.

Socio-economic Impact Assessments and Claims Statements

Beginning around 1971 with the proposals to develop hydro-electric power in northern Quebec, and to construct a gas pipeline up the Mackenzie Valley, a new interest developed in Native harvest statistics. The chief issue arising from these and other large-scale development projects was the value of Native harvests and harvesting. What would be the effect of these developments upon those values, what was the nature of the Native interest in those values, and to what compensation might Native harvesters be entitled in the event that such damage actually occurred? The starting point for these questions was necessarily volume: how much food were Native people harvesting from their lands and waters? The problem of converting that volume into value, dollar equivalent or otherwise, has been of concern to a number of users, and is of particular importance with respect to compensation and public policy (e.g., Berger 1977b; Hough, Stansbury, + Michalski 1982;

Langford and Cocheba 1978; Usher 1976,1983a). The value problem is not, however, the direct concern of this study.

Not surprisingly, the initiative for these evaluations came largely from Native organizations themselves, many of which were able to obtain the funds (chiefly from governments) to commission special studies, for example, Dimitrov and Weinstein 1984 (Yukon); Brody 1981 (British Columbia); Fort McKay Tribal Administration 1983 (Alberta); Ballantyne et al. 1976 (Saskatchewan); Usher et al. in prep. (Ontario); Elberg et al. 1972 (Quebec); Weinstein 1976 (Quebec); and Wetzel et al. 1980 (Newfoundland). Brody's study alone appeared as a trade book, whereas all the rest were released for limited distribution only by the sponsoring organizations. Although most of these evaluations concerned the effects of major projects, some were intended to document the interest of the sponsoring group in certain lands and resources, in preparing statements of claim thereto.

Most of these authors were people with graduate training in the social sciences and with considerable field experience, although the reports themselves are generally written in a language of advocacy. In documenting Native harvests, most of these reports do two things: first, they show that the official records drastically underestimate the total harvests; and secondly, they include annual recall data obtained from interviews with hunters about their harvests. These recall data were then projected to total annual estimates. Most reports provide estimates of total food production by weight. Most of the reports were written with the expectation that they would be used in adversarial proceedings such as public inquiries, negotiations, or court cases, and the authors were therefore concerned to ensure that their findings could be validated in these circumstances. Where these reports, or submissions based on similar evidence, were actually used in such proceedings, for example in Quebec (Kanatewat et al. versus Hydro-Quebec, the James Bay and Northern Quebec Agreement), Saskatchewan (the Churchill River Board of Inquiry -- see its Report, 1978), and the Northwest Territories (the Mackenzie Valley Pipeline Inquiry -- see Berger 1977a,b), their findings on Native harvests were generally vindicated.

One consequence of these decisions has been that both industry and government planners have become less willing to rely on the conventional wildlife agency statistics as a basis for estimating Native harvests. For example, the impact assessments commissioned by the federal government in Old Crow in 1973 in connection with the proposed gas pipeline (Stager 1974), and in Baker Lake in 1977 in connection with mineral exploration in the region (IDS 1978), both employed hunter

recall surveys. The federal and Newfoundland governments sponsored a study of seal harvesting in Lake Melville involving a recall survey (Boles et al. 1983).

Polar Gas commissioned several studies involving hunter recall surveys, in advance of submitting an application for pipeline construction in the central Arctic (Kemp et al. 1977; McEachern 1978; Stager 1977). Major oil companies operating in the eastern Arctic also sponsored hunter recall surveys (Finley and Miller 1980; Resolute Bay Hunters . . . 1983). McEachern, and Finley and Miller, paid particularly careful attention to methodology. The industry and government studies, like those sponsored by the Native organizations, were conducted mostly by individuals with both field experience and graduate training.

In some of these studies, harvest data are linked to Native land-use patterns, thus drawing on another group of related studies: the land-use and occupancy projects associated with Native claims documentation in the 1970s (e.g., Freeman 1976; Brice-Bennett 1977). However, rarely is there any precise or detailed correlation of quantitative harvests with specific areas.

The impact and claims studies both influenced, and were influenced by, the methodological development of the James Bay and northern Quebec surveys. Many of them stand up as valid, and even innovative, documentations of the levels of Native harvesting and the consumption country food. Few, if any, were intended for the purpose of wildlife management. Their data are at best useful to wildlife managers as a possible indicator of some otherwise unheralded problem with the human use of wildlife, but certainly not as a basis for active management intervention.

Nutritional Studies

Some medical and nutritional studies in the North have provided information on Native harvests by documenting what people actually eat. Although most of these studies were not intended to estimate total harvests, the harvest levels of at least some species can be inferred from them, and hence they provide a useful cross check for harvest survey results. The basic method of survey is the individual recall interview, the objective of which is to determine what the household has consumed over a specified period of time. Researchers have used time periods ranging from 24 hours to a year, but the most thorough studies have involved a sample of households keeping a daily diary of consumption for several weeks or months (e.g., Ballantyne et al. 1976; Barbeau et al. 1976; Honigmann 1961; Kemp 1971; Mackey 1984a,b; Spady et al. 1982; and Usher et al. in prep.).

Biological and Wildlife Management Studies

Estimates of Native harvests by wildlife management agencies or independent biologists date back in some cases to the 1950s. Biologists' estimates have, however, usually been limited to a particular species or group of species, depending on the research topic or the jurisdiction of the agency. A review of the biological literature on Native harvests suggests that distinctive conventions for estimating these harvests have arisen with respect to the following categories of wildlife: a) migratory birds, b) fur bearers, c) big game, d) small game, e) large marine mammals, f) seals, and g) fish. Where the species or populations cover large areas (and have therefore had a history of federal management involvement), and especially where there has been a national or international, rather than purely local, concern about their status, harvest estimation techniques are better developed. This finding appears to be true of commercial and recreational harvests as well as of Native harvests.

a) Migratory birds. The abundance, recruitment, and mortality of migratory birds are closely tracked under a continental system of management. Periodic estimates of Native waterfowl harvests have been made in Alaska (Klein 1966; Thompson and Person 1963), the western Arctic (Barry and Carpenter n.d.), Alberta (McCauley and Boag 1974), and especially on the James Bay coasts of Ontario and Quebec. Work done by or in co-operation with the Ontario Ministry of Natural Resources or its predecessors includes that of Hanson and Currie (1957), Hanson and Gagnon (1964), and Prevett et al. (1983). A review of the James Bay estimates is found in Curtis (1973).

Two methods have been used to estimate Native waterfowl kills, one based on direct observation, the other on interviews. First, observers have gone out with Native hunters and have recorded the number of birds coming within range, hunter effort, gear, and success. From these data they have calculated rates of kill per hour, per day, per shot, and so on. Secondly, researchers have interviewed hunters, asking them to recall the numbers of birds they shot during the season.

The chief problem with the first method is that the proportion of relevant events that can actually be observed is often quite small, and may not be representative. The chief problem with the second method is that although the proportion of relevant events that is reported may be quite large, there may be some doubt about their reliability. The authors found no case in the literature where both methods were used simultaneously. However, Curtis (1973) projected total kills

from data obtained by both methods from different places and times in the James Bay area. Although not intended as a direct comparison of the two methods, the results in fact are not dissimilar.

b) Fur-bearers. Fur-bearer harvests are almost always assumed to be represented by commercial statistics. These statistics, however, usually record the commercial exchange or circulation of pelts, for example the purchase or export of pelts, rather than the numbers actually removed from the wild. This fact was discussed in detail as long ago as 1942 by Elton (with specific reference to Hudson's Bay Company trade statistics), and since then, numerous scientists have tried to estimate the size and regularity of these differences. Direct observations of trappers' catches on the trapline are rare in the literature, and cannot alone form a reliable basis for generalization.

In some jurisdictions, notably the Northwest Territories, there is an historical record based on licence returns (in effect, recall interviews), but the only direct comparison of recall and commercial records of which the authors are aware is Graf (1984). During the course of the JBNQ harvest surveys, however, considerable effort was made to compare, and if possible reconcile, the survey results with the commercial records of the Government of Quebec.

c) Big game. Tabulations of Native big game harvests, where they have been made at all, have been based chiefly on the educated guesses of wildlife officers, or in the case of the Northwest Territories, the Kill Statistics from GHL returns. The deficiencies of such data have already been noted. The literature contains very few examples of observational data, and it is in any case impossible to generalize from such data. Where quotas are in effect and harvesting is controlled by tags, the numbers of tags issued and returned provides a reliable count, but in the Northwest Territories, this applies only to polar bears (since 1967), to muskoxen (since 1970), and to narwhals. No big game quotas apply to Native people in the Yukon. It is generally assumed that kills in excess of quota must be minimal because of the difficulty of concealing such kills in small northern communities, and of disposing of the products commercially.

The Yukon Wildlife Branch has recently conducted hunter recall interviews in Old Crow and in Ross River, with respect to caribou only. The Beverley-Kaminuriak Caribou Management Board has expressed a preference for the hunter recall survey method, and the Keewatin Wildlife Federation (KWF) survey is now the standard.

d) Small game. No systematic effort has ever been made by wildlife biologists or agencies to estimate the Native harvest of small game. The kill statistics from GHL returns recorded kills of upland game birds taken in the Northwest Territories, but made no taxonomic distinctions among grouse or ptarmigan. Statistics gathered for these categories have always been acknowledged to be highly unreliable, even by comparison with the other species recorded. Otherwise, there are no tabulations of such species as rabbits, hares, or porcupines, based on either observations or hunter interviews. Although in some communities, small game sometimes constitutes a significant proportion of the diet, no management problem is perceived to exist because such species continue to be both ubiquitous and, at least in peak years, abundant.

e) Large marine mammals. Counts of large marine mammal harvests are commonly based on either direct observations (of landings if not strikings) or interviews at hunting camps. In 1972, the Department of Fisheries and Oceans (DFO) established a regular program for obtaining annual counts by region based on these sources, using a combination of its own field officers, other government officials, and individuals on contract. Only sporadic records exist prior to 1972. The reliability and comprehensiveness of the current reporting system is greatly enhanced by the fact that the harvests of these species are relatively concentrated in time and space. DFO managers consider these counts useful for management purposes but recognize that deficiencies still exist, chiefly because of insufficient standardization of reporting procedures; the failure to include animals struck and lost; the possibility of strategic response bias by hunters; and in the case of narwhal, possible non-reporting of untusked animals (e.g., Hunt 1979; Fraker 1980 for Mackenzie Bay beluga; Brodie et al. 1981 for Cumberland Sound beluga; and Finley et al. 1980 for North Baffin narwhal).

f) Seals. There is no systematic record of Native seal harvests. Since the late 1960s, the GNWT has kept records of pelt sales, and Hudson's Bay Company records are available for earlier years (Smith 1975). However, the difference between the numbers of animals struck, the numbers retrieved, and the numbers of pelts sold is far greater than for any other fur bearer, hence these data are of limited value. Most information on Inuit seal harvests comes either from interview data or from direct observations of hunts, as is the case with migratory birds. The difference is that these data have been collected and published by social scientists (e.g., Haller 1968; Foote 1967; Usher 1971; Wenzel 1980) rather than biologists (with the notable exception of McLaren 1958).

g) Fish. There is no systematic recording of domestic fish catches in the North, although numerous estimates have been made from time to time for specific communities or areas (see summaries by Corkum and McCart 1981 for the Mackenzie Delta and adjacent Beaufort Sea coast, and DIAND/MPS 1973 for the Mackenzie Valley). Many of the Area Economic Surveys attempted to estimate domestic fish catches as well. The methods used in the literature include chiefly interviews with fishermen, sometimes supplemented by observational data. Both methods are beset with special problems, however, when applied to fisheries. People catch fish in such quantities, and often over such an extended period of time, that they do not readily recall numbers, assuming they even counted them and committed numbers to memory in the first place. As well, people catch fish at so many locations and on so many occasions that it has rarely been possible to generalize from a limited set of observations.

Fisheries managers also require information on length, weight, and age of fish caught, and these data cannot be reliably obtained through recall. Nor, unless the fishery is a relatively intensive one, is knowledge of gear size alone an adequate basis for inferring these data, and in any event, Native people often use a wide variety of gear to fish throughout the year. Consequently, direct observation of a sample of the catch is required.

Few studies of domestic fisheries in the North have attempted to account for all of these problems. Bond (1973) used a questionnaire in combination with some weighted averages (presumably based on observation) to make an annual estimate of total domestic consumption at Lac la Martre.

The DFO is currently conducting surveys of domestic fishing in the Mackenzie Delta, using the following technique.[1] Active fishermen are identified by preliminary survey, and their co-operation is sought for the detailed survey. Field workers are sent to all fishing camps at least three to five times and up to eight times during the intensive fishing period (about 8-10 weeks from July to September, plus the November fishery where it occurs). On each visit, they observe the nets being lifted and they record gear, length of set, and catch by species (numbers and weight). A questionnaire is also administered, to determine the amount of gear used, number of days or weeks set, and lift frequency, as well as household

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1 V. Gillman, personal communication.

composition, use of fish, and other data. Because the observations are made at several points throughout the season, the sample is thought to be representative, and estimates can be weighted to take account of intra-seasonal variation. About 70-80% of fishermen have co-operated with the survey, the results of which are, as yet, unpublished.

OBSERVATIONS ON THE LITERATURE

From this brief review of the history and literature of the attempts to document the volume of Native harvests in the North, three essential points emerge. First, the studies to date have been limited in purpose, time, space, and coverage, making direct comparisons difficult. Secondly, hunter recall surveys have proven to be a necessary method, and in many cases the only possible method, of obtaining Native harvest data. Finally, despite a substantial literature (of which the authors have reviewed over 100 items) based on over two decades of occasional, special purpose recall surveys, some important methodological problems remain inadequately recognized, let alone resolved.

Limitations of Scope and Coverage

The collection of harvest statistics, by whatever method, has usually been with a single purpose in mind. Historically, these have included chiefly the following: commercial accounting or bureaucratic record keeping; wildlife management (and usually the management of a single species or group of species such as ungulates or waterfowl); socio-economic analysis and planning; and the balance between human populations and animal resources (some of the Area Economic Surveys and the scholarly studies have attempted to calculate the theoretical harvest requirements of specified human populations, as well as their actual harvests, and to compare both of these with the sustainable yield of local wildlife populations (e.g., Science Advisory Board 1980). However, the two chief uses have been for species-specific wildlife management, and socio-economic analysis.

Except for the officially maintained records, such as fur exports and licence returns, previous studies have been restricted in time, space, and coverage, usually providing data for a single year, and for a single community or region. As well, some have been concerned with particular species, and therefore have not attempted to determine the total take of all harvested species. This last restriction applies to official statistics as well as noted.

Importance of Recall Surveys

Only in exceptional circumstances can reliable Native harvest data be obtained on the basis of direct observation. These cases are limited to species or populations whose harvest is highly restricted in space and time, such as large marine mammals and migratory waterfowl. Even in the latter case, direct observation is feasible only where there are large hunting camps, whereas it is not feasible if hunters are scattered over large areas in small, mobile parties. As well, although this method covers the bulk of the catch that actually is taken under these circumstances, it does not include incidental kills at other times and places.

In some other cases, like domestic fisheries, a combination of carefully selected sample observations and interviews can in combination provide the basis for generating reliable harvest estimates. For the most part, however, it is not feasible either to observe all harvests independently, or to take a census or "body count" of all harvested fish and game. Participant observation in hunting and trapping, and counts of particular harvested items (e.g., numbers of fish on drying racks) are useful not so much for generating total counts, but rather for verifying or cross-checking harvesters' reports.

Thus biologists, like social scientists, have relied mainly on hunter recall surveys to obtain Native harvest data. The difference appears to be that whereas social scientists commonly deal with interview data, biologists are, by training, unfamiliar, somewhat uncomfortable, and perhaps even suspicious of them. Some biologists, especially those with enforcement responsibilities, may feel that it is simply inappropriate to rely on the unsubstantiated testimony of a population in which an unknown subset is violating the regulations. Regretably, some simply dismiss out of hand the possibility that Native people have credible and useful information to provide. However, even biologists who do not share those views have some difficulty with interview data in that these data do not appear to be "hard", in the way that observational data are assumed to be. Sometimes there has been inadequate recognition on the part of biologists that harvest surveys are not biological but social in nature, and consequently, that they require the application of social scientific techniques for their conduct and interpretation. However, many social scientists who have conducted these surveys have also failed to give adequate recognition to established social scientific methodology. Indeed it seems fair to say that the techniques for social

surveys now often used by North American wildlife management agencies (see Filion 1980a) have had virtually no effect on the estimation of Native harvests for several reasons:

- lack of familiarity with these techniques on the part of northern researchers, whether they have had biological or social-scientific training. Most of the social scientists have been anthropologists or geographers, with less training in survey techniques than sociologists;

- the problem of cross-cultural adaptation of these techniques so that they can be applied validly in Native communities;

- the relatively small populations of Native harvesting communities, which makes a census as opposed to a sampling approach attractive and feasible;

- the assumption, usually unstated, that the survey population is relatively homogeneous, and that the distribution of individual harvests is normal; and

- the fact that the Native harvest, unlike most recreational ones, is not necessarily restricted to a very short season, and this increases the recall problem to some extent.

However, as indicated earlier, by no means all fish and wildlife agencies take adequate account of these considerations in gathering recreational harvest data either.

Problems of Definition

The two basic but differing objectives of harvest data collection in the literature reviewed -- wildlife management and socio-economic analysis -- have led to important differences in the definition of who and what is being surveyed.

Among resource management agencies, the conventional categories of fish and wildlife harvesting are commercial, sport (or recreational), and domestic. These categories cover the entire harvest of wildlife by people but are mutually exclusive. With such exceptions as recreational saltwater fishing and shellfish gathering, all non-Native people require licences to engage in them.

In surveys of commercial and recreational harvesting, the problem is relatively simple. These categories of harvesters are licensed by statute, and the possession of such a licence is the primary criterion for inclusion in the study, although some surveys have been done using a population of households rather than licence holders. Adjusting the results to take account of unlicensed and therefore unlawful harvesters is an entirely separate matter.

Aboriginal hunting and fishing rights complicate this otherwise neat division. Lawful Native harvesters may or may not be licensed. Consequently, the possession of a valid licence is not necessarily a reliable indicator of whether a Native person harvests. However, the definition of a Native person (or harvester), or one with aboriginal rights, is fraught with difficulty in Canada. There are the definitions commonly used for public administration, such as status and non-status Indians, métis, and Inuit (a useful discussion of terminology may be found in Johnston 1983:), some of which are based on the Indian Act.[1] The Census of Canada, however, frequently changes its procedure for enumerating Native people (Statistics Canada 1982), hence there are certain difficulties in using census data for identifying the study population. There are also, however, community definitions (which are rarely articulated in print), and individual self-identification. These sometimes do not coincide with official, administrative definitions. In practice, the literature has defined Native harvesters as the Native residents of small communities, which is in fact where most Native northerners live. The authors found no reference to a Native harvest survey in such centres as Yellowknife or Whitehorse where Native people are a minority, in some cases not easily identified, and certainly not easily surveyed as a separate category of persons.

The problem for resource management agencies is not only to identify Native harvesters but to categorize what they do. In the view of many of these agencies, the harvesting that Native people do does not fit comfortably into the tripartite division of commercial, recreational, and domestic harvesting. In practice, Native people may obtain their harvests by the gear and methods typical of each, and engage in the harvest and make use of its products for each of these purposes.

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1 The Indian Act, Revised Statutes of Canada, 1970, chapter I-6. Note: changes/amendments to this act are being debated by the House of Commons, 33rd Parliament, 1984-85, under Bill C-31.

For example, Indians in northwestern Ontario commonly obtain fish by commercial netting, domestic netting, (using different mesh sizes for each), and angling, in the course of commercial fishing, guiding sport fishermen (in both cases keeping the rejects for domestic consumption), and in fishing for their own use. Of their total catch, they may sell some on commercial markets, exchange some within their community and among kin (in some cases for money or money's worth), and retain some for household consumption (Hough, Stansbury, + Michalski 1982; Usher et al. in prep.). Although this degree may be an extreme example of the complexity of Native harvesting, it occurs to some extent and with particular variations in all Native communities and for a wide range of species.

Resource management agencies want to know above all how many individuals were removed from a population by harvesting activity, i.e., how many were killed by, or subsequently died as a consequence of, shooting, trapping, snaring, netting, harpooning, or other consequences of harvester activity. This figure includes individuals struck and lost as well as those actually retrieved by the harvester. Harvesting activity, along with non-harvesting activity, such as industrial activity, and natural mortality factors such as predation, starvation, and disease, are the three causes of wildlife mortality. These three are mutually exclusive categories which, if they can be quantified, provide an essential piece of information for fish and wildlife management; total mortality. For this particular management objective, the social or economic characteristics of the harvester, or the subsequent fate of the carcass, are of no consequence whatever.

For economic purposes, however, the resource managers' definition of harvest is irrelevant. A narrower definition would be the number of animals (or parts thereof) actually used for human purposes, i.e., for domestic food (including dog food), clothing, bedding, or other uses, or for commercial sale as food, raw fur, or inputs to other products such as handicrafts. This quantity is of interest to economists who want to estimate the economic benefits of wildlife harvesting, either for the purpose of future development or for estimating potential or actual losses resulting from natural or human causes. It is also the quantity of interest to the nutritionist or epidemiologist who is concerned with the dietary basis of health or with exposure to toxic substances through ingestion.

In short, whereas resource managers want to know kill, economic analysts want to know consumption. Somewhere in between is the number of animals struck and retrieved. In most cases this number is closer to the number of animals used than the number killed, for once an animal has been retrieved, it is almost invariably used in some way. Exceptions would include animals cached but, for some reason, not subsequently brought home; trapped fur-bearers whose pelts are later judged unsaleable or unusable; and meat that is spoiled or lost between retrieval and consumption. Usher (1975) discussed at length the causes and magnitude of these progressive reductions in quantity, with respect to species used by Inuit. The most practical definition of harvest is struck (or shot, trapped, netted, snared, as appropriate) and retrieved, or, in effect, production. Indeed, production (the term is used here in its economic, rather than its biological, sense), is almost always what harvest surveys, whether conducted by biologists or social scientists, have in fact recorded but not always clearly stated. In some studies the terms kill, production, and consumption are used interchangeably as though they meant the same thing. Sometimes there is no way of interpreting whether the statistics presented refer to kill, production, or consumption, either because this information is not specified, or because the methodology is sufficiently ambiguous that respondents themselves might not have reported consistently.

Problems of Standardization

Even within the major categories of harvest surveys -- biological and social scientific -- no precise methodologies or protocols for obtaining and presenting harvest data have been developed. Too often it appears as though each study reinvents the method for itself. Besides the problems with basic definitions like harvester and harvest, other problems include the fact that harvest years are in some cases calendar years, or they are adjusted to the local seasonal round, or to some administrative convention like the licence year (which in the Northwest Territories begins on 1 July) or even the fiscal year. Areas covered may refer to police detachment boundaries, game management zones, community trapping areas, traditional land-use areas, herd ranges, and so on.

Problems of Sampling and Inference

Virtually every study or survey has attempted comprehensive coverage of all harvesters, although few have achieved it. This attempt is true of the kill statistics from GHL returns (response rate varied substantially from place to place and

from year to year, where it was indicated at all), the Area Economic Surveys (high response rate), and the scholarly and the impact studies (high response rate in most cases). Although many of these studies indicate the response rate, rarely do they indicate precisely how estimates of total community harvests were derived from reported totals. There is insufficient recognition that a very large sample is still a sample nonetheless, and in the case of an incomplete census, never a random sample.

In practice, whether the response rate has been high or low, the studies reviewed have relied on fortuitous samples: whoever was in town or at home when the interviewer arrived, or whoever the study could reach, within budget, time limits, and logistics. Consequently, the sample may be biased.

Further, whether for the official statistical records or the results of special purpose surveys, reporting has been voluntary for harvesters. There have been no penalties for failing to report harvests to wildlife officers, or for failing to participate in surveys undertaken either publicly or privately.

The question therefore arises as to whether those who chose not to participate in the survey might in some important way differ from those who did; for example, either that they were the top harvesters, or that they did not harvest at all. This possibility of non-response bias receives virtually no attention in the literature. Instead, reported results are commonly projected to total estimates, on the assumption that a representative sample was obtained. If, however, a disproportionate number of the top harvesters were excluded for whatever reason, then proportional projection, even from a sample of 70-80%, could produce misleading results.

How these methodological difficulties may have actually affected the findings in the literature is assessed under "Overall Quality."

Problems of Response Bias

Response bias arises from the fact that, in any social survey, there may be a difference between the true answer to a question and the respondent's answer to it. The causes of response bias in recreational hunting surveys have been reviewed by Filion (1980a), and include:

- poor questionnaire design (for example, leading or misleading questions, unclearly or ambiguously worded questions, excessive burden on the respondent because of length or complexity of the questionnaire);

- recall failure (inability to remember the facts);

- bias introduced by the interviewer (he or she may inspire discomfort or mistrust in the respondent, or may unwittingly elicit a response intended to please); and

- strategizing (respondents may wish either to assert an interest and therefore claim to have hunted when they did not, or to exaggerate their catch, or to conceal something and therefore deny or under-report their catch).

The solutions to these problems include:

- clarifying, simplifying, or otherwise improving the questionnaire;

- improving reporting frequency, requesting the respondent in advance to record certain events for later recall, and providing the respondent with recording aids;

- selecting and training interviewers either to recognize, minimize, and assess the bias introduced by personal contact, or to avoid it by using a mailed questionnaire; and

- creating a situation in which the respondents have no systematic motivation to misrepresent their harvests for strategic reasons.

To what extent do these causes of response bias also exist for Native harvest surveys, and what have been the means of eliminating them or correcting for them?

Interview design and format. Most of the studies reviewed did not use standardized questionnaires, but instead relied on informal interviews. Especially where the objective was species-specific data, the interview was limited to a few simple questions such as: how many (of species x) did you get (since time y)? Where the enumeration of harvest was part of a larger objective, standardized questionnaires have sometimes been used, but the harvest section itself remained fairly simple. For the most part, there is no specific discussion of the interview or questionnaire format, or of the interpretation of the results. McEachern (1978) and Wetzel et al. (1980) are among the few examples in the literature reviewed in which the

questionnaire itself is appended to the report, and in which the methodology is described. No examples were found that predate the JBNQ research, however.

Recognizing that much of the literature was the product of individuals with substantial field experience, or academic training, or both, the authors assume that reasonable care was taken to avoid misleading or ambiguous questions, especially in a cross-cultural situation. Nonetheless, the definition of harvest itself is rarely specified in the literature. Even assuming that it refers to animals killed and retrieved by the hunter, certain ambiguities remain. For example, where two or more individuals hunt together as a party, the questionnaire must specify the criteria for who reports what, to avoid double counting or omissions. Who killed an animal may not be the same person who brought it home or who eventually consumed it. A correct understanding of these cultural rules is as important for interpreting observational data as it is for interpreting survey data.

These considerations are especially important if the questionnaire is to be administered in a Native language (either directly or in translation), or if the respondent is not especially fluent in English. Relatively few of the authors cited are known to be fluent in any Native language, and rarely is it indicated that the interviews were conducted in languages other than English.

The question of excessive burden, leading to item non-response, or less accurate overall response, has not been specifically analysed with respect to any single Native harvest survey questionnaire, apart from Filion (1981) on waterfowl sport harvest surveys. The perception of excessive burden by Native respondents appears to result not only from the length or complexity of the questionnaire itself, but also from the prevailing view of research in the community at the time. Hostility toward research and scientists results in low receptivity to even a simple interview, regardless of content. However, of the literature reviewed, no one has reported excessive burden leading to poor response, perhaps because none of the surveys combined excessive questionnaire or interview length (e.g., more than 20-30 minutes) with repeated administration. Either they are long and administered only once, or if repeated at intervals, they are short.

Recall failure. Native northerners, like most other people, have long memories and accurate recall of the things that are important to them. The reliability of Inuit recall of historic events over living memory was favourably assessed by Arima (1976), and Krech (1978) cited a case of detailed recall by

Dene informants of certain events decades afterward, which he was subsequently able to corroborate very closely on the basis of independent contemporary documentation.

Native people have traditionally relied on oral transmission of knowledge and information, which probably results in a much greater emphasis on accurate recall and recounting of events or knowledge than in a culture in which there are alternatives to memory, such as writing, for ensuring the continuity of knowledge. Nelson (1969) in his study of North Alaskan Inuit hunters, stated that they rely on each others' empirical knowledge unquestioningly, this being the source of the common fund of knowledge with respect to harvesting. However, he found this to be less the case among the interior Athapascans, who apparently rely more on individual knowledge and experience (Nelson 1973). It is generally considered that individuals who reported to the various land-use and occupancy studies in the Canadian North during the 1970s took special care to relate their land-use activities accurately and completely.

These findings do not mean, however, that recall failure is not a problem for harvest surveys. First, harvest surveys are not necessarily analagous to the example of the land-use and occupancy interviews already cited. Those interviews (which were of a directed but informal nature rather than a survey questionnaire) were seen as a once-and-for-all statement on matters of great cultural and historic importance. They constituted, for many respondents, the occasion for them to relate an important story: not only their autobiography but the manner in which they as individuals put their heritage into practice. In traditional Native cultures, great value is placed on stories and their accurate transmission. The recall of a simple series of numbers, even though relating to as important a subject as harvesting, is probably not considered by many to be in the category of a "story," and, hence, less importance may be attached to a full and accurate recounting.

Secondly, practically all of the studies cited are retrospective, and ask the harvester to recall, on the single occasion of the interview itself, the number of each species he or she took over a specified time period (usually the preceding year). Success in doing so requires first that the numbers were actually committed to memory at the time, and secondly, that they remained accurately fixed in memory during the intervening period. The occurrence of recall failure in Native harvest surveys results chiefly from the failure of harvesters, in the ordinary course of events, to count their harvest of a certain species, and thus to have any number to remember. Once such a number has been tabulated and committed to memory, the ability to recall it is generally satisfactory.

There are several reasons why Native harvesters have not usually committed to memory the numbers of animals taken. One is that, in most cases, the precise quantity of animals taken is not a useful datum for the future success of either the harvester or the members of the group. General observations of abundance or scarcity, or precise observations of animal behaviour or environmental conditions are much more important. It is the factors that affect success or failure, rather than the quantitative estimation of success or failure itself, that have traditionally been considered important. Success or failure was adequately measured by, simply, enough or not enough.

Another reason is that some species are taken in such quantity and in such a routine fashion over extended periods of time. In an unpublished recall survey at Fort Good Hope it was found that ambiguous questioning resulted, in some respondents tending to estimate average annual harvests of small game, rather than those for the year in question, despite the fact that there can be substantial cyclic variation in catch.

On the other hand, the calculation and memorization of quantities is likely to occur where the harvest is rare or occurs under exceptional circumstances, where it is sold commercially, or where it has special ceremonial significance. As well, where quotas or possession limits exist for certain species, the likelihood of hunter tabulation and recall is increased. As well, women, who are much more involved in the butchering and preparation of animals, may be more likely to recall quantities, but this hypothesis has not been put forward or tested in the literature, nor have any harvest surveys been designed specifically to rely on womens' knowledge.

The senior author, during research on trapping on Banks Island, N.W.T., found that trappers' verbal recollections of the numbers of foxes taken as long as 30 years before often corresponded closely with their reports to game officers at the time, as recorded in the GNWT licence returns.

When scientists have commented favourably on the recall of Native people, however, it has usually been in the context of a situation in which substantial trust has been established, which is more likely to be the case with extended observation of participants rather than survey research in which personal contact is limited.

Aids to recall. In a few studies, recording aids have been used with mixed success to enhance recall. During the early 1960s, the GNWT Wildlife Service gave out, to GHL holders diaries with spaces in which to record their take of the major

species by month. The senior author found that, at Sachs Harbour, almost all of the trappers filled these diaries out diligently, whereas at Coppermine and Holman, very few did so. The practice was discontinued in the late 1960s, and in any event, the Wildlife Service used them only for annual tabulations, and rarely, if ever, made use of the monthly data. Otherwise the use of continuous recording aids has been mostly limited to those studies the authors of which were interested in nutrition, or in detailed household budgets, as well as harvests (e.g., Ballantyne et al. 1976; Kemp 1971; Mackey 1984a,b).

Other aids to recall include designing multiple-choice rather than open-ended questionnaires, and breaking down harvesting activity into components from which an annual (or whatever period is desired) total can be reconstructed. The few examples of these techniques have, not surprisingly, been applied to those species which, for the reasons already noted, people typically have the most difficulty quantifying; namely, fish and small game. McEachern (1978) for example, used multiple-choice or categorized questions to ascertain fish catches. Usher et al. (in prep.) broke down the fishery by gear and season, obtaining recall data for each item, to reconstruct total annual catches.

Interviewer-induced bias. All harvest data, whether obtained from licence or permit returns or through special-purpose surveys, have been based on personal interviews, administered by police constables, game wardens, government field officers, or trained social scientists. In no case has a self-administered, mail-in or drop-off questionnaire been used, because, in earlier years, of the certain expectation of almost complete non-response to written, mail-in questionnaires, to say nothing of the infrequency of mail service. Even today, however, despite higher rates of literacy, greater familiarity with survey research, and better communications, no self-administered questionnaire survey of any kind has been undertaken in the small, largely Native communities, to the authors' knowledge. Consequently, interviewer-induced bias is necessarily a consideration in harvest surveys to date, whether outsiders or local people do the actual interviewing, and regardless of their training. Given the nature of the data, however, it is difficult to dissociate this bias from the more important source, namely, strategic response.

Strategic bias. The possibility that Native harvesters might strategically bias their responses to harvest surveys has long been recognized. The earliest discussions of this bias, and how to overcome it, appeared, not surprisingly, in the

literature on migratory birds in the 1960s. Klein, a wildlife biologist, in a survey of waterfowl harvests in the Yukon-Kuskokwim Delta, commented:

> ". . . the reason for the study was explained; it was pointed out that everyone would benefit from an objective appraisal of the problem based on facts.
>
> ". . . where the people had physically resisted enforcement attempts by U.S. Fish and Wildlife Service agents in the spring of 1961, the men were extremely cautious about divulging information about their use of waterfowl. Generally, however, the people freely provided the information I requested about their spring and fall harvest of geese and ducks. . . . The fact that I used an interpreter who was an Eskimo, well known to the people, and further, that I was not identified with the U.S. Fish and Wildlife Service, undoubtedly contributed to the reliability of the data I collected."(Klein 1966)

Similarly, Carpenter, a local Inuk, in a survey of waterfowl use in the western Arctic, stated:

> "I explained that if the goose hunting laws were changed and not to their liking that it would be their own fault from what they had told me in the interviews. I told them of the trouble C.W.S. people had taken to get them to keep up the spring hunt without R.C.M.P. pressure and that if they did not tell me the truth it was their fault at the results the study got. The reactions were interesting and I am sure that the Tuktoyaktuk waterfowl utilization census is a true one." (Barry and Carpenter n.d.)

Prior to the mid-1970s, the chief reason for strategic bias in Native harvest surveys was the fear of individual prosecution for violation of game laws, or more rarely, with respect to commercial harvests, the fear of income investigation for tax or social-welfare purposes. The fear of prosecution in most parts of the North, however, was limited to migratory birds. Another concern was the possibility that even where individual prosecutions were not an issue, the collective results of a harvest survey could lead to the imposition of quotas. This concern may have been the case in certain parts of the Northwest Territories mainland with respect to barren-ground caribou.

In our experience, these biases were likely to exist whether the interviewer was a biologist or a social scientist, and could only be dispelled, if at all, through a lengthy establishment of trust. The influence of strategic bias up to that time, then, was most likely to have been to produce an underestimate of the harvests of certain, but by no means all, species. The causes and effects of strategic bias have multiplied in the last decade, however we will discuss these in a subsequent section.

Overall Quality

Despite the general tendency to ignore methodological questions in the Native harvest literature, the authors consider the results of most of the studies to be at least as reliable as harvest data of any other type, for nine reasons.

a) For the most part, the results should be interpreted as referring to production (in the economic sense) rather than to kill or consumption.

b) Although the results are sometimes difficult to compare directly from one study to another, the lack of standardization does not detract from the reliability of any individual study.

c) The choice of a fortuitous, rather than a random, sample is largely overcome where the sample size is very large. Most of the studies reviewed achieved over 80% coverage, and in many cases special efforts were made to contact the most active hunters.

d) Most researchers have had sufficient sensitivity to the problems of interview design and procedure in cross-cultural situations to minimize that cause of response bias.

e) Recall failure is not a problem for most species, and especially those that constitute the bulk of the harvest, except for fish.

f) Strategic bias is not systematic but rather is restricted to certain species, readily determined in advance of the survey. For the most part, however, a consensus emerges from these studies that Native harvesters, once they chose to co-operate with a survey, made the effort to record their harvests accurately, but on balance underestimated slightly because of their cautious interpretation of the questions, and a concern, based on their cultural values, to avoid exaggeration.

g) Most researchers have had substantial field experience and, consequently, have had a good subjective or intuitive sense of the quality of the information they received.

h) In many studies, the reliability of interview data is considered against other evidence such as spot counts, participant observation, personal accounts, and estimates by other knowledgeable individuals.

i) When the results of a wide variety of surveys are compared, the total harvests per capita fall within a limited range, and the variations are more or less readily explained. However, this verification is purely inferential.

Conclusions

As a result of both the comprehensiveness (if not the accuracy) of the GNWT statistical record, and the number and quality of special purpose harvest surveys, there is a more complete record of Native game harvests in northern Canada for recent decades than exists for any other hunting society in the world, with the possible exception of Greenland. Unfortunately this fact is seldom recognized. Too often, biologists and social scientists fail to make themselves fully aware of each other's work, let alone make good use of it. Too often, both resource managers and socio-economic planners make uncritical use of poor quality or out of date statistics, when better ones with more explanatory text are readily available. Indeed, too often both set out to gather new statistics with ad hoc methods, in ignorance of a substantial body of experience and literature.

To some extent, however, the reasons for this woeful situation involve the very nature of the studies themselves.

a) Objectives and purposes have varied over time, and there is rarely any clear recognition of the implications of the study objectives for the design of the study and the interpretation of the results. In particular, wildlife management and socio-economic analysis objectives are not easily reconciled (although it is by no means impossible to do so).

b) In many cases, especially the academic social scientific studies, harvest statistics are a by-product rather than the central focus of the research. They were generated as a means of testing certain relationships between human groups and the environment. Consequently, the estimation of total harvests for a particular group or area has been

less important than accurate recording of the harvests of particular individuals or groups. However, even where harvest statistics are the primary intent of a study (which is especially the case with the impact assessments and the biological studies), the methodology tends to be developed on an ad hoc and often internal basis, with little reference to the literature and without benefit of external peer review.

c) Coverage is discontinuous in space and time, and rarely includes all harvested species. Consequently, it is often difficult to generalize from any particular study to a large region or to the North as a whole.

d) Terminology and definitions have not been standardized.

e) Although there is a trend over time to a more precise interview protocol, there has been no systematic or collective effort on the part of researchers to standardize procedures and methods.

f) Sampling techniques and their implications have barely been acknowledged as an issue, let alone been standardized.

Yet the demand for Native harvest surveys has grown, and now includes active management intervention, the allocation of wildlife resources among competing users, and the value of harvests with respect to possible compensation requirements for loss or reduction. These demands have transformed Native harvest surveys from a merely academic pursuit to one having practical and immediate application.

They must, however, be capable of withstanding the scrutiny of both external peer review, and of adversarial proceedings. Crude methodologies, which provided useful "guesstimates" in years past, are simply not adequate to meet these new demands.

In the one case -- James Bay and northern Quebec -- where a large development project led directly to a negotiated claims settlement, the question of Native harvest levels was resolved by establishing a formal system for obtaining the required data. Thus began the generation of surveys now commonly referred to as "Native harvest surveys."

JAMES BAY AND NORTHERN QUEBEC SURVEYS

OBJECTIVES, DESIGN, AND CONDUCT

Section 24 of the James Bay and Northern Québec Agreement[1] guaranteed to the Inuit and the Cree "levels of harvesting equal to present levels of harvesting of all species in the Territory." Present levels were to be determined over a five-year period (1975-80) by interviewing, at regular intervals, every harvester in the territory who was to be a beneficiary of the agreement. The agreement, and related legislation, called for the establishment of a joint committee, made up of all parties to the negotiations, to undertake the research, according to terms of reference to be negotiated among the parties. Most of the results are now publicly available in report form (see addendum to references).

The amended Terms of Reference (JBNQNHRC 1982a) called for slightly different study formats for the Cree and the Inuit, which were meant to reflect chiefly the differing socio-economic circumstances and harvesting practices of the two groups. The two studies were staffed and conducted separately, although there was contact and co-operation between the two teams, and the reports were prepared and released separately. For the purpose of this discussion, the authors refer here only to the most recent Cree and Inuit reports (i.e., JBNQNHRC 1982a, 1982b, respectively), unless otherwise specified, as each contains a history of the project, and the most up-to-date versions of the questionnaires, diaries, methodologies, and so on.

The James Bay and northern Quebec harvest studies involved several major methodological innovations, each of which is described.

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1 JBNQA, 1975 (subsection 24.6.2), Op. cit.

Co-operative Approach

Given the need for accurate harvest statistics to implement the agreement, and the universally acknowledged inadequacy of existing data, all parties agreed that harvest research:

> ". . . should be conducted by a joint research organization, so that differences among the parties concerning method, the interpretation of the data, and the form of the results could be worked out and agreed upon before the research was undertaken. If each party came to negotiate with figures derived from the results of its own research, it was thought that:
>
> 1) there would be many conflicting results;
>
> 2) the negotiations themselves would bog down in methodological debates; and
>
> 3) the results would bear less resemblance of [sic] the reality of the Native harvesting activities than if the parties agreed on a method of arriving at numbers in advance of negotiations.
>
> By conducting joint research, the resources available to each party could be used more effectively, and Native informants would not be burdened by several parallel research projects." (JBNQNHRC 1982a)

To this end, the James Bay and Northern Quebec Native Harvesting Research Committee (JBNQNHRC) was struck, as a subcommittee reporting to the Coordinating Committee on Hunting, Fishing and Trapping, established under the agreement. Each signatory to the agreement contributed to the funding of the project, and each was represented on the committee by technical specialists. The JBNQNHRC acted as a steering committee which approved the research design and procedures, and monitored the progress and results of the study continuously.

The terms of reference for the study was a negotiated document, as was each progress report. On occasion, individual participants arranged for independent evaluation of aspects of the research, which presumably influenced their ongoing negotiating stance. Although these negotiations were certainly time consuming and often arduous, the effect was to bind all of the participants to the outcome of the study, as required by the original mandate.

Local Input

The Native organizations retained professional staff to represent them on the steering committee, so as to negotiate the design and conduct of the study, and to co-ordinate the field work. However, Native residents were hired in each community or region to conduct the field interviews and to assist in diary maintenance. As well, substantial input to the study design was solicited from Native harvesters. The Cree and Inuit reports emphasize that the final design of the diaries used to record harvest levels was established after numerous discussions with hunters. The questionnaires used in both Phase I and Phase II to consolidate the harvest counts recorded on the calendars were developed by means of field tests with Native hunters and field-workers. Both the Cree and Inuit harvest studies depended on Native field-workers to maintain contact and co-operation with the communities and with individual harvesters.

Two-Stage Study Design

The design of the continuous recording survey (Phase II) was to be based on a prior, retrospective survey involving recall for up to three years, depending on the species (Phase I). Phase I, in turn, was developed on the basis of special-purpose studies that had already been undertaken in the region to assess the effects of proposed hydro-electric developments (e.g., Elberg et al. 1972; Weinstein 1976).

Phase I of the Cree and Inuit studies was used to design, test, and review the basic data collection instruments as well as to obtain recall harvest data from a stratified random sample of one-third of the Cree and Inuit hunters aged 18 years and older. The one-third sample was stratified according to three age categories: 18-26, 27-45, and 46+ years. An additional function of Phase I was to familiarize harvesters with the study as a whole.

In Phase II, harvesters were provided with diaries for each coming year in which to record their harvests continuously on a weekly or monthly basis. Field-workers visited harvesters, yearly in the case of the Cree and every three or four months in the case of the Inuit. The field-worker and the harvester together, with the aid of the diary, would complete a questionnaire which was designed to consolidate the harvesters' record. The completed questionnaire was then sent for coding and data analysis. In the case of the Cree study, the diary was sent with the completed questionnaire to be used for cross-checking the questionnaire counts. Although both the

diaries and the questionnaires had been pretested during Phase I, they continued to be modified as necessary over the life of the project. Phase II ran for four years (1975-79) for the Cree, and five years (1975-80) for the Inuit.

Coverage

Harvesters. Phase II aimed at complete coverage of all harvesters: about 1600 in the Cree communities and 875 in the Inuit communities, per year. This coverage, coupled with the use of local field-workers and local design review, required an unprecedented level of local involvement in, and commitment to, the project.

The population of harvesters was identified as resident male beneficiaries of the agreement over 18 years of age, with an additional cut being made of those identified as non-hunters (e.g., incapacitated or away at school). The JBNQ studies examined not only the individual success of those harvesters, but also of their households. For each hunter a file was created showing such social characteristics as age and household composition. Thus a reporting unit was identified for each hunter:

> "Each adult male who was a head of household was to report his own harvests and, where applicable, those of his spouse, all other women in the household and all minors in the household. Adult men over the age of 18 years who were not heads of households were asked to report only their own harvests, which were not to be included in the harvests reported by the head of the household in which they resided." (JBNQNHRC 1982a)

Species. Coverage included all harvested species -- terrestrial mammals, including big game, small game and fur-bearers, marine mammals, migratory and non-migratory birds; and marine, anadromous and freshwater fishes -- irrespective of management jurisdiction. As well, based on an extensive literature review (JBNQNHRC 1976b, 1982a), standard edible weights were estimated for each of these species to calculate country food production by weight from total estimated harvests.

Location. The entire area covered by the agreement was to be surveyed. This area covered about 1 million km^2, and contained about 27 communities. Within this region, harvests were located not simply by community. For each community, two zones were identified in consultation with local hunters: near (i.e., day travel) and away. All harvests were then coded as originating from one or the other zone for each community. In

the Cree study, further geographical identification was based on individual trapping areas, a unit which did not apply to the Inuit, however. No attempt was made to continue the more precise geographical coding system (using 100 km^2 UTM grid squares) developed by Weinstein in the Fort George prototype study (1976).

Data Processing

Formal procedures were established for accepting, coding, and processing interview data, and for internally verifying these data at each stage (JBNQNHRC 1982a, 1982b). For example, abnormally large harvests were questioned and checked against the hunter's diary. Field-workers also followed up to check abnormally large harvests. Data entry and storage were done on mainframe computers outside the study region.

Projection Method

To estimate total harvests on the basis of reported harvests (given that coverage, although high, would be incomplete), a method of proportional projection was adopted. This method effectively assumes the respondents to be a random sample, although in fact, because they were the ones present and willing to be interviewed, they were a fortuitous sample. Nonetheless this procedure was judged superior to certain other estimation procedures tested at the outset (JBNQNHRC 1979, 1982a). For further precision, the Cree harvesters were stratified into two subsamples: intensive harvesters who spent most of their time in the bush; and active harvesters whose harvesting effort was assumed to be lower on average. The distinction was made first on an ad hoc basis, and later with reference to the Income Support Program. Reported harvests were then projected separately for the two subsamples. The Inuit harvesters were not so stratified, and in any event, the Income Support Program did not apply to them. Reported harvests were projected for each Inuit community as a whole.

Independent Verification

A systematic attempt was made to cross-check the survey results against other sources of information, including the results of independent studies, such as Canadian Wildlife Service (CWS) migratory waterfowl surveys, and the fur sales records maintained by the Government of Quebec.

RESULTS AND EVALUATION

Although it is not the purpose of this report to review the quantitative findings of any of the harvest surveys, some observations about how the results have been presented, used, and evaluated are relevant.

Local Involvement

The direct involvement of Native people in the survey appears to have led to the employment and training of several dozen local people, the modification of the research design so as to incorporate Cree and Inuit concepts and practices with respect to harvesting. Local involvement also contributed to the widespread acceptance of the study by harvesters as serving their interests and producing credible results. While a significant degree of Native involvement in wildlife management was intended by the James Bay and Northern Québec Agreement, the harvest surveys have proven to be a significant educational tool in actually achieving that objective. Wildlife managers interviewed, who were familiar with the JBNQ experience as well as project personnel themselves, regarded it as positive in terms of both the use of the results for wildlife management, and for conservation education and management participation. There is a consensus that both wildlife managers and Native harvesters learned from each other, and established a more co-operative relationship.

Methodological Development

The JBNQ studies represent a major advance in both the practical consideration of methodological problems associated with harvest surveys, and the detailed analysis of these problems. The final Cree report (JBNONHRC 1982a) is over 800 pages in length and not only presents the survey results, but also devotes 61 pages to a discussion of the project structure and methodology, 83 pages to a discussion and evaluation of the results, and nearly 500 pages to appendices, most of which provide further detail on methodology and evaluation. The Inuit reports do not provide the same level of detail, but, in effect, rely on the Cree reports for validation as the terms of reference and methodology were similar.

In both cases, there is a clear progression from a thorough examination of the relevant literature on the region as well as the literature and experience with harvest surveys in general (JBNQNHRC 1976b), through the Phase I retrospective surveys (JBNQNHRC 1976a,c), to the Phase II continuing surveys.

Although there are certain minor deficiencies with particular aspects of the methodology, the manner in which the surveys were done, and the results were presented, is made very clear by the published reports.

Phase I of the Cree and Inuit harvest research studies made three major contributions to the Phase II research as well as to harvest survey research in general. First, Phase I permitted extensive testing of the data collection instruments used in Phase II, which includes the harvest questionnaires, diaries, and field-worker training.

Secondly, Phase I allowed the testing of hunter stratification methods. Stratification of the hunter population by age proved not to explain adequately the observed variation in Cree harvesting levels. Phase II therefore adopted a different strategy for stratification (see "Projection Method") which proved much more successful in accounting for variation in Cree hunter success. The testing of the relationship between age of hunter and harvesting levels in Phase I is a significant contribution to the findings of Native harvest surveys in general.

Thirdly, Phase I sought past harvest data and, in so doing, tested the ability of harvesters to recall for up to three years their household harvests. The value of this aspect of the JBNQ studies is that it provides a systematic and broadly based comparison of harvesters' recall ability for a wide variety of species. Of particular interest is that the verification studies undertaken in Phase II indicate that the Phase I recall data did not differ significantly from Phase II recall data.

The system of recording aids used in Phase II proved workable, although it is not clear that it added significantly to recall (Table 2). From these data it may be observed that, first, less than half of the reporting harvesters actually used the recall aids they were given, and secondly, that the proportion using them dropped slightly as the study progressed. There are no comparable data from the Inuit reports.

TABLE 2
Use and return of diaries, Phase II, JBNQ Cree Survey

	Questionnaires completed with aid of NHR* diaries		NHR* diaries collected	
Year	no.	%	no.	% of no. issued
1975-76	--	--	341	27
1976-77	450	43	498	37
1977-78	423	40	477	34
1978-79	367	35	367	26

* NHR = Native Harvesting Research

Source: JBNQNHRC 1982a.

The questionnaires themselves appear to have been designed to reduce ambiguities and to enhance the comparability of data. However, the imprecise definition of harvest remains. In the Cree surveys, the English version of the questionnaires asks for the number of animals killed, yet the interviewers' manual refers interchangeably to numbers killed and numbers caught (see appendices to JBNQNHRC 1982a). The Inuit survey is not specific on this point, but the authors understand that the numbers refer to animals retrieved.[1]

Coverage

Harvesters. Coverage in the Inuit communities was 89% of harvesters in 1976, and ranged from 77 to 80% thereafter. This excludes two communities which for political reasons not directly related to the study refused to participate in it at all, but includes one community where for the same reasons only about half of the harvesters participated. The Cree study achieved 74 to 78% coverage during its four years of operation. With the exception of

[1]W. Kemp, personal communication.

the very high coverage achieved during the first year of the Inuit survey, there is no significant trend in participation rates over the life of the surveys, and no significant difference between the two.

In both cases, however, variation in coverage was substantially greater when broken down by community (Table 3) and by species.

TABLE 3
Variation in coverage by community, Phase II, JBNQ surveys

Cree		Inuit*	
year	range(%)	year	range(%)
1975-76	55-96	1976	72-100
1976-77	59-92	1977	50-96
1977-78	49-94	1978	56-95
1978-79	61-88	1979	72-94
		1980	63-96

*Inuit data exclude Sugluk because of intentionally limited participation in that community.

During the life of the Cree study, 765 individuals were potential hunters during all four years. Of these 491 or 64% were reached every year, and 758 or 99% were reached in at least one year (JBNQNHRC 1982a). Thus, there does not appear to have been a consistent or "hard-core" group of non-respondents, which in turn suggests that non-response bias was not a significant problem in the Cree surveys. No similar analysis is contained in the Inuit reports.

The rate of refusal to participate in the Cree surveys was consistently low, but did rise from a range of 0.8-1.8% during the first three years of the project to 2.8% in the final year (JBNQNHRC 1982a). This result may provide some indication of the length of time harvester participation can be sustained for extended surveys of this type. Again, no similar analysis is contained in the Inuit reports.

Species. In the Cree survey, respondents were asked to report 32 different items which covered a total of 64 species of birds, animals, and fish actually taken by the Cree. No taxonomic differentiation was requested for the single category of ducks, although 23 different species are taken in the region. Similarly, three species of grouse and three species of whitefish were lumped together. The only mammals aggregated were seals (ringed and bearded). The aggregation of some species appears to have resulted from the inability to obtain consistent subjective species identification across the region, however, it does reduce the value of the survey results for waterfowl management. In the Inuit survey, respondents were asked to report 32 different species, plus duck and goose eggs. Although the reports do not specify this, it would appear that there was no aggregation of species, with the possible exception of whitefish and cod.

Although not specified in either the Cree and Inuit reports, item non-response (i.e., failure to respond to some items at all, as opposed to stating nil harvest for them) appears not to have been significant in the surveys.

Calculations of total production by weight were made for all species. The resulting figures for edible weight estimates of the harvest refer, of course, to the amount of food potentially available, not necessarily the amount actually consumed.

Geographic coverage. Harvest data were successfully tabulated by zones near and away for each community, as originally intended. However, the reports do not provide any graphic representation of the results.

Data Processing

No significant problems appear to have arisen with the data coding, internal verification, or data-processing procedures.

Proportional Projection Method

In a review of the Cree data, Steiger (1981) concluded that the proportional projection method had been vindicated. This conclusion was based on a comparison of the estimates derived from the proportional projection method with the actual harvests of a previously unsampled group of harvesters.

Although the use of a fortuitous sample provided statistically valid results in this case, it should be noted that:

- the sample sizes were very large (only rarely falling below 60%);
- the sample was stratified;
- there was a high level of continuity in the sample over the life of the survey; and
- non-response bias does not appear to have been a significant problem.

Independent Verification

The JBNQNHRC compared the results of Phase I and Phase II and found them not to differ significantly. Therefore, it was concluded that Phase I data were representative of Cree harvesting levels.

Certain additional and independently compiled sets of data were available for comparison with the Cree harvest survey results. These included six independent (but more restricted) surveys conducted during, or shortly prior to, Phase I, and three independent (but again much more restricted) harvest surveys conducted during Phase II. From the comparison it was concluded that harvesters had submitted accurate reports to the JBNQNHRC study, and that any errors were on the side of under-reporting. As well, a special study was undertaken to compare the survey's own estimates of fur harvest to the Quebec Government's annual statistics on pelt sales. However, the criteria for recording these two sets of data were so different as to render direct comparisons of limited value.

Discussion of these findings is found at various points in the Cree report (JBNQNHRC 1982a), as well as in several appendices to it. The Inuit study did not undertake similar comparative studies, chiefly because of the lack of available independent material.

Evaluation by Participants

The JBNQNHRC functioned as the technical steering committee through the life of the project. The results of the study (JBNQNHRC 1982a) "were judged by the Committee to have an acceptable level of reliability, and are the best available on

the Cree communities for the study period." It is understood that this view extends to the results of the Inuit survey as well. Consequently, there are, on the public record, harvest data for all of the Native communities in northern Quebec, by year and by general location, for a period of five years, which all parties to the agreement concur are the best available. Although the parties can still make recommendations for improvement, the community harvest figures have not become matters of adversarial dispute or proceedings, but rather have provided, as they were intended to, a commonly accepted statistical base for addressing the question of allocation.

Several participants described frequent and sometimes difficult negotiations within the steering committee. No assumptions were left unquestioned or untested by other parties, and, as a result the project was frequently modified in progress. The subsequent benefits, however, became evident during the final negotiations over harvesting levels, pursuant to the agreement. The negotiations with respect to migratory birds took about a day to complete, and the harvest levels documented by the JBNQ surveys were never at issue. Instead, the discussion turned on such matters as the relationship of those numbers to total waterfowl populations, sport harvests, crippling losses, and the like. Indeed the CWS had to convince the Native negotiators of the reliability of its own survey data on population and sport harvest.

The JBNQ data are now commonly referred to in the scientific literature, and appear to be accepted with no less difficulty than other management data such as population estimates or sport or commercial harvest estimates. Indeed Boyd (1977) considered data on waterfowl sport harvest to be less reliable than the JBNQ results.

CONCLUSIONS

The JBNQ surveys achieved their negotiated and stated objectives. They made major innovations in the scope and design of harvest surveys, and produced statistics that are considered to be reliable and verifiable by a large and diverse set of users. The key to this success was first, that the objectives, design, and control of the project were negotiated among equals; and secondly, that all parties were able to ensure, through the steering committee, continuing adherence both to the necessary technical standards and to the original terms of reference. The surveys made extensive use of the literature, and were preceded by a pilot phase of recall surveys which was instrumental in developing Phase II methodology. The interim and final documentation is extensive

and thorough, and all aspects of the surveys are carefully reviewed. This is especially true of the Cree surveys. The Inuit surveys are carried in part by the Cree documentation, but even as stand alone documents they provide an adequate account of the survey. Accordingly these surveys provide an excellent (although by no means perfect) model for the conduct of Native harvests surveys on a global, multi-year basis.

The resulting statistics were not intended for and, thus, cannot necessarily be used for the following four purposes. First, they were not designed for wildlife management, and have only limited use for that purpose. For example, the species composition of the waterfowl harvest is not broken down sufficiently for management. No attempt was made to obtain age and sex data on harvests, and kills are located only within very large areas, and then with reference to the land-use patterns of harvesters rather than to the life-cycles of animals (with the exception of the trapline-specific location of much of the Cree harvest).

Secondly, as the surveys lasted only five years, a data base was obtained, but there is no continuing flow of data for management purposes. Wildlife management agencies have had to rely, since 1980, on alternative sources of information for such data: either the systems that were in place before the surveys began, or some modification of them. It is generally thought that the quality of current data is substantially lower for many species than was obtained during the period of the harvest survey, and some consideration is currently being given to revising the harvest surveys, although probably in less elaborate and costly form.

Thirdly, although the final data base is useful for compensation under certain scenarios of loss or damage, the surveys were not specifically designed with compensation issues in mind. Again, there is no continuing flow of data, and as time passes, the data base itself will be of less use, especially with respect to local incidents and individual losses as opposed to major catastrophes and widespread affectation. The question of final storage and disposition of intermediate records such as diaries and calendars was not worked out in detail at the outset of the surveys. It is understood that in many cases it has been left to the individual communities to decide this, and that they in turn may return these documents to the original harvesters. It may be that in the long run it will be impossible to relate the data file to individuals. As well, the surveys did not document individual harvesting effort, although such information may be obtained independently, for the Cree, from the records of the Income Support Program.

Finally, the surveys were not designed to relate harvests to socio-economic phenomena for the purpose of economic analysis or planning. Both the Cree and the Inuit surveys provided a derivative statistic from the total counts of harvest by species: edible weight of country food produced, on both a community and a per capita basis. The reason for doing so was to provide a more graphic illustration than did the raw statistics themselves, of the reliance of the Native communities on country food. It is important to reiterate, however, that these statistics represent neither kill, in the sense of the total biomass removed from living stocks, nor consumption, in the sense of the total amount of country food actually eaten, although a number of subsequent researchers have used them as proxies for the latter figure. Aside from this derivative statistic, and the hunter file itself, which indicates participation and success, there was no attempt to obtain linked data on employment, income, or expenditures.

A REVIEW OF THE NWT SURVEYS

Three comprehensive Native harvest surveys of the JBNQ model are currently underway in the Northwest Territories, which together will provide coverage of the entire Nunavut region. Each has been undertaken on the initiative of a regional Inuit organization. The organizations responsible are the Baffin Region Inuit Association (BRIA), the Keewatin Wildlife Federation (KWF), and the Kitikmeot Hunters and Trappers Association (KHTA).

The BRIA survey, the first of its type in the Northwest Territories, was conceived in the late 1970s and began in 1980, the final year of the JBNQ Inuit survey. Indeed it drew directly on the methodological approach established in Arctic Quebec. The KWF and KHTA surveys, which began in late 1981 and 1982, respectively, did not draw so directly on the JBNQ experience, but were based instead on what is now referred to as the "BRIA model."

Despite the strong influence of the JBNQ surveys, the NWT surveys differ significantly from them in conception, execution, and result. This difference results only from intentional modification of the survey design, but also from the rather different political and legislative environment that pertained to each jurisdiction, and from the institutional arrangements for harvest surveys that have resulted. The NWT surveys also differ from each other to a greater extent than was the case between the two JBNQ surveys, for the same reasons.

In this section are reviewed the design modifications to the JBNQ model made by the NWT surveys; the way in which those surveys have been conducted, interpreted, and used; and their achievements and problems to date. Special attention is given to the BRIA survey because it was the key link between the JBNQ surveys and the model that now prevails in the Northwest Territories. The review is based on the following materials:

- the reports of the NWT surveys released to date, consisting of two BRIA technical reports, covering the 1981 and 1982 harvest years respectively (Donaldson 1983, 1984); one BRIA progress report (BRIA 1983); one KWF technical report covering the period October 1981 to September 1983 (Gamble 1984); and one KHTA progress report, covering the 1983 harvest year with late 1982 data for selected communities (Jingfors 1984);

- associated documents provided to the authors directly by the project offices or by sponsors, including harvest calendars, diaries, manuals, and worksheets from all three projects; sample spreadsheets of actual data supplied by KWF and KHTA; and such internal documents as funding applications, contracts, and departmental memoranda, from the projects and from the sponsoring agencies;

- interviews with professional staff and field-workers on all three projects; and

- interviews with representatives of sponsoring and user agencies.

OBJECTIVES AND ORGANIZATION

Status of the NWT Surveys

The NWT surveys have been undertaken on an ad hoc basis, in anticipation of needs rather than as a legislated response to them. They began as pilot studies, financed from general program funds rather than from a specific allocation legislated by Parliament or authorized by Treasury Board. This structure is in substantial contrast to the JBNQ surveys, which were undertaken by virtue of a legislated agreement, that mandated the terms of reference, the responsibilities of the participants, and ensured funding for the life of the project. In that case, all of the participants were committed, through the negotiation process, to terms of reference and a research design with a limited but clear set of objectives and procedures. To understand their different outcomes, it is essential to recognize these institutional and structural differences between the JBNQ and NWT surveys.

In the Nunavut area of the Northwest Territories, the current studies were formulated by the various participants with a variety of goals specific to both the "actors" and to the regional situations, but not necessarily consistent from study to study. Each study is distinctive in terms of organization, methodology, institutional context, and objectives. Although this is partly a response to the dynamic social, political, and ecological conditions pertaining to each region, it is also a reflection of the uncertain status that harvesting research holds among the contributing agencies. Unlike the JBNQ project which, once the primary methodology and objectives were negotiated and tested, was set in motion for an extended but defined period of time, the NWT projects have had to renegotiate both funds and objectives annually.

Technical Objectives

Whatever other needs or interests the JBNQ research served (and in the outcome it did indeed do so with varying success), its specific mandate was to establish present levels of harvesting, for the purpose of negotiating base level allocations of fish and wildlife. This technical objective has been met to the satisfaction of all parties. The NWT surveys, in contrast, have each set out their own objectives and indeed, to justify funding, they have often identified multiple objectives.

As a minimum, the main technical goal of all three NWT surveys is, as was the case in Quebec, the gathering of accurate data on fish and wildlife harvesting which reflect the sum of each region's successful harvest. In addition, however, each NWT project has come to incorporate a unique set of adjunct objectives that parallel this central goal, chiefly because of the diverse sponsorship of the projects, and their ad hoc and unco-ordinated nature. Unfortunately, some of these goals have proven inconsistent with the technical objectives of a harvest survey. With particular reference to the evolution of the BRIA project, the authors illustrate here how the problem developed, and then examine the consequences.

BRIA survey. In the original project and funding proposal presented by BRIA to Department of Indian Affairs and Northern Development (DIAND), the purpose was to provide ". . . a precise estimate of the returns from the lands and waters where Inuit apply their . . . skills . . . .." (Arvaluk 1978)

This proposal was rationalized in terms of BRIA's socio-cultural and economic goals. The overall technical objective discussed was, however, clearly separated by BRIA from other essential, but not necessarily compatible data gathering.

> "Information on both the economic and biological productivity of the resource base is needed, but the immediate value derived from harvest studies makes these the essential first step." (Arvaluk 1978)

BRIA drew a clear distinction between the gathering of "hard" technical harvesting data and the potential political (land claims), economic (compensation), and socio-cultural benefits to which such data might contribute. BRIA raised two points that later became blurred. These were first, that ". . . studies be carried out . . . in order to acquire baseline information, and not as a response to immediate needs . . ." and secondly, that:

". . . the overall study be controlled in terms of the data sought, in order to ensure that it is limited to an investigation specifically of harvesting. Additional information might be desirable, but should not be incorporated within the subject study; a requirement for too much data would tend to confuse, and not enhance, the knowledge sought." (Arvaluk 1978)

This early discussion paper was then followed by a formal proposal to DIAND for a harvesting survey to span one year, in which the stated objective was defined as ". . . data collection of harvest totals for all species of food and fur resources in the thirteen communities of the Baffin region." (BRIA n.d.)

BRIA offered four rationales for the gathering of such quantitative information. However, although these rationales were presented in support of the harvest study proposal's technical goal, they were not construed within the document as representing parallel objectives.

In the 1978 and 1980 BRIA documents, the purposes to which BRIA hoped to apply the technical harvesting information it had gathered were clearly outlined, but there was no stated intent to implement these additional goals until after the technical data collection task was completed. Rather, these goals are presented, appropriately, as rationales for the gathering of basic technical information which is then to be analysed for the purpose of supporting the presented rationales, each of which is political or economic in nature.

In BRIA's 1982 proposal for the continuation of research funding for the harvest survey period April 1982 to March 1983 (essentially the third research year), the stated objectives to be addressed over that period included:

"a) to estimate (1) total hunter kill and (2) kill per hunter by community and month in the Baffin region;
b) to estimate and discuss the accuracy and precision of the above statistics;
c) to examine and discuss the effects of a hunter's age and his employment status on his hunting frequency and success;
d) to examine and discuss the distribution of hunting frequency and success within each community;
e) to discuss seasonal patterns and differences among communities." (BRIA 1982)

The 1982 proposal also noted that whereas DIAND was the sole original funding source for the BRIA project, by the 1981-82 fiscal year the number of participating agencies had grown to nine, and included the federal and territorial governments, industry, and Native organizations.

In 1984, funding of the BRIA project was converted to a contract arrangement between BRIA and the Department of Supply and Services, with DIAND as the responsible technical authority. The current contract lists four research objectives. The most prominent remains ". . . to determine the harvest of wildlife by Inuit hunters living . . . in the Baffin region . . . on a monthly basis." (Department of Supply and Services 1984a). The others are:

> "to determine the number of Inuit participating in hunting, trapping and fishing in each community and outpost camp;
> to develop . . . a system for identifying the locations of harvests of each species . . .;
> to develop a standard approach for estimating the harvest of bird eggs . . .." (Department of Supply and Services 1984a)

As well, among other things, the final report is to "contain an assessment of the economic development opportunities associated with the use of the renewable resources in the Baffin Region."

BRIA's technical reports 1 and 2 state the following to be study objectives for the year 1981:

> ". . . firstly, to design a system to collect harvest statistics from the hunters of the entire region, secondly to implement that design, and thirdly to develop and implement a computer system for processing this large data base" (Donaldson 1983)

and for the year 1982:

> ". . . firstly, to develop a system to gather and process harvest statistics from the 1500 hunters of the region, secondly, to implement this system in order to estimate harvest levels and related statistics, and thirdly, to interpret the significance of the findings." (Donaldson 1984)

These objectives are consistent neither with each other, nor with those in the original proposals.

The products of the first three years of the survey are the technical reports 1 and 2, for the 1981 and 1982 years (no results have been released for 1980). These reports are intended to demonstrate that BRIA first, had gathered harvest data; secondly, had set up a system to store these data; thirdly, had developed a system for estimating total harvests from reported harvests; and fourthly, could evaluate the reliability of the data.

These additional objectives included in the harvest survey frame of reference are analytical, rather than technical, in design. They are in fact included in advance of the establishment of a multi-year technical data base, such as was created in the JBNQ case. Thus, whereas BRIA originally separated the political and economic aspects of the survey from the actual development of a raw data base, at least for the life of the technical study, the sponsoring agencies, or at least some of them, have chosen to include exactly such goals in the basic terms of reference of what was intended to be a technical harvest survey project.

It is also clear that by 1982, with the expansion of the BRIA survey's financial sponsors, the resolve expressed earlier to stay with the single technical objective of gathering accurate harvest statistics for all species on a regional basis was lost. This conclusion was confirmed by several of the interviews. One product of the expanded 1982 study objectives is the progress report on operating costs of hunting in two communities during May 1983 (BRIA 1983). In contrast to the report for 1982 as a whole (Donaldson 1983), the progress report's objectives resemble those stated in the 1982-83 funding proposal (BRIA 1982) which relate to "collection of some socio-economic information related to hunting." This specific project was done for the GNWT Department of Economic Development, one of the funding agencies.

The diversity of financial sponsorship is reflected in the diverse set of objectives listed in the 1982 funding proposal. While they are all relatable to the defined principal goal of a harvesting survey as conceived in northern Quebec, and in the original BRIA discussion paper, their adoption is in direct contradiction to the precautions and intentions of BRIA prior to 1982.

The original goals of the BRIA study seem to have become lost along the way, probably because of the involvement of a large and diverse sponsorship. There is little indication that much serious scientific or technical evaluation ever took place of either BRIA's original objectives or those that were added on along the way. Instead, there seems to have been more of an

administrative concern on the part of steering committee members to ensure maximum value for the dollar, without adequate consideration of the technical feasibility of achieving that otherwise important goal. The continued financial support of each sponsor became, to a significant extent, contingent on getting at least some of its particular objectives met through the common vehicle of the survey -- objectives which the sponsoring agencies perhaps realized they could not otherwise attain.

Several of the individuals interviewed confirmed that, at meetings of the steering committee on which all financial sponsors were represented, "shopping lists" of additional study objectives were discussed and in some cases were added on to the duties of the project. Additional objectives were by no means always imposed by sponsors, however, as BRIA sometimes sought more funding by offering to undertake certain additional tasks, both within and outside of the context of the steering committee.

The resulting imprecision of both the study objectives, and the criteria for assessing when and whether they have been achieved, seems to be an inevitable consequence of the ad hoc status of harvest surveys in the Northwest Territories at the time.

KWF survey. The KWF survey was designed in 1981 by the Kivalirmi Inuit Land Claims organization (the Keewatin regional claims negotiating group of the Inuit Tapirisat of Canada). The rationales for the survey included:

- the need for more comprehensive and reliable harvest statistics for management purposes (The Keewatin Inuit Land Claims claimed that it could collect more reliable information than could regulatory and enforcement agencies);

- the need for better information on harvesting activities to monitor socio-economic effects of development activities;

- the need for harvest statistics for the estimation of the economic value of renewable resource harvesting for economic planning and for compensation in the event of adverse effects;

- the need for harvest statistics in the negotiation of a claims settlement, with special reference to land selection; and

- the participation of Inuit harvesters in wildlife management through their direct involvement in the harvest survey.

The Inuit Tapirisat endorsed the survey proposal and pressed for the federal government to fund it, in the context of claims negotiations. The administration of the survey was to be transferred to the newly formed Keewatin Wildlife Federation.

The original objectives of the KWF survey were:

- to determine the hunter kill of each species by Inuit living in communities and outpost camps;
- to develop an approach that could be reusable, in future, for the ongoing monitoring of the wildlife harvest;
- to determine the number of Inuit participating in hunting, trapping, and fishing in each community, and to compare the harvest taken by hunters of different ages; and
- to estimate the value of the harvest as food or income. (Kivalirmi Inuit Land Claims 1981).

These objectives, when compared with those stated in the first project report (Gamble 1984), underwent virtually no change during the life of the project. The exception is the last which, wisely, was restricted to providing the base data required to evaluate the harvest, rather than actually to making that evaluation.

KHTA survey. The Kitikmeot Inuit Association sought support for a similar project in 1982, chiefly to obtain the information necessary to establish "basic need levels," as identified in the context of the Wildlife Provisions of an Agreement-in-Principle[1] between the Inuit and Canada that had been initialled the previous autumn.

Comparison of NWT surveys. The sponsorship of the KWF and KHTA surveys has been much less diverse than that of the BRIA survey, and the funding arrangements have undergone fewer alterations. The KWF survey has been sponsored by DIAND, DFO, CWS, and GNWT Department of Renewable Resources, while the KHTA survey has been sponsored by the last-named agency only.

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1 Nunavut Wildlife Agreement (Wildlife provisions of an Agreement-in-Principle, initialled 27 October 1981, between the Inuit of Nunavut, and the Government of Canada (hereafter called "NWA, AiP, 1981").

The KWF and KHTA harvest surveys have had much less direct pressure on them by sponsors to diversify their objectives. As well, they were less directly influenced by the JBNQ survey model, and were conceived with more local concerns in mind. If anything, these two studies focused perhaps too much on immediate objectives, with the longer-range concerns given little attention. For example, special emphasis is placed on the recovery of data on species considered to be of local importance: caribou in the Keewatin, and caribou and muskoxen in the Kitikmeot region.

All of the NWT surveys, for whatever reasons, have come to incorporate as co-equal objectives, a number of tasks that none of the JBNQ surveys did. For example, all now incorporate location of the harvest as a primary goal. Both the BRIA and KWF surveys are now required to develop a standard methodology for estimating the harvest of bird eggs. Clearly, these objectives are the priorities of resource management agencies.

Similarly, for economic development, social welfare, and resource development planning, data on harvester effort, socio-economic conditions, and harvesting costs and efficiency are valuable, but their relationship to technical harvesting data is based on the particular needs and goals of specific agencies, and are not inherent to the research design and methodology of harvesting surveys as these have evolved through the JBNQ to the NWT surveys.

KWF and BRIA, partly because of their sponsorship, have included in their objectives the expansion of the basic harvesting research towards more strictly social and economic types of information (although it is not without interest to resource managers). Among the KWF objectives is a provision to determine the number of Inuit directly participating in subsistence harvesting in each community and to compare the proportion of harvest taken by hunters of different ages (Gamble 1984). In the past, the BRIA survey included similar goals.

It seems that the transformation of the original objectives of the NWT and especially of the BRIA surveys has occurred almost unconsciously, as a by-product of each sponsor seeking to maximize the return on its input. What becomes evident is a desire on the part of sponsoring agencies to maximize the opportunity to acquire specific data, only some of which is consistent with the defined primary objective of a harvest survey. The process has

been entirely logical and reasonable from the perspective of each participant, given the requirements of each, in the context of the overall situation. Perhaps neither BRIA nor any other organization fully recognized the transformation that was occurring, or was made to undertake work against its will, although possibly it did so against its better judgement. To the extent that there was a co-operative spirit in setting the terms of reference of these projects, the technical representatives of the projects may well have been anxious to please by showing that they could, in fact, achieve several goals simultaneously. After all, they themselves often drew attention to the desirability of these additional objectives when seeking financial support. It was the basic situation in which all parties tried to function that seems to us to have created such difficulties, in the outcome.

The recent shift to funding the studies on a contractual basis at least clarifies the objectives of the studies, and the mutual obligations of the signatories. It does not, however, overcome the difficulties imposed by incompatible or inappropriate objectives.

The Problem of Diversified Objectives

The gathering of additional technical information, including kill location, population or herd affiliation, age, and sex, is not necessarily incompatible with the main direction of harvest surveys as conceived by the Native organizations themselves. Nevertheless, the question arises about the relative priorities within each project, and whether emphasis on particular species enhances or detracts from the principal objective, which is to determine accurately the sum total of Inuit harvests.

The question of priorities and study loading has resulted in several actual or potential problems, one of which is the size and complexity of the surveys. Minimizing response burden is an essential aspect of the design of any social survey, and the greater the diversity of survey objectives, the more difficult that will be. The greater the response burden imposed on the data-gathering process, the more inducement is needed for the respondent (the individual harvester) to co-operate, and the more sophistication is required by the field worker who must obtain the data. Similarly, the less the harvester is willing or able to respond to the demands of the survey, the less satisfactory the results will be overall.

The loading of objectives also carries with it the problem of decreasing the comparability of results between surveys. Thus, the greater the emphasis placed on locally or regionally important resources, the more regional, rather than global, the survey results will be. If an overall objective of harvesting research in the Nunavut region is to provide an overview of Inuit harvesting, based on regionally convenient units, then technical loading focused on perceived major resources does not serve such an objective well. Within the context of Nunavut, as the main geographic entity for the present harvest research, emphasis either on derivative technical data, or on a "principal" species only, reduces the scale at which useful comparisons can be made. Such emphasis presented no difficulty when BRIA alone was conducting harvesting research, but with the expansion of this research into the Keewatin and Kitikmeot regions, the loading of multiple and distinctive objectives on any of the studies, over and above the main technical objective, dilutes the value of harvesting research on a Nunavut-wide basis.

It is worth recalling that since the BRIA project began, the Wildife Agreement-in-Principle[1] between the Inuit and Canada, which, although not signed, remains the primary model for the future, envisages a Nunavut Wildlife Management Board which would require reliable harvest data in order, among other things, to manage wildlife and to allocate harvests within Nunavut as a whole. This model underlines the need for a broadly based, comparable data base for the entire region.

The whole process has caused problems for the three Native-based research organizations actually involved in accomplishing the technical aspects of the work. Among these problems are first, the incompatibility of some goal provisions with the basic project objective, and secondly, each organization's own internal goals, which form the basic rationale for becoming involved in harvesting research. Foremost among these subjective goals, and one which was explicitly stated or at least implied by representatives of all three organizations, is the need to gather accurate harvesting data to provide basic information toward a Nunavut land claims settlement. Unlike the rationales of non-Native participants, however, such political-social-economic objectives have not been

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[1] NWA, AiP, 1981, Op. cit.

incorporated directly into the harvest research goal set, but rather await the acquisition of the required basic technical data. Perhaps the greatest contradiction is that the researchers employed by BRIA, KWF, and KHTA are being asked not only to gather the basic harvesting information sought by all participating agencies, but also selectively to gather and analyse other data to satisfy the subjective requirements of the non-Native participants, whereas Native organizational goals and rationales are in abeyance.

Organization and Sponsorship

Although all three NWT surveys are ostensibly focused on the same principle objective, each differs at least slightly with respect to administrative organization. Two of the surveys, those of KWF and BRIA, are directed through a steering committee, consisting of representatives of the various agencies that have financially supported the research. The KHTA survey, however, is a co-operative one with the GNWT Department of Renewable Resources, which supplies funds and technical personnel. Technical and administrative direction therefore comes essentially from KHTA and the Regional Biologist.

The steering committee structure under which BRIA and KWF function is based nominally on the JBNQ model, in which a steering committee, composed of representatives of the parties involved, provided technical co-ordination on matters of research design, methodology, and study refinements. It also evaluated the study results, in the form not only of annual reports but also of the raw data, in terms of the criteria so established. In practice, however, the BRIA steering committee operated quite differently, but provides the link between the JBNQ experience and subsequent developments in the Northwest Territories.

The BRIA steering committee acted much more as an administrative committee than a technical one. It appears to have concentrated on scrutinizing the administrative and financial operations of the BRIA survey, and to have served as a conduit for transmitting the particular goals of sponsoring organizations to the project. As more sponsoring groups joined between 1980 and 1982, the project objectives in the BRIA survey expanded rapidly. In effect, matters clearly established by the Terms of Reference in Quebec (see Appendices 1 and 2, JBNQNHRC 1982a) were continually renegotiated in BRIA steering committee meetings. A further unique feature of the BRIA steering committee is that whereas representatives of all the sponsoring agencies -- both government and private -- sat on it, the region's hunters and trappers were not represented

directly. Neither BRIA itself nor the Baffin region Hunters and Trappers Association (HTA) sat on the committee directly, only the technical staff of the BRIA survey did. For internal reasons, it appears that the BRIA Harvest Survey Project maintained some distance from BRIA itself, sharing neither staff, budget, nor office space.

Unlike in Quebec, there appears to have been no continuing technical evaluation or refinement of the BRIA project as it proceeded. It was left to the BRIA technical staff to deal with the detailed design changes and refinements, despite the fact that some significant and previously untested modifications were made to the Quebec model. The lack of external examination or peer review of the research design, and direct technical participation by the steering committee, was compounded by the absence of any product to evaluate. Committee members asked for, but were not given, access to raw data as it came in, and no technical reports were released until nearly four years after the project began.

Many of the people interviewed by the authors had had some connection with the BRIA project, and consequently offered opinions as to why there had been a lack of technical direction on the steering committee. It is not the purpose of this report to apportion responsibility for any project deficiencies, nor would it be appropriate for the authors to recount personal disagreements. Whether technical advice was offered but not accepted, or requested but not forthcoming, seems less important than analysing the consequences of the basic structural arrangements of the project, and especially the lack of a common objective.

In brief, BRIA proposed the project for its own purposes, not the least of which was to generate data for use in adversarial proceedings or negotiations with government and industry. In view of the conflicts over resource developments in the North Baffin area specifically, and over development and Native claims generally, in the late 1970s, BRIA considered itself to be in an adversarial relationship with government and industry. Nonetheless it enlisted funding and support for the project from government, and subsequently from industry. This arrangement was not unusual for government, in view of its by then well-established policy of providing core and special project funding to Native organizations. For its part, industry does not appear to have seen itself in an adversarial relationship with BRIA, especially with respect to harvest data. Rather, it sought to purchase good will as well as information by supporting the project financially.

It seems natural enough that BRIA would have taken a proprietary interest in the project, reserving to itself the ultimate authority for project design and execution. Given the variety of possible uses of the data, BRIA did not want to release either raw data, or unanalysed data, into an environment it could not control, with results that could adversely affect the willingness of the region's hunters and trappers to continue participating.

It also seems natural enough that the sponsoring organizations would want to see some results, as later funding applications promised would be the case. The pressure for access to data and for specifically useful results seems to have come primarily from the government rather than from the industry representatives on the steering committee. All of the government agencies had specific management objectives and increasingly perceived the use of the data to those specific objectives as well as for the original purposes of the project. Thus, the priorities of the sponsoring organizations eventually came to dominate the project. The problem for BRIA was that it sought, but did not get, an unrestricted research grant for the survey, and seems never to have been able to come to terms with the compromises it made to get and maintain its funding.

The KWF situation has been somewhat different. The sponsoring government agencies sit on the steering committee with two representatives of KWF and two project staff members; there are no industry sponsors. The greater technical input from the steering committee is reflected in the higher quality of the technical results and their presentation.

In both cases, a notable contrast with the JBNQ surveys is that no social scientists sit on the NWT steering committees. Because harvest surveys are social surveys, the lack of social science input to study design and monitoring is clearly inappropriate, and has, in the authors' view, been a significant cause of the technical deficiencies in the NWT survey designs and results.

Funding, Costs, and Project Design

The funding of the NWT surveys has been an ad hoc, year-to-year arrangement, in spite of all parties having recognized that, for harvest studies to be useful, they must have a duration of several years. Consequently, key project personnel have had to divert valuable time each year to the task of fund raising and project justification.

The early BRIA arrangements have already been reviewed. The KWF project has, since its inception, been funded through a Department of Supply and Services (DSS) contract, as has BRIA beginning in 1984. (The KWF survey was originally funded as an unsolicited proposal to DSS, but has subsequently been placed on the same footing as the BRIA contract.) Funds are contributed by DIAND, DFO, CWS, and GNWT, with DIAND taking the co-ordinating role. The KHTA survey has been supported entirely through the budget of the GNWT Department of Renewable Resources. Additional contributions for the current year (fiscal year 1984-85) have been provided from Economic Development Agreement[1] funds, but these are intended to provide bridge funding only, and are not intended as continuing support. Currently, the sponsoring organizations are attempting to regularize funding for harvest surveys through Treasury Board.

Phase II of the JBNQ surveys were to be financed jointly by the federal government (25%), the provincial government (25%), the corporations (25%), and the Native parties (25%) (JBNQNHRC 1982a). A total of $307,525 was budgeted for the Inuit surveys over five years (starting at $68,325 annually and ending at $58,325), and a total of $380,750 was budgeted for the Cree surveys over four years (starting at $99,150 and ending at $92,400) (JBNQNHRC 1982a). However, because these figures are in 1976 dollars, the actual funds expended in subsequent years were greater. In constant dollars, the budgets were front-end loaded to take account of start-up costs.

The BRIA survey, during its first four years of operation, cost about $800,000, or about $200,000 per year. The budget for fiscal year 1984-85 is $225,500. The KWF survey, during the first two years cost $289,000 or about $140,000 per year, and the 1984-85 budget is $165,429. The KHTA survey was allocated $21,000 from GNWT Wildlife Service funds in its first year, but this did not include some salary money, housing and travel costs, and data-processing equipment and software costs which were absorbed through regular program funds.

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[1] The Economic Development Agreement, between the Government of the Northwest Territories and the Government of Canada, was signed 21 December 1982, and expires 31 March 1987.

The JBNQ surveys appear to have cost about $70 per year per harvester, whereas the BRIA survey has cost nearly $150 per year, and the KWF survey about $120 per year. Direct comparisons of the budgets of the various projects are difficult, however, and indeed somewhat invidious, because of such hidden costs as in-house staff and travel, publication, and other items that are covered by the budgets of the participating agencies rather than by the project itself. As well, each project has undertaken somewhat different tasks, with different practical and logistical problems. Nonetheless, taking into account inflation since 1976 as well as logistical differences between the regions, survey costs as a whole do not appear to have risen unduly.

Although these budgets are only roughly comparable, the authors have chosen the final year of each of the JBNQ surveys to compare against BRIA's original proposed budget, its proposal for the third year of operation, and the actual contract budgets of BRIA and KWF for their fifth and third years of operation, respectively (Table 4).

TABLE 4

Comparison of some harvest survey budgets
by major category of expenditure (%)

	JBNQ		BRIA			KWF
	Cree	Inuit				
Category	1979	1980	1980	1982	1984	1985
Labour inc. subsidies	70.5	61.5	62.8	59.1	62.9	70.7
office	(18.6)	(19.5)	(38.5)	(45.8)	(40.3)	(48.8)
field-workers	(51.9)	(42.0)	(24.3)	(13.3)	(22.6)	(21.9)
Travel	10.8	12.9	27.0	25.7	21.5	9.1
Other*	18.7	25.6	10.2	15.2	15.6	20.2
Total	100.0	100.0	100.0	100.0	100.0	100.0
budget ($)	92,400	58,325	100,000	308,000	225,500	165,429

* Office costs, supplies, computer services etc.

In all cases, labour accounts for 60-70% of the budget. Because the project offices for the JBNQ surveys were in southern Canada, and in the regions themselves for the NWT surveys, direct comparisons between field and head office labour are probably inappropriate. Nonetheless, it seems clear that the JBNQ surveys devoted a substantially greater proportion of their budgets to their field-workers. Examination of the BRIA budgets suggests that at no time, even at the outset, was provision made for the kind of start-up or finishing costs that typify a long project; specifically for the short-term use of outside expertise in the design phase, and for report preparation and production costs at the conclusion. The same is true of the KWF budget (although it is a third-year one, the proportional allocations in the proposal budgets are similar). In the JBNQ budgets, the costs of negotiating the terms of reference, which in effect constituted the study design, had already been borne by other budgets.

The current NWT contracts make no reference to occasional input from experts, so the authors assume that the costs of attendance at steering committee meetings, and of the provision of expert advice, by personnel from the sponsoring agencies are absorbed by those agencies. In the case of KWF, the publication of the first technical report as part of a continuing DFO technical report series was borne by DFO as a separate contribution.

The NWT survey budgets are based clearly on the assumption that a valid operating model was already at hand, and needed only to be put into effect locally. Indeed, this is stated explicitly in the original KWF proposal of May 1981:

> "The study design in (sic) adapted from the Baffin Region Inuit Association Harvesting Study. The methodology was originally developed by Makivik Corp., was adapted successfully by LGL Consultants for the High Arctic in 1979, was adopted by BRIA in 1980, and has now undergone sufficient refinement to eliminate the possibility of repeating past mistakes." (Kivalirmi Inuit Land Claims 1981)

The weight of evidence presented in this section suggests that that was an incorrect assumption, and one which contributed in no small measure to the subsequent difficulties.

The budgets made no practical provision for the analysis and reporting of survey results. Instead, a system was designed primarily to collect and maintain data. It is a common failing in projects of this type to make insufficient plans for technical analysis, writing and review, in the late

stages of the project. The relative inaccessibility of the data for useful analysis, and the generally poor presentation of technical results, of the NWT surveys, is in large measure a consequence of the failure to plan for them in advance.

Scope and Duration

All three of the NWT surveys have attempted to ensure funding for a period of several consecutive years, chiefly on the technical grounds that, to provide a sound data base, harvest data must cover a minimum of four or five years but also on the premise that a multiple-year funding program provides project stability. However, none of the NWT surveys has been able to operate with any assurance of long-term survival, although the BRIA survey is now in its fifth year, thus matching the longevity of the JBNQ Inuit survey (Table 5).

TABLE 5

Scope and duration of harvest surveys

Item	BRIA	KWF	KHTA	JBNQ	
				Inuit	Cree
No. communities	14*	7	7	14	8
No. harvesters (app.)	1500	1330	625	875	1600
Duration to 1-1-84 (yrs.)	4	2	1	5	4
Projected duration from start (yrs.)	n.s.	n.s.	5	5	4

* plus 22-25 outpost camps.
n.s. = not stated.

The NWT surveys do not differ greatly from the JBNQ surveys in geographical extent and the number of harvesters to be interviewed. Logistically, the BRIA study is probably the most complex, extending from southern Ellesmere Island to the Belcher Islands, as well as covering outpost camps (see Table 5).

In terms of the numbers of species covered by each of the NWT harvest surveys, the most complex is the KWF survey. It records 12 terrestrial mammals (as well as discriminating among three separate caribou populations), 8 marine mammals, 11 avian species (plus several categories of eggs), and 8 fish species. Of the five surveys reviewed here, including the JBNQ surveys, only the Cree survey required such extensive data inclusion.

Staffing and Community Relations

All three NWT surveys have similar staffing policies. There is a project director or research co-ordinator, a small office and data processing staff, and one to three local field-workers in each community in which data are sought. KHTA is somewhat of an exception because of its link to the GNWT Department of Renewable Resources. Unlike the BRIA and KWF situations, Renewable Resources personnel in the Kitikmeot region are more involved in the design and management of the research. For instance, the research co-ordinator for the KHTA survey is the territorial regional biologist, whereas in the BRIA and KWF surveys, Renewable Resources personnel are in contact with the studies mainly through the steering committee process and are not directly involved at any level of the research.

Essential to the success of any Native harvest survey are the two basic elements of the data-gathering process: the harvester and the field-worker. As noted, all three NWT surveys employ local people as community field-workers, which is, in part, a result of the JBNQ experience. The use of local community field-workers in the Northwest Territories, however, dates from at least the early 1970s for survey research (Francis 1973), and certainly to the beginnings of claims research (especially the Inuit Land Use and Occupancy Project of 1973-76).

Community relations have been recognized as essential to each of the NWT harvest surveys. However, whereas in the JBNQ surveys, clear-cut and negotiated objectives could be communicated to all parties, and especially to the harvesters themselves, such communication has not always been the case in the NWT surveys. The BRIA and KWF surveys present two contrasts in this regard.

On the one hand, BRIA has seen its operational, as opposed to its technical, goal orientation, steadily shifted during a period of five years until it now functions essentially as an employee of its diverse funders. This shift has not aided its community situation, or its ability to staff locally, as such changes in objective orientation are noted at the local level.

On the other hand, because of the crisis situation with respect to caribou, KWF has the most clearly recognizable goals at the local level. Further, the clear utility of KWF's technical information in the development of management decisions, particularly concerning caribou, works to enhance its standing locally. This community response to the KWF survey seems, more than the other NWT surveys, to resemble that enjoyed by the JBNQ surveys.

Another important aspect of community relations, in all three surveys, is how the study data have been transmitted back to the local communities. To date, no annual progress or published report of the BRIA or KHTA surveys has been either translated into Inuktitut or returned to the participating communities other than in raw data form. However, a summary translation of the KWF survey has been published and distributed locally.

However, even sending written technical reports to the communities does not necessarily fulfil the organization's responsibility to the participating harvesters for a full and clear explanation. The Inuit Land Use and Occupancy Project (ILUOP), to cite a mid-1970s example, included within it a final summary meeting in every participating community, at which the preliminary results were not only explained to the community, but were reviewed and discussed, and subsequent modifications were made if necessary (Anon. 1976).

The initial experience of all three NWT surveys seems to have been similar. In their respective first years, the project director and members of the parent organization's executive contacted harvesters through meetings of local Hunters and Trappers Associations (HTAS) and through general community meetings. Participation in the project was sought, and the technical goals of both the collection and the uses of the data were explained. Agreement was sought on a community, rather than an individual basis. Once such agreement was received, the local HTA was asked to nominate prospective field-workers.

Most communities require only one field-worker, but larger settlements like Frobisher Bay, or ones with a highly diverse population, may require several. The field-worker's role is to contact all local harvesters on a monthly basis and to collect all pertinent harvest information from each individual for the month. The field-worker, as well, records whether the individual was unsuccessful, did not hunt, or was absent from the local area. In some areas, as well, a small amount of socio-economic data pertaining to individual harvesters is also collected, such as age, marital status, and sex.

Depending on the survey in question, field-workers receive a base monthly salary ($50-100), as well as a payment for each interview completed and returned within a specified period. In one case (KWF), there is a basic payment of $1.75 per interview, and a bonus for every interview after 75% of the hunters have been reached. The hunters themselves, however, participate on a voluntary, unpaid basis.

All three NWT surveys have experienced at least some difficulties in retaining field-workers, especially BRIA. Because each of the three surveys has provided each field-worker with some survey training before he or she participates actively in data gathering, turnover represents a loss of investment by the project. It requires either expensive retraining, involving bringing in a new worker from the home community, or relying for some period on an untrained worker. Equally important, however, is that the loss of a field-worker may result in the loss of data, sometimes for several months, in the area covered, and as well, replacement by an inadequately trained or insufficiently conscientious field-worker may result in incomplete or unreliable survey returns.

Generally, each organization plans an annual workshop for field-workers to discuss project problems and to continue training. Liaison between the office and the communities is generally by telephone, although all research directors visit at least some of the communities in their region each year. The KHTA survey is something of an exception because a certain amount of on-site liaison is possible through local Renewable Resources officers. BRIA is faced with a special problem because of the number of outpost camps in the region; logistically, it is seldom possible for office or even settlement field-workers to visit these camps on a regular basis. Thus, when field-workers are at outpost camps, they are rarely in monthly contact with the project office.

The surveys have employed local people as technicians, and have maintained formal contact with local organizations such as HTAs, but there is little substantial local involvement in the design and review of the surveys. Thus, the NWT surveys may not have benefited fully from local knowledge and perceptions, and their objectives and results may not be as well understood by local hunters as they should be.

TECHNICAL CRITERIA AND METHODOLOGY

The BRIA survey, although modelled after the JBNQ Inuit survey, made a number of technical as well as organizational modifications, which in turn have set the pattern for the other NWT surveys. Details on the technical specifications and methodological problems of each project are contained in Appendix B to this report.

Use of Existing Literature

When the BRIA survey began in 1980, it was in a position to draw not only on the experience of the JBNQ surveys, but also on the experience of the Inuit Land Use and Occupancy Project recently completed in the area (Freeman 1976), as well as on the substantial literature on Native harvest surveys in the Northwest Territories and elsewhere. Six studies, which had recently been conducted in the Baffin and neighbouring regions (Arctic Quebec and Greenland) stand out. These studies (Finley and Miller 1980; Foote 1967; Beaubier 1970; Haller 1978; Smith 1980; Wenzel 1980), four academic, one Area Economic Survey, and one industry consulting report, were undertaken for diverse purposes, including baseline data accumulation, hunting efficiency, and human ecological studies, yet all relied, at least partially, upon the accumulation of basic Inuit biological harvesting data. Each involved the analysis of a data base spanning several months to several years.

With the exception of Finley and Miller (1980), these studies were directed beyond the accumulation of technical harvest data, and employed a variety of research methods, including the use of HBC and archival records, intensive participant observation of a large sample of hunts, long recall (3 to 9 years) from a few selected hunters, questionnaire surveys, and hunter-kept harvest records. Because much of this work was oriented towards effort-efficiency data, participant observation formed one necessary research strategy. Haller, operating in a Danish milieu in Greenland, found a questionnaire on a limited but detailed subject successful. Beaubier especially made use of long recall information from a sample of harvesters. Foote relied to a great extent on local HBC fur records. Smith used JBNQ harvest data, along with limited observation, to formulate a harvesting strategy. Finally, Wenzel used intensive observation within a small group, together with recall and fur records to reconstruct social patterning within harvest activities among a larger group.

Several other recall harvest surveys had been conducted in the BRIA region during the 15 years previous to the BRIA project, including those by Bissett (1968a,b), Haller (1967), Kemp (1971), Kemp et al. (1977), and Treude (1977). Although all were published and accessible by 1980, none are referred to in the BRIA reports.

Although these studies employed somewhat different methodologies to those of the current NWT surveys, they are worthy of note not only for what they could have told BRIA, but also because of the broader secondary objectives which have been requested of the NWT surveys by outside agencies. Whereas these sponsors have linked their own internal goals to the gathering of primary technical information through surveys, the methods and techniques of those other studies might be more suitable than the survey method in meeting their secondary objectives satisfactorily.

Of particular importance to the BRIA survey, however, was the 1979 pilot harvest survey undertaken by Finley and Miller in the communities of Clyde River, Grise Fiord, and Pond Inlet, for Petro-Canada Explorations. Several of the methodological and study design issues covered in the following sections were raised and discussed by Finley and Miller. The data collected in 1979 and released in July 1980 could have been compared to harvest statistics collected by BRIA, thus providing an important data check. The discussions of study biases could also have been addressed by BRIA and so extend our knowledge further as to the influence of sponsorship, hunter age, socio-economic status, and species preference on response rates and reporting of harvests.

Finley and Miller followed the methodology made current by the JBNQ surveys. Hunters in the three communities were given calendars and asked to record monthly harvest totals. These were collected at the end of each month by field-workers. In cases where these recording aids were not used, harvests were recalled during the field-worker interview.

The definition of hunter was identical to the JBNQ definition: males over 18 less those identified as non-hunters. This definition included most of the men since virtually all, unless they are physically unable, hunt at some time during the year. Harvest was defined as the number of animals actually recovered by the hunter. Data were collected for 21 species including eggs. Response rates varied each month, but on average over the year the study achieved 79.3% coverage in Clyde River, 81.1% in Grise Fiord, and 54.9% in Pond Inlet. As in the JBNQ surveys, estimated harvest totals were computed by means of the proportional projection method.

One important feature of this study is that Finley and Miller discussed potential biases and assessed critically the proportional projection method. They pointed to the fact that the sample of hunters may not truly represent the population from which they are drawn. They examined the variability of hunter success and effort by analysing the monthly harvest totals for each hunter sampled, and observed substantial variation in the number of animals of each species taken by individual hunters. As was found by Smith (see Appendix C of this report), a small number of hunters can take a large proportion of the harvest. For example:

> "Over half (51.9%) of the reported monthly harvest of ringed seals was made by 13 hunters. Fourteen hunters (15.6%) took half (50.1%) of the reported monthly harvest of caribou and four hunters (4.4%) took 52% of the char. In fact, a single hunter took 40.9% of the harvest of char." (Finley and Miller 1980).

The study also compared the collected harvest data to existing data sources, such as the RCMP records (1956-72), the Fisheries and Marine Service large marine mammal harvest data for the period 1974-77, and other studies such as Haller et al. (1968), Bissett (1968a), and Treude (1977).

Finley and Miller did not, however, explain the way in which the community hunter list was established, or how field-workers were selected and trained. Spot checks were conducted on harvesting and on harvest recording, but this is not fully discussed in the report.

Finley and Miller thus raised several important methodological issues which have not been addressed by BRIA in any written materials. As well, their harvest data provided BRIA with the unique opportunity to compare response rates and survey results of a Native-run study to one conducted in a similar manner but under the auspices of industry. Of all the omissions in the BRIA literature reviews, this item stands out.

In conclusion, a substantial local as well as general literature was available to BRIA at the outset of the survey. However, there was no provision in the budget for a literature review and design phase, and the published results suggest that none was ever carried out.

A similar, though less extensive, literature existed for the Keewatin and central Arctic regions, but the harvest surveys in those regions have also failed to make any use of it. As a result, despite the fact that significant technical innovations were made to the JBNQ survey model, in

progressively different environments (geographically, culturally, and institutionally), what has come to be known as the "BRIA model" has been adopted and implemented without serious technical consideration in the steering committee or in the sponsoring agencies, and without much local discussion or involvement. To some extent the KWF survey has been an exception, as it has continuously tried to modify its approach in the light of experience and external review (from which it seems to have benefited to a greater extent than the others).

Definitions

Harvester. The definitions of hunter, harvester, trapper, and fisherman, used synonymously in the JBNQ surveys, were modified in the NWT surveys. Unfortunately they are inconsistent both among the surveys and within them over time. They are also often poorly worded and ill conceived. Confusion as to the definition of hunter has led to an inability to describe precisely the hunter population in at least some of the surveys.

The JBNQ survey defined hunters as male community residents over 18 who hunted at least once a year. Those hunters who were heads of households were to report the entire household harvests, including those of women and males under 18.

The NWT surveys record the harvests of individual hunters, male and female, rather than his or her household. However, each study has set different age limits and defined the potential hunter population in different ways. BRIA has been the most inconsistent in the definition of the hunter population (see Appendix B, Part 1). The inclusion of both sexes in the definition of hunter in the 1983 report is not repeated the following year.

The author of those reports stated that women were included as hunters, and that field-workers made the effort to cover everyone 18 and older, but often younger people were included by field-workers. She was of the opinion that long-term white residents should be included in the harvest survey because questions are so often raised about the effects of their harvesting.[1]

The present BRIA research director stated that the current hunter population includes all hunters, male and female, over 18, including whites, especially in Frobisher Bay.[2]

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1 Judy Donaldson, personal communication.
2 John Pattimore, personal communication.

KWF has the most inclusive definition of hunter of all the NWT surveys:

> "Included in the term hunter are Inuit males and females over 16 who hunt (they may or may not have a general hunting licence), Inuit youths under 16 who hunt regularly, and some long term residents in the area of other ethnic origins who hunt. This latter group comprises less than 1% of the total hunters in the region." (Gamble 1984)

In the KHTA progress report, hunter is defined as a GHL holder, but the KHTA harvest calendar distributed to hunters defines hunters as "anyone who hunts." These definitions may be inconsistent for the reasons explained in Appendix B, Part 3.

Thus, if a harvest survey uses GHL lists to identify the target population, there must be a sound understanding of the relationship between GHL holders and actual hunters. The relationship is by no means clear, and is a problem in recreational harvest surveys as well (e.g., Filion 1980b).

The NWT surveys fail to make clear the rationales for either their original definitions of harvesters, or for changing along the way. This problem of definition emphasizes the sociological rather than biological nature of a harvest survey, which, in the authors' view, is a significant problem in the design of current surveys.

Harvest. The NWT surveys have also been unclear about what is actually counted as harvest. In most cases it is somewhere between the number struck and retrieved and the number consumed.

BRIA defined harvest to be "the number of animals caught" (Donaldson 1983), but about marine mammals, the report states that "The estimates of the harvests of marine mammals should approximate the harvest that hunters bring home." Animals struck but lost are specifically excluded. The former research director expressed the view that harvest counts should exclude sport and commercial harvesting, whereas the present director stated that harvest should include all kills including losses, and commercial harvests as well.[1]

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1 Judy Donaldson, personal communication.

The KWF report does not define harvesting, but instead refers simply to kills. The research director stated that in his opinion it should include all aspects of domestic harvesting. KWF is planning to undertake a pilot project to estimate losses, although the difficulties of doing so are acknowledged.[1]

KHTA does not define harvest other than to describe it as, on the one hand, "kill" and on the other "actual take." The project director stated that harvest was defined as the number of food animals retrieved and brought home. The number of animals wounded and lost were not included in the study, although in his opinion, they should be.[2]

The terms "kill" and "catch" are used interchangeably, although they clearly do not mean the same thing, yet none of the reports indicate how they are either intended to be or are actually used by interviewers in Inuktitut.

In their treatment of Native commercial harvests, the surveys are inconsistent. The BRIA and KWF surveys include fur-bearers, but the KHTA survey did not, in its first year, because they are already recorded by existing GNWT systems. In 1984, however, the KHTA survey began recording fur harvests. Commercial fishing occurs in all three regions, yet none of the NWT survey reports clearly specifies whether or not commercial fish catches are included, and if so, whether or how they were distinguished from the domestic harvest. The authors are advised, however, that the KHTA survey does not include commercial fish catches.[3]

For the following reasons it is important to record commercial harvests in a Native harvest survey.

a) In the case of species taken primarily for commercial sale, some percentage may nonetheless be retained for domestic use and therefore not recorded in the commercial statistics.

b) In the case of species some parts of which are sold commercially and other parts of which are consumed domestically (e.g., seals, narwhals, walrus, and beaver), the commercial statistics alone may be misleading.

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1 Lloyd Gamble, personal communication.
2 Kent Jingfors, personal communication.
3 Kent Jingfors, personal communication.

c) In some cases, domestic and commercial harvests are undertaken with the same effort, i.e., with the same gear at the same time, so that any subsequent attempts to link harvest data with effort and cost indices would be misleading unless the harvest for both purposes were known.

d) The independent recording of commercial harvests may provide a useful comparison or cross-check with the harvest survey data.

Thus, there is a need to be more precise in the use of key terms. Some straightforward conventions are at hand in the literature, although as already noted, the NWT surveys are by no means the first to ignore them. The problem, however, is that unclear terminology invites the misuse of the resulting statistics.

Determination of Population Size

The NWT surveys have used a variety of means to determine, for the purposes of the survey, the number of hunters in each community. The most common is the GHL lists, with the field-worker updating them on the basis of consultation with the HTA and of personal familiarity with the community.

BRIA used government records, including GHL and social services lists, to establish the list of community hunters, and updated them on the advice of the HTAs and the field-workers' own knowledge. However, because it took two years to establish, the present list of community hunters is no longer considered current. BRIA then attempted to verify the number of hunter totals by reference to 1981 census data, the reliability of which in reporting small community sizes, especially outpost camps, for the purpose at hand is suspect, not only because of its reporting methods but also because of the suppression limits imposed on the published results.

The KWF report does not describe the means used to establish the list of community hunters. However, instructions to the field-workers were to interview all those thought to be hunting (Gamble 1984). It was the field-workers' responsibility to maintain an up-to-date list of hunters.

KHTA used the GHL lists to establish the base number of community hunters, which was then updated by the field-worker.

Not only has the identification of a population been made difficult by imprecise working definitions but also the surveys either do not use the optimum means of enumerating hunters, or fail to present these numbers in a clear and consistent way. These are fundamental principles of social research and should be given much greater attention in the NWT surveys. The size and attributes of the surveyed population are of crucial importance if there is to be any subsequent attempt to make generalizations about it on the basis of sample observations (reported harvests), which is indeed a central objective of the surveys. Given the small size of most communities, and the relative ease of identifying all members of the target population individually, once defined, the empirical method of local verification of GHL or similar lists is clearly preferable to making inferential estimates of the population size from census data.

Sampling and Survey Methods

The NWT surveys, like the JBNQ ones, attempt to obtain harvest records from all of the hunters in the region, by instructing the field-workers to interview as many hunters each month as possible. In reality, however, the NWT surveys do not attain full census coverage of the hunters, but rather obtain a sample. The apparent annual average coverage for each survey is 70-80%, however, a closer examination suggests that there are substantial gaps (see Appendix B). Further, samples are neither random, nor are they stratified in any way to ensure representativeness. They are instead fortuitous samples that include those individuals whom the field-worker is able and willing to reach.

Bias may arise in such a sample in at least two ways. First, the field-worker chooses to interview some people in preference to others. Secondly, some individuals do not participate in the survey, because of outright refusal, deliberate avoidance of the interviewer, or absence from the community (the last reason being by far the most common, apparently). The problem is that these non-participants may well be in some way unrepresentative of the population as a whole.

Neither of these biases necessarily occur in any region, but they may occur, and it is necessary to be reasonably sure either that they do not, or if they do, that they have been accounted for. The published reports of the NWT surveys do not seem to comprehend properly the issue of sampling bias, and consequently do not adequately reassure the user that it has been accounted for. The current research directors at BRIA and

KWF believe that underestimates of harvest could be occurring because the better hunters were interviewed less often as a result of being out hunting. However, this has not been confirmed by any scientific test.

Each NWT survey uses an incentive program to encourage at least a base level of coverage each month. BRIA pays each field-worker $50.00 per month plus a bonus for all interviews over 50% coverage. Field-workers also earn a bonus for meeting a mailing deadline. KWF, on top of its base pay, pays $1.75 per interview up to 75% coverage and $2.25 for every interview above that level. KHTA pays the field-workers $50.00 per month, plus $1.00 per interview for the first 50% coverage and $2.00 for every interview above that level. Although these incentives may be effective in increasing the size of the sample, they do not alter its fortuitous rather than random nature.

All three harvest surveys rely heavily on the use of calendars and diaries by harvesters as recording aids, with the monthly field-worker interview intended to supplement the written documentation. These recording aids are distributed by the projects at the beginning of each year.

BRIA developed a very complex calendar which has since been abandoned in favour of a simpler calendar in use by KHTA. The KWF report (1984) provides examples of the calendars that have been developed and since modified. In theory, each hunter is to record the monthly totals of all species in the calendar and the field-worker is then able to copy the recorded levels of harvesting from the calendar. In practice, hunters do not use these recording devices consistently. Interviews with project personnel and others experienced in harvest research suggest that field diaries in particular are rarely used. There is therefore some doubt as to whether this system should be continued. Calendars, on the other hand, appear to have entered into wider use. One researcher noted that 30-35% of harvesters were using calendars in his region. Although this is well above the rate of field diary use, it appears that calendars are still less well used in the Northwest Territories than they were in Quebec, although their use is patterned on that model. Gamble recommends that there be a further evaluation of the use of these materials and their effectiveness (1984), and the authors concur with this recommendation. Where recording aids are not used, the field-worker interviews consist of a monthly recall of individual harvests rather than a transcription of already recorded data.

None of the NWT surveys had the equivalent of the first phase of the JBNQ surveys, nor does there appear to have been significant pretesting of either the questionnaire or the survey procedure. In the KWF survey, the questionnaire was modified several times while the work was in progress. The BRIA and KHTA surveys do not mention this point.

Reporting Interval

The NWT surveys collect harvest data on a monthly basis, as compared to the JBNQ surveys, which collected data on an annual basis. The reasons for this modification are not made clear in the published materials, but there appear to have been at least two. One reason was to shorten the recall period, and the other was that BRIA considered that monthly field-work coverage of households would be useful in establishing its political presence in the communities.

Although a monthly reporting system has the advantage that it reduces the likelihood of recall failure, it may introduce another problem, which none of the surveys appear to have considered. If people do not use recording aids, consistent recall of their harvests for precisely a calendar month may be difficult. As a result people may be inadvertently either double counting or omitting a part of their harvests, in each interview. If there is a random tendency either way, the bias could be assumed to self-cancel, but this would have to be verified by simultaneous use of recording aids and unaided recall.

One solution might be for the field-workers to attempt to contact harvesters as soon as possible after their return from hunting trips, to the extent that this is known, and thus to rely on a trip reporting system rather than arbitrary time divisions for recall. Several of the authors cited earlier used this method during their field research, and some harvesters interviewed in the western Arctic also suggested it. It would not, however, cover day trips or incidental harvests near the community very effectively, and would demand more initiative on the part of field-workers.

Annual totals in the NWT survey reports are thus the sum of the monthly samples. The following problems result. First, the sample sizes vary and include different hunters each month. Secondly, the method of backdating files is inconsistent. KWF attempts to do so for hunters who have been missed in a month, if the hunter seems to be able to recall earlier months' harvests satisfactorily (Gamble 1984). However, neither BRIA nor KHTA indicate that such backdating

occurs. Thirdly, the use of monthly samples whose continuity cannot be tracked (by virtue of the software used, as described next), and the failure to backdate them, especially at the outpost camps, has created significant problems for BRIA, particularly in the validity of its projection methods. Thus, prior to 1984, BRIA appears unable to track an individual hunter's harvesting over a year, or to stratify the hunter population on the basis of individual participation or success. Fourthly, an additional problem is the high variability in coverage achieved to date.

If these primarily technical problems were overcome, the monthly reporting system would be an improvement over an annual one. To date, however, the results suggest that this is not yet the case.

An additional problem with the monthly reporting system is that it requires an additional set of personal data: hunter activities must be recorded each month. Each survey maintains a hunter participation file to record each hunter's monthly involvement in harvesting. Monthly hunter participation is thus a sub-system of the harvest data base, and is kept separate from, but can be correlated with, the hunter characteristic file which indicates age, sex, and so on for each hunter.

The monthly tracking of individual hunter's activities sets the NWT surveys apart from the JBNQ surveys, which sought only annual reports of harvesting. Those surveys assured that each individual who actually hunted would be successful to some degree during the year, and consequently did not have to distinguish successful from unsuccessful hunters.

The monthly recording of hunter participation establishes a detailed record of individual activities which, to the authors' knowledge, is not replicated among the general population anywhere else in Canada. For example, the monthly data sheets in some cases record not only that an individual is out of town, but that they are in a correctional centre. This type of information seems a matter for some community concern, and emphasizes the need for tight control over confidentiality of the data.

Data Coding and Processing

Whereas in the JBNQ surveys, data were processed and entered in mainframe computers in Montreal, the NWT surveys have all employed microcomputers. The exception was the first year of the BRIA survey, during which a southern-based

mainframe system was relied on and gave unsatisfactory results. From 1981 to 1984, BRIA used the VisiCalc spreadsheet system and custom programs to analyse monthly harvest data. KWF and KHTA use a data base management (dBase) software system to store and analyse the data. Of the two, KWF has the more complex set of interrelated files on hunters, participation, location of kill, and species. BRIA is understood to be converting to a dBase system at present; a difficult decision in light of the previous investment in software and training time. However, the earlier spreadsheet system created problems in data handling and analysis for BRIA.

Each of the NWT surveys has used a different system for coding data. Until now BRIA has kept two separate files; one on hunter characteristics and another on harvests. The hunter file was not always completed by the field-worker, which complicated the estimation procedures used to calculate the total harvests. The two files could not be interrelated and thus individual harvest records could not readily be tracked from one month to the next.

KWF uses a complex coding of hunter activity and harvest data, which takes advantage of the capability of the dBase program to correlate files (see Appendix B, Part 2). Data are processed and analysed monthly with the capability of backdating the harvest statistics. KHTA records hunter activities, number of species killed, and location on dBase interrelated files.

KWF is the only study to have implemented internal data checks. If harvests are too large, the computer will not accept them and the data must be verified by KWF staff and field-workers (Gamble 1984). BRIA checked for inputting errors against a master report that had been prepared independently, which summarized the monthly harvest figures for each community and species (Donaldson 1983). KHTA does not describe any checks for coding errors.

Achieved Coverage (Sampling Intensity)

None of the NWT surveys has achieved total coverage of all hunters (Table 6). The annual coverage appears to range from 70 to 80% of the regional hunter population, except for the KWF survey in which coverage appears to be lower (Appendix B, Part 2). However, determining actual coverage is difficult because of vague definitions and enumeration systems.

TABLE 6
Achieved annual coverage in NWT surveys

Survey	No. of hunters	No. sampled	Annual coverage	
			Region (%)	Community (%)
BRIA 1981	1358	915.7*	71.5*	45.1-90.0
BRIA 1982	1514	n.s.	79.1*	71.9-95.5
KWF 1983	1331	n.s.	n.s.	n.s.+
KHTA 1983	623(±26)	n.s.	74(±23.4)	52.0-95.0

n.s. - not stated.
* Mean monthly sample size.
+ Monthly data given only.

Whereas regional annual coverage rates appear high enough, there is substantial variation in coverage among communities, and by month, and indeed there are several instances of no coverage, i.e., a nil report for an entire community for a particular month. Although the apparent annual coverage rates in the Northwest Territories are close to those of the JBNQ surveys, the latter rejected individual records which were not complete for the year in question, whereas the NWT surveys accept them. The NWT surveys do not report their achieved levels of coverage in identical ways (see Table 6), so that direct comparisons must be interpreted with caution. However, the significant incidence of low or nil monthly reporting rates raises substantial uncertainty about the validity of projection methods.

Reported and Estimated Harvests

All of the NWT surveys total the reported harvests, which are the numbers of animals taken by the sample of hunters actually interviewed. Estimates of total harvests are made by means of projecting reported harvests on the basis of the sample size. The BRIA and KWF reports give reported and estimated harvests for all species (with certain exceptions in the latter case as noted in Appendix B, Part 2). The KHTA report gives reported harvests for all species, but provides estimated harvests only for caribou. However, because all data are collected and tabulated by month, the annual figures for reported and projected harvests are the sum of the monthly reports and estimates.

The NWT surveys have followed the practice initiated by the JBNQ surveys of projecting total harvest from the sample harvests. The underlying assumption of this method is that if the size of a fortuitous sample is large enough, then the possible atypicality of the unsampled population will not significantly affect the results. This assumption appears to have been vindicated in the case of the JBNQ surveys.

BRIA and KHTA have used a direct projection method, whereby the mean kill per hunter of the sampled population was multiplied by the total hunter population. KWF uses a more sophisticated projection formula. It involves first applying the same success ratio established for those who hunted and were interviewed to the hunter population known to have hunted but who were not interviewed. A lower success ratio is applied to the group of potential hunters known to have been out of the hunt area or for whom nothing is known, which is based on the total range of activities in which they could have been engaged. This method is an improvement over that used by BRIA, although the formula contains a minor error as noted in Appendix B, Part 2.

Both sample size and hunter non-response bias affect the reliability of the estimate of total harvest. In the case of KWF, the ability of the field-workers to report correctly the activities of all hunters significantly affects the estimated total results. Where the field-workers provide incomplete records of all the potential hunters' activities, only the reported harvests are presented, and no estimates of total harvests are made.

BRIA and KHTA report that hunters known to have been out of the hunt area were excluded from the total hunter population used to estimate total harvest. However, neither provides much detail on the ability of field-workers to report consistently and accurately on harvester activities. BRIA reports that in several cases it was necessary to estimate total hunter population size because the field-worker only recorded the number of hunters interviewed and made no mention of the activities of the total community hunter population (Donaldson 1984).

Response Bias

All of the NWT reports treat the question of response bias on an impressionistic basis. For example, all state that their projected harvests are probably underestimations of actual total harvests, which is thought to be especially true for high-volume species such as fish or low-profile or incidental

species such as ptarmigan. Problems with field-worker turnover and delays in obtaining harvest data from hunters, who then had to recall for periods longer than a month, were also frequently cited as explanations of underestimations of total harvest.

The question of strategic response bias receives only brief treatment in the NWT survey reports. Donaldson (1983) dismissed the possibility of deliberate exaggeration on the basis of anecdotal evidence, probably rightly. As well, she reported that local hunters had no hesitation about reporting illegal spring harvests to the survey. Apparently, since harvesters have been willing to participate in the JBNQ surveys as well as in the Land Use and Occupancy Project, it is assumed that this willingness would automatically be replicated in the NWT surveys by virtue of their being carried out under the auspices of a Native organization. However, this assumption has not been carefully tested. At this point, only the KWF survey bears much structural and political resemblance to the JBNQ situation, but even this should be verified.

Verification of Results

Verification of estimated and reported harvests has not always been undertaken. BRIA compared reported and estimated data on polar bear, narwhal, and beluga to GNWT tag returns and DFO counts. KHTA compared reported kills of muskox to GNWT tag returns. KWF compared none of its data to independent sources.

None of the NWT surveys has undertaken in-house spot checks or special studies to establish areas of under- or over-reporting. Neither have the NWT surveys used existing studies to check reported and estimated harvest statistics.

The GNWT Wildlife Service, however, recently attempted to verify the harvest survey results against some of its own data (Graf 1984). With respect to fur harvests, it was found that the GNWT Vendor Returns and the harvest survey results were very close, except in two cases. In one, it was thought that the problem of hunter specialization referred to earlier explained the variation; and in the other, there appeared to be a clear case of strategic response bias for economic reasons. Graf (1984) recommended that controlled access species be dropped from harvest surveys on the grounds that projected estimates will almost invariably introduce a level of error not found in the direct tabulation of the tag returns. If adopted, this recommendation would simplify the reporting and processing of data. It would also, however, reduce the possibility of verification through cross-checking independent sources of data.

Supplementary Data

Geographic coding. None of the NWT surveys follow the JBNQ example of near and away zones, and the location of harvests by individual trapline does not apply in the Inuit regions of the Northwest Territories. The BRIA data are located only by community, except for the outpost camps which, curiously, are lumped together as a separate category, although they are within the land-use areas of several communities. The KWF data are located by a longitude- and latitude-based grid of about 50 km per side. The KHTA survey records caribou and muskox kills by GNWT game management zone, and other species by community only. The KWF survey is the most ambitious, but as the first technical report tabulated the results only by community, there is as yet no basis for judging its success. However, an examination of sample data printouts provided by KWF indicate that the grid recording system generates an enormous volume of data to be handled.

Biological data. The KWF survey asks respondents to identify caribou harvests by sex and herd, and the KHTA survey asks for identification of caribou and muskox harvests by sex and age. The BRIA survey began identifying caribou harvests by sex in 1982. Some project personnel have noted that in the case of group hunts, where individuals later divide up the kill, it is sometimes difficult for respondents to specify these details. However, according to the tabular results, there is usually only a small residual of unclassified animals, so that this innovation appears to have been successful.

Socio-economic data. All of the surveys maintain a hunter characteristic file showing age, sex, and ethnic or legal status, and a hunter participation file showing activity by month, as described earlier. The KWF survey aggregates harvesters by 15-year age class as part of its data processing, but no cross-tabulations of these totals against harvest results are presented in the published report.

Only the BRIA survey has gone beyond this, and at various times, at the request of various agencies, obtained data on the employment status of harvesters and the operating costs of harvesting. However, coverage is highly sporadic over place and time, and many of the data have not yet been coded. A BRIA progress report (BRIA 1983) provided a preliminary analysis of these data, which were further examined by Hill (1984).

The data provided by the BRIA survey are extremely sketchy, and it is difficult to generalize from them for two reasons. First, until socio-economic hypotheses are precisely framed, it is difficult to be certain that one is obtaining the appropriate data in the most useful and unambiguous form. For example, is harvesting effort related to having a job in the present, or to the prospect of having or not having one in the foreseeable future? Secondly, such data may often be of more reliable quality and in more useful a form if obtained through methods other than surveys. However, the data obtained on harvesting costs by the BRIA survey, at least as reported in BRIA (1983), are so limited in scope as to permit no useful generalizations or conclusions.

Effort. The only type of effort data obtained by the NWT surveys (other than the aforementioned expenditure data) are the files on monthly hunter participation showing whether the individual hunted at all, or hunted successfully. In no case, however, can these facts be related to effort with respect to individual species. Consequently, as is demonstrated in the following section, certain attempts to derive "success" ratios from the existing data are both inappropriate and misleading.

Derivative Statistics

BRIA developed two derivative statistics: mean harvest per person, and mean harvest per hunter. Unfortunately, neither of these are enlightening. The mean harvest per person refers to the mean kill per person interviewed, and includes those who did not hunt or were unsuccessful that month, as well as the successful hunters. This statistic does not measure effort. The size of the mean, in this case, is dependent on the number of hunters interviewed, and the BRIA sample size varied considerably each month. There appears to have been no attempt to adjust for sample size fluctuation, or bias in field-worker effort such as interviewing only successful hunters.

A second statistic, the mean kill per hunter, is defined by Donaldson (1983) as being a "success rate [which] should give a better indication of the relative abundance of wildlife than the previous mean [mean kill per person]." The problem with this statistic is that it appears to apply indiscriminately to all those who hunted, but is used in reference to individual species for which it is not clear if it means the success of those who hunted the species in question or of all possible hunters. For example, the average regional kill of arctic foxes in 1982 is reported to be 3.98 per hunter, but not all hunters set traps for arctic foxes. Consequently, this statistic does not in fact measure the relative availability of species.

KHTA uses a mean kill rate to summarize the number of caribou, for example, killed by successful caribou hunters. KHTA provides mean kill rates for both reported and estimated caribou kills. For all other species, only the reported kill statistics are summarized by means of the mean kill per successful hunter value.

KWF calculates all reported and estimated harvests on a per-hunter basis, with standard deviation included. Annual reported and estimated harvests are converted to edible weight equivalents for all species for all communities on a total basis and on an average per month level.

Presentation of Results

The only harvest survey report that approaches commonly accepted standards of presentation is the KWF report (Gamble 1984), which was published by the Department of Fisheries and Oceans in September 1984. The BRIA reports, the first of which appeared in late 1983, nearly four years after the survey began, suffer from a lack of peer review, of careful editing, and of content integrity that comes by submitting results for publication in a refereed forum. The KHTA report is less ambitious than either of the other two, and so leaves less room for criticism although certain methodological aspects are left very unclear. It is stated to be a progress report, although whether a final report for 1983 will be released is not specified. However, the progress report was released in extremely timely fashion.

EVALUATION OF NWT SURVEYS

The chief problem in evaluating the results of the NWT surveys at this time is that published materials have been available only since late 1983, so few organizations have been in a position to make use of the results. The scarcity of useable data from the NWT surveys, and especially from the BRIA survey which has been underway the longest, has been a source of considerable dissatisfaction for many user organizations. Those interviewed evaluated the projects more than the results, and often these evaluations turned on specific persons and events. The authors considered it inappropriate to include such observations in this report, and have tried instead to identify the basic structural problems that have confronted the NWT surveys.

The agency that appears to be the most satisfied with the results as a whole is the GNWT Wildlife Service, because, for the big game species in which they are particularly interested, the results seem reasonably reliable and provide a data base for monitoring harvest levels that was previously unavailable. The Canadian Wildlife Service appears to be the least satisfied with the results to date, because the results are perhaps the least specific and reliable with respect to migratory waterfowl, or at least there is a substantial basis for believing that they might be. The Department of Fisheries and Oceans' position lies somewhere between. The Department of Indian and Northern Affairs would like to see substantially more in the way of socio-economic data from the NWT harvest surveys.

The authors share some of these concerns about timeliness and quality of reporting from the NWT surveys. Certainly the reports to date do not meet the standards set by the JBNQ surveys. However, many of the problems stem from the way in which the projects were supported and controlled by the sponsoring agencies, as well as from internal deficiencies. Consequently, it would be inappropriate to expect to continue existing surveys and to begin new ones, merely on the basis of technical tinkering (important as that is), without a fundamental review of the existing structural problems.

As many of the user interviews which provide the basis for the next section were based on experience with the NWT surveys, further specific evaluation is provided there.

USERS AND THEIR NEEDS

The demand for Native harvest statistics for public policy purposes came originally from resource management and economic development agencies. During the 1970s, Native harvest statistics assumed new importance in the context of both the impact assessment for major development projects in the North, and the settlement of Native claims. As a result, Native organizations now also have a direct interest in these statistics.

It is only since the JBNQ agreement[1] in 1975, however, that any government has been willing to commit significant funding and personnel to the gathering of these statistics. Yet even since then, there has been a rapid evolution in the development of the North, and an increasing number of agencies, both government and non-government, have identified a growing variety of uses for Native harvest surveys.

In identifying users and their particular needs the chief source of information was the interviews conducted with various actual or potential user agencies (Table 7), which covered 123 individuals representing 32 organizations. These interviews were supplemented by:

- the senior author's involvement, as chairman, of the GNWT-sponsored workshop on Native harvest studies in January 1984, at which the chief participating government and Native organizations were represented (see Usher 1984);
- background documents provided for this study by several of the participating agencies; and
- discussions with knowledgeable individuals during the course of this study and during the GNWT workshop.

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[1] JBNQA, 1975, Op. cit.

TABLE 7

Organizations interviewed for this project

Government

Federal - Indian & Northern Affairs*
Fisheries & Oceans*
Environment*

Territorial
- GNWT - Renewable Resources*
  Economic Development
- Yukon - Renewable Resources*

Local (settlement councils)
- Clyde
- Fort Good Hope
- Holman

Industry
- Dome Petroleum*
- Esso Resources*
- Gulf Canada*
- Petro-Canada*
- Polar Gas*

Non-government

Territorial Native Organizations
- COPE*
- CYI*
- Dene Nation*
- Dene/Métis Secretariat*
- Métis Association of the NWT*
- Tungivuk Federation of Nunavut*

Regional Native Organizations
- Kitikmeot Inuit Association*
- Mackenzie Delta Regional Council*

Other Territorial or Regional Organizations
- Beverley & Kaminuriak Caribou Management Board
- Deh Cho Regional Council
- NWT Hunters & Trappers Federation
- South Slave DIZ Group

Hunters & Trappers Associations
- Clyde
- Holman
- Inuvik
- Tuktoyaktuk

Outside N.W.T. & Yukon:
- Alaska Dept. Fish & Game (Subsistence Division)
- Labrador Inuit Association

* see text

The organizations starred in Table 7 have a controlling interest in harvest surveys, either because they initiate, sponsor, or design them, or because they will use the results for management purposes and therefore influence the criteria and standards the results must meet. These organizations will

almost certainly use the results in negotiations among themselves, and, in some cases, have done so already. They are referred to here as participants, in contrast to the others which, although they certainly have an interest in the conduct and results of harvest surveys, and may very well be consulted on those matters, will probably not initiate harvest surveys or negotiate their design, conduct, and use. This distinction is made without endorsement or criticism, but simply in recognition of the current situation.

The participants can be divided into three groups: government departments with resource management or economic development responsibilities; private industries whose operations may affect Native harvesting; and Native organizations responsible for negotiating, on behalf of their constituents, with government and industry on matters affecting Native harvesting.

Government Departments

Five government departments (three federal and two territorial) have a direct interest in harvest studies, not only because they require the resulting statistics, but also because they provide the funding for them. The federal agencies are as follows:

Department of Indian Affairs and Northern Development. The Northern Program of the Department has no direct responsibility for the management of fish and wildlife resources. Its interest in harvest statistics is primarily economic and social. The Department is concerned with economic and land-use planning, and the role of renewable resources in the future economy of the North. The following specific responsibilities and concerns have been identified by the Department.

a) Economic development. Matters currently under consideration include the economic status of renewable resource activity; the cost and availability of food; the resolution of compensation issues with respect to the possible loss of fish and wildlife harvests; the development of employment programs that take account of the role of renewable resource harvesting from both an economic and cultural perspective; and the effects of non-renewable resource development projects on all of these questions.

b) Northern environment. The Department administers several environmental acts such as the Territorial Lands Act[1], the Arctic Waters Pollution Prevention Act[2], and the Northern Inland Waters Act[3]. At the field level, this is the responsibility of the regional offices in Yellowknife and Whitehorse. Harvest statistics are potentially useful to these offices for land-use planning, project modification or mitigation, and compensation, in connection with their statutory responsibilities.

c) Native claims. Every Native claim involves the resolution of the harvesting entitlements and management rights of the claimant group. Decisions about allocation depend in part on the documentation of historic and current levels of use or need. The current pattern for the resolution of comprehensive claims (which includes all of the Northwest Territories and the Yukon) is that, following the signing of a final agreement, these levels are to be documented through a Native harvest survey. This precedent was set in the JBNQ Agreement[4], and it is likely that some form of harvest survey will occur in the Western Arctic now that the Inuvialuit Final Agreement[5] has been signed. Other Native organizations, as well as the responsible government agencies, anticipate that this will be the case in future settlements. The Office of Native Claims, however, sees itself as a facilitating agency for Native harvest surveys, rather than a user agency. Its responsibility is to assist with the funding and implementation of harvest surveys, and to assist in the implementation of signed agreements, but it is not involved in the details of their design, administration, or analysis.

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1 Territorial Lands Act (and Land Use Regulations pursuant to the Act). Revised Statutes of Canada, 1970, chapter T-6.

2 Arctic Waters Pollution Prevention Act. Revised Statutes of Canada, 1970, chapter 2 (first supplement); act in force, 2 August 1972.

3 Northern Inland Waters Act. Revised Statutes of Canada, 1970, chapter 28 (first supplement); act in force, 28 February 1972.

4 JBNQA, 1975, Op. cit.

5 The Inuvialuit Final Agreement (the Western Arctic Claim), signed between the Committee for Original Peoples' Entitlement (COPE), the Government of Canada, and the Governments of Yukon and Northwest Territories, in June 1984.

From the late 1950s to the late 1960s, the Department sponsored a number of studies which, among other things, obtained harvest statistics for specific communities or regions, usually for only a single year, based on harvester recall. Since then, the Department has maintained no independent system of Native harvest data collection, but rather has relied (as it did in earlier years) on the statistics generated by other agencies, chiefly the GNWT and DFO. All departmental assessments of the Native economy have, for the last decade or so, been based on these sources, or on others' evaluation of those sources (e.g., Berger 1977b; Dome Petroleum et al. 1982a).

Department of Fisheries and Oceans. The Department is responsible for the management of fish and marine mammals in the North. The Department identifies four requirements for Native harvest statistics.

a) Resource management. Native harvest statistics are essential management data, especially if Native harvests are to be expanded, and to include commercial as well as domestic use. These data are required on a continuing basis. The Department anticipates that harvest statistics will be essential tools for management boards with harvester representation, as envisaged in the Wildlife Provisions of an Agreement-in-Principle[1] with the Inuit, should these come into being. In some cases, the Department is responsible for collecting and presenting Native harvest data in the context of international negotiations (e.g., whales), and thus has a special concern that the data be reliable and based on a sound, recognized methodology.

b) Allocation. The Department is responsible for negotiating allocations of fish and marine mammal harvests pursuant to Native claims, and prefers that need levels be established through Native harvest surveys.

c) Compensation. The Department recognizes that compensation may become an issue with regard to fish and marine mammals, and desires that reliable harvest statistics be available for that purpose, if and when necessary.

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1 NWA, AiP, 1981, Op. cit.

d) Conservation education. The Department's view is that the involvement of individual harvesters in harvest surveys is an important means of promoting conservation education among resource users, along with other education and management programs.

The Department maintains several systems for recording the harvests of fish and marine mammals, as described earlier.

Department of Environment. The Canadian Wildlife Service (CWS) is responsible for the management of migratory birds throughout Canada, for the management of wildlife in National Parks, and for certain aspects of the management of terrestrial wildlife populations which move across interprovincial or international boundaries. CWS requires Native harvest statistics for essentially the same purposes as DFO: namely, the management of waterfowl populations; the allocation of waterfowl harvests pursuant to Native claims negotiations; and as a tool for conservation education among resource users. Compensation is not seen as a significant issue at this time.

CWS maintains an elaborate system for the collection of waterfowl sport harvest data, but recognizes that this system does not include the harvests of Native northerners. Although there is a long history of Native waterfowl harvest surveys in various parts of Canada, there is no systematic means of obtaining comprehensive data on a regular and continuing basis. CWS believes that Native harvest surveys are potentially the best method of obtaining these data, but is concerned that the NWT surveys may not be providing sufficiently comprehensive and reliable information.

The territorial agencies are as follows:

GNWT Department of Renewable Resources. The Department includes the GNWT Wildlife Service and the Environmental Planning and Assessment Division. The GNWT Wildlife Service is responsible for the management of all terrestrial wildlife species (including polar bears) within the Northwest Territories. It requires Native harvest statistics for purposes similar to DFO and CWS: first, for wildlife management; secondly, for negotiating allocations pursuant to Native claims; and thirdly, for conservation education and harvester participation in management. The Department seeks to manage wildlife on a co-operative basis with Native harvesters. GNWT concerns are not limited to species management, however, but include social and economic considerations as well. The Wildlife Service itself makes economic evaluations of the various species it manages to aid it in setting management priorities.

The GNWT Wildlife Service has for over 50 years maintained a relatively comprehensive set of statistics on Native wildlife harvests, based chiefly on declarations of annual hunter recall and fur export permits. These data bases, as described earlier, have significant and not always quantifiable sources of bias. Indeed, the annual summary of kill statistics from GHL returns came to be regarded as so unreliable that it was discontinued in 1978. Since then, the Wildlife Service has relied on monthly reports by local game officers, which in some instances are not tabulated and returned on a regular basis. Where harvest surveys are currently underway, the Service relies on them in preference, and would like to base its entire data collection system on harvest surveys (this would not necessarily replace, however, the independent recording of fur and other exports).

The Environmental Planning and Assessment Division is currently working on a compensation policy for renewable resource harvesters, and sees harvest statistics as important for that purpose.

Other GNWT departments, such as Economic Development and Tourism, are interested in harvest statistics for economic planning and development purposes, such as renewable resource based enterprises and intersettlement trade. They depend on the statistics provided by the Wildlife Service, however.

Yukon Department of Renewable Resources. The Yukon Wildlife Branch has not had much concern with harvest data until recently. A relatively young agency, it was first concerned with wildlife inventory, and only lately with the use of wildlife. The Wildlife Branch's requirements for harvest statistics are the same as those of the other resource management agencies, however, it has fewer financial and personnel resources with which to obtain those data.

In contrast to the Northwest Territories, the historical record of Native harvest statistics has been poor to non-existent in the Yukon (Usher 1979). This lack of records is chiefly because status Indians have neither been required to obtain hunting licences nor to report their harvests. Only fur harvest statistics approach the necessary reliability for management purposes, and this situation has really only existed since the recording system was reorganized in 1978.

Industry

Industry has no direct responsibility for managing fish and wildlife resources. Industry representatives interviewed indicated that their companies were interested in Native harvest statistics for the following purposes (the order reflects a chronological sequence in any particular project, and not necessarily the priorities of any particular company or of industry as a whole):

- preparation and evaluation of project impact statements, and preparation for public hearings;

- modification and monitoring of projects to avoid or reduce negative effects on harvesting, where possible;

- contingency planning, to take into account harvesting activity in special situations; and

- compensation of harvesters, if they are adversely affected by project activities.

Data requirements for these purposes differ from those of management agencies in that there is no need for either global or continuing coverage. However, there is a greater concern with establishing accurate baseline data from which change can be measured, and with obtaining more site-specific data in relation to the project or activity itself.

Formerly industry relied on harvest data either provided by management agencies or found in the scientific literature. Realizing the inadequacies of some of these data, some companies have undertaken limited harvest surveys in areas or for species which may be significantly affected by their activities. For example, continuing studies of beluga whales in Mackenzie Bay are funded by Esso Resources (e.g., Fraker 1977). Annual harvests have been estimated in a manner similar to DFO, with similar results (namely, Fraker 1980; Hunt 1979). Polar Gas commissioned two surveys employing hunter recall questionnaires or interviews during the late 1970s in the High Arctic (Kemp et al. 1977) and at Eskimo Point (McEachern 1978). However, that company's attempts to conduct similar surveys were rebuffed at Chesterfield Inlet (McSkimming and Stager 1978) and in northern Manitoba and Ontario (McIlveen 1978). Petro-Canada sponsored a pilot survey in the North Baffin region in 1979 (Finley and Miller 1980).

A different strategy for obtaining Native harvest statistics from direct surveys was employed by Dome Petroleum and Petro-Canada, in contributing funds to the already established BRIA survey. On the other hand, an offer by Petro-Canada to fund a similar survey in northern Labrador was rejected by the Labrador Inuit Association in 1981.

Native Organizations

During the last ten years or so there has been a growing interest on the part of Native organizations in documenting Native harvest levels. The most common objectives are:

- to demonstrate the continuing use of, and interest in fish and wildlife resources;

- to support demands for specified levels of allocations and for management rights in claims negotiations;

- to assist designated organizations such as regional wildlife management boards in conserving and managing wildlife;

- to monitor and assess the effects of industrial development on wildlife and its harvesting;

- to document possible claims for compensation in the event of reduction or loss of harvests due to industrial activity; and

- to plan for future economic and social development.

Harvest surveys result not only in scientific reports and statistical tables, but also in a process whereby harvesters can be involved in study design, data interpretation, and wildlife management, and whereby local people can obtain useful training and employment.

The primary requirement is for baseline data that cover an adequate period of time to smooth out chance variations in harvest resulting from wildlife cycles, or other short-term natural or human factors. In the JBNQ and NWT survey proposals, this period has ranged from four to seven years. However, there is generally a recognition that the surveys should continue in some form after the initial baseline period.

The rationale for, and appropriate design of, Native harvest surveys has been most thoroughly considered in the Northwest Territories, by the Inuit groups, who initiated such surveys, in some cases as long ago as 1980, and whose concerns were extensively reviewed in the previous section. The needs of the Dene, Métis, or Inuvialuit groups of the western Northwest Territories, and the Yukon Indians, for harvest surveys have been less precisely articulated by them, and they have yet to initiate a survey. (A one time, annual recall survey was undertaken at Fort Good Hope by the Band Council as a pilot project, but the results have not yet been written up or released because of a lack of funds.) Nonetheless, all appear to be interested in undertaking harvest surveys, under certain conditions. Although these initiatives have or will come from the regional and territorial organizations, local organizations like the Hunters and Trappers Associations generally want to have substantial input and control over the design and execution of the surveys in their own communities.

The Dene and Métis have drawn attention to the importance of existing historical statistics, as well as future statistics, in dealing with questions of compensation and allocation. Fur export and GHL records could, properly interpreted and taking their limitations into account, provide baseline data of much greater depth, which could be linked to the results of a five-year forward survey.

Thus, if Native people are to be involved in management, and particularly in allocation decisions, the statistical information base they will require must include not only a record of their own harvests, but those of all others, resident and non-resident, in the region in question, as well as adequate population data on the species in question.

Other Non-Government Organizations

No other non-government organizations have initiated harvest surveys, although some have a direct interest in being able to use their results. For example, the Beverley and Kaminuriak Caribou Management Board requires harvest statistics for its work, but has relied on the results of the KWF survey in preference to other sources. Both this board, and the way in which it uses harvest statistics for management, may become models for other regions and species.

Other local or regional organizations, such as Development Impact Zone (DIZ) groups and regional councils, have not expressed any special need for harvest statistics or surveys, although they recognize that these could be useful for compensation issues.

Finally, there will be a demand for harvest survey data from bona fide researchers, either on behalf of other agencies, government and non-government, or for themselves for graduate or scholarly research. The JBNQ Native Harvesting Research Committee began receiving such third-party requests at an early date during Phase II, for data in greater detail or disaggregation than was released in their progress reports. The Committee drafted a policy statement in 1977 to deal with these situations (JBNQNHRC 1978), which addressed both the maintenance of the confidentiality of individuals, and the cost to the NHRC of preparing responses and providing the data in the format requested. During the following two and a half years, the Committee formally processed 14 requests for Cree data (JBNQNHRC 1980).

None of the NWT surveys have formally addressed the issue of requests for data, and so would probably treat such requests, if received, on an ad hoc basis. Few, if any, such requests have actually been received. However, as the surveys become more widely known, there is likely to be a growing number of these requests, and the broader the spectrum of data obtained, the more numerous these requests will be.

There is as well the question of access by individual harvesters to their own records, or the authorization by harvesters for the release of their own records to third parties, for example, with respect to compensation, but the NWT surveys have no established policy in this regard.

Participant Categories

The participants may be grouped in the following categories, in terms of their interest in harvest data:

- government resource management agencies
- government economic development agencies
- industry
- native organizations.

Each of these groups has distinctive requirements for Native harvest statistics. Each group has, for its own purposes, at one time or another, initiated or sponsored harvest surveys to obtain these statistics, and each has also co-operated with the others on occasion to do so. It is worth reiterating, however, that the Native organizations act, ultimately, as the bargaining representatives of the harvesters in whatever negotiations, co-operation, or conflict might occur with respect to harvest studies. Without the willing participation of the harvesters themselves, harvest surveys cannot proceed.

PARTICIPANTS' REQUIREMENTS

The major purposes for which the participants seek to use Native harvest surveys (Table 8) are common to several participant.

TABLE 8

Participants' objectives

Objectives	Participants			
	Resource management agencies	Economic development agencies	Industry	Native orgs.
Fish & wildlife management	X			X
Harvest allocation	X			X
Conservation education/ management participation	X			X
Economic planning		X		X
Project impact	X	X	X	X
Compensation	X	X	X	X

Shared requirements for information do not necessarily imply a shared perspective on how to use the information, or on the problems at issue. For example, although both the resource management agencies and the Native organizations want harvest

statistics as a tool for managing fish and wildlife, there are some fundamental differences in philosophy between the two about how to manage these resources, and how to use harvest statistics for that purpose. Similarly, although conservation education and management participation are sometimes talked about interchangeably, they do not mean the same things to everybody. The resource management agencies emphasize conservation education, by which they mean getting harvesters to understand the managers' perspective and accept their authority and activity as legitimate, whereas the Native organizations emphasize management participation, by which they mean inserting and legitimating their own perspectives and authority in the management process.

Some significant conclusions emerge from Table 8.

a) Management and allocation issues concern primarily the resource management agencies and the Native organizations. These issues have been, for many years, a source of friction, and more recently of protracted negotiations, between the two. They constitute a central focus for harvest studies, but they do not involve industry, and only in a peripheral way do they involve the economic development agencies.

b) The issues of economic planning, project impact, and compensation, although primarily the concerns of industry, the economic development agencies, and the Native organizations, are to some extent also concerns of the resource management agencies, especially with project impact and compensation.

c) What people want and expect from harvest surveys depends not only on their objectives, but also on their previous experience with surveys and statistics of this type. Not surprisingly by it is the government agencies, and especially the resource management agencies, that are in the strongest position to articulate clearly and in detail their ideas about how and why these studies should be done, what standards they should meet, and how the results should be used. The Native organizations, although they have a great stake in the conduct and results of harvest surveys, are the least able to articulate their positions on these matters, except in the most general way. Indeed, as the BRIA experience shows, even when a Native organization has stated its objectives clearly and precisely, the ensuing surveys may bear little resemblance to these, in the face of the demands made by sponsoring agencies. Thus, at present, there is an imbalance, at least where government agencies initiate or fund harvest surveys, which, if

uncorrected, will result in a consistent tendency for government to take the initiative and for Native organizations to have to respond to them.

Although the demands of resource management agencies for harvest data differ in some respects from the demands of industry and the economic development agencies for these data, there remains an onus on Native organizations to facilitate the gathering of statistics that will be useful for both purposes. The fact that the term "harvest statistics" refers to a variety of somewhat dissimilar products poses a central difficulty in achieving results satisfactory to all parties.

The following sections cover the specific form and detail in which each user group wants the data for each of its objectives, in relation to eight sets of issues in the design of harvest surveys. These needs and concerns are set out and compared. The authors' views on the administrative or technical difficulties in meeting them, and of their merits or the relative priorities that should be given to each, are, for the most part, discussed later.

Subject of the Survey

For Native organizations, a harvest survey should show the results of the harvesting activities of the set of individuals on behalf of whom they act. For other agencies, however, the distinction between Native harvesting, as opposed to other kinds of harvesting, may be less clear.

Resource managers would like to be assured that, whatever else Native harvest statistics show, these data can also be used to quantify Native domestic harvesting as a phenomenon distinct from those enumerated by commercial or sport harvesting recording systems.

For the purposes of harvest allocation, however, resource managers must know the identity of the harvester and the use of the harvest. They are likely to agree with Native organizations that Native harvesters should be identified as the beneficiaries of a claims agreement or a particular program. Traditionally, resource management agencies have tended to equate the Native harvest with, and indeed to restrict it to, the domestic or subsistence harvest (e.g., Bennett 1982).

Economic analysts would like to be assured that whatever else Native harvest statistics show, the data can be used to quantify, separately, the various streams of benefits -- the commercial as well as the imputed domestic or perhaps even recreational or other perceived benefits -- of wildlife harvesting to the harvesters (e.g., Usher 1983a). Depending on the agency, the ethnic or other socio-economic characteristics of the harvesters may be important for identifying the differential flow of costs and benefits to different groups of harvesters.

Finally, for compensation purposes, the legal rights and status of harvesters may be essential information, and harvest data must therefore be attributable to specified categories of harvesters and, depending on the circumstances, to particular individual harvesters.

Duration, Interval, and Timeliness

Duration of program. For management purposes, harvest data are a continuing requirement. The GNWT, for example, has gathered statistics on Native harvesting continuously since 1930, and, although it has from time to time changed both its method of doing so and the use of these data for management purposes, it intends to continue collecting these data indefinitely. Consequently, the parties concerned with resource management are committed to a long-term, open-ended program of harvest data collection, although not necessarily on a continuing and comprehensive basis. For the purposes of harvest allocation, project impact, and compensation, however, the primary concern is to establish a data base and then to monitor changes during the life of the project or as otherwise necessary, which does not require an open-ended commitment.

Recording intervals. For resource management purposes, it is generally important to be able to discriminate harvest data by relatively short time periods -- for example by the week, month, or season. In this way, the effects of harvesting can be related to the life-cycle of the harvested species. Particular requirements vary with the species or population, but for the purposes of harvest allocation, annual totals are usually sufficient. For economic analysis, annual totals are essential, but seasonal variation may also be important and monthly intervals are adequate for that purpose. For project impact, annual data are adequate for preliminary estimates, but for project modification or compensation, much more time-specific data may be required.

Timeliness of reporting. Management agencies generally require harvest data prior to the next harvesting season. Consequently, data must be available for analysis substantially less than a year following the event, for example, catch statistics for a summer beluga hunt should be available to managers well in advance of the next summer. In some cases, data may be required more than once a year, or even on a continuing basis through a long season, with a relatively short time lag such as a month or two. This requirement has been a stated objective of some fur record-keeping systems, e.g., in Ontario and the Yukon. These considerations would also apply to project monitoring and modification.

Timeliness is a less important matter for economic analysts. The concensus appears to be that data made available even a year or two after the date of collection, let alone the event, would be adequate for most purposes, although such a time lapse would not permit rapid policy responses to sudden changes. For the purposes of harvest allocation and prediction of consequences, during the initial phase of data collection, whether the data for year one is reported immediately or only at the end of the project as a whole is, in one sense, unimportant. However, the early availability of results to the participants enables problems to be identified and corrected at an early stage, and indeed continuously throughout the study. Generally, it would seem appropriate that those who demand from others the rapid tabulation and release of data should be able to make equally rapid use of those data.

Species Coverage and other Biological Data

No single resource management agency is responsible for the entire range of species harvested by Native people. Each agency is therefore concerned with a particular set of species, such as marine mammals or waterfowl, and further, almost inevitably select particular species or populations for management priority. Resource management agencies are therefore likely to initiate or press for species-specific harvest surveys, and if inter-agency co-operation is lacking, will probably also design a study that not only fails to obtain harvest statistics for other species but, by virtue of its design, may be inappropriate for doing so. In other words, the best way to get caribou kill statistics is not necessarily the best way to get goose kill or fish catch statistics. As well, each agency has its own criteria and priorities for species identification. Simple totals for ducks and geese killed are almost useless for waterfowl management unless the species are clearly identified. Caribou or fisheries biologists will want to know the particular herd or stock from which the harvest was

taken. As discussed later, location of kill may be an additional or alternative means of identifying species or populations. Those concerned with project modification also place priority on the species or populations that may actually be affected.

For the purpose of economic analysis, precise species and population breakdowns are of less importance than ensuring that the total volume of all species is accounted for. Precise breakdowns of caribou harvest are of little additional value to the economist than a simple total, but without data on the harvest volumes of all the other species, economic analysis can say very little about the total benefits that flow from harvesting. On the other hand, the kill of uneconomic species, e.g., of certain types of birds or small game for target practice, is of little interest to the economist, but may be of much interest to resource managers.

A precise breakdown of the kill by species or population alone, however, is not always sufficient information for management. In many cases, breakdowns of the kill by age and sex are also required. For ungulates, hunter identification of calf, yearling, or adult is generally sufficient. In fisheries, besides the number of individuals, the age and size breakdowns of the catch are important not only to resource managers but also can be useful to economic analysts, enabling them to make more precise estimates of the total weight of country food harvested.

Geographic Coverage and Location

Extent of coverage. Ideally, resource managers and economic analysts alike might prefer complete geographic coverage of their jurisdictions or areas of interest. In practice, however, limited financial and personnel resources often force them to set priorities for geographical coverage. For resource managers, priority will likely be given to areas where problems have already been identified. The harvests of rare species or declining populations will certainly be of more importance to them than the harvests of ubiquitous species or abundant populations. Such a geographical target may well not coincide with what economic and social planners might identify as a problem area. As well, the economist may, in trying to get a global picture, select a limited number of representative areas or communities, and attempt to generalize from this sample. For project impact and compensation, the location of the project itself and its anticipated impact zone will determine the appropriate geographic extent of the survey.

Location of harvests. All users agree that at the very least, harvests should be identified by community, which assumes in effect that each community has a distinct and identifiable land-use area, within which residents harvest fish and wildlife. Although this continues to be the case in the areas currently being surveyed, it may not be a universally valid assumption in the western Northwest Territories and Yukon, where there is a substantial road network, and where a significant proportion of the Native population lives in large, non-traditional towns. It remains to be demonstrated that Native people living in Whitehorse and Yellowknife, for example, have community-based harvest areas which are separate and distinct from those of other, smaller communities, and that those people hunt only in those areas. On the contrary, there is some evidence that Native city dwellers travel widely by road and air to hunt, sometimes in the hunting areas of their communities of origin, and sometimes in areas in which they have no traditional prerogatives. Indeed, the use of non-traditional hunting areas may not be restricted to residents of the main centres, where road travel is common.

Many users expressed a need for more precise geographical location of harvest data, in some cases to within 1 km. The degree of precision requested was not clearly associated with any particular agency or type of use, as both resource managers and economic analysts expressed a wide range of preferences. Reasons for wanting more specific locations than community harvest areas for the most part consisted of, first, the "objective" identification of species or populations, based on their known occurrence at particular times and places, instead of, or in addition to, "subjective" identification by harvesters, and secondly, the precise identification of adverse affects on particular elements of population ranges, such as calving grounds, spawning beds, or river crossings, as well as on the harvesting areas of particular individuals or groups.

Some users did not make a clear distinction between harvest data and land-use data. Mapping the location of kills is to map hunter success, whereas mapping land use is to map hunter effort, as well as hunter interest in land, however that might be defined legally. For questions of project impact, modification, and compensation, land-use data may be of greater significance, both in the minds of the harvesters themselves and in terms of the theories of injurious affectation and compensation which may be adopted in any particular situation. A substantial amount of land-use data has already been mapped in the Northwest Territories, much of which is already in the public domain, or is otherwise readily obtained. Examples include the Inuit land-use and occupancy project (Freeman 1976); the Dene Mapping Project which has coded the data from

the Dene land-use and occupancy project of the mid-1970s on a 10 km^2 grid and can generate computer maps; and the Northern Land Use Information maps prepared by the Department of Environment. These sources, along with consultation with local HTAs or Band Councils for updating, are entirely adequate for certain user needs, without recourse to harvest surveys.

Harvesting Effort

There is a consensus that effort data would be useful to have, but few placed high priority on them. There are various indicators of harvesting effort, including simple participation rates; quantitative measures of time, or time and gear, such as hunter days, trap checks, or units of fishing effort; and quantitative measures of harvester expenditures.

The measurement of effort along with harvest provides the basis for estimating the rate of harvester success. Participation rates are important for designing socio-economic programs which may affect, or be affected by, harvesting, such as wage employment and training programs, or harvester support programs. The measurement of effort, beyond simple participation, provides a basis for estimating the rate of harvester success. Success rates are useful for the following purposes. When populations cannot be directly censused, for example fish, the size of the stock can be inferred from catch and effort data. As well, harvest expenditures, along with catch statistics, enable cost-benefit calculations and provide some indication of a person's economic commitment to harvesting as an activity.

The importance of effort data most often cited, however, was for purposes of compensation. The use of harvest and related data for compensation is discussed at greater length in the section on "Options." For now it is sufficient to note that proof of injury for purposes of compensation, where no proprietary interest has been violated, usually requires documentation of effort as well as success.

Harvester Characteristics and other Socio-Economic Data

Interest in the socio-economic characteristics and status of harvesters, although expressed almost entirely by the economic development agencies, is shared to a lesser extent by some of the Native organizations. With few exceptions, the resource management agencies, and industry, attach little or no importance to obtaining such data. The following kinds of information have been suggested as useful: age, sex, household

characteristics, employment, income (total and by source), and harvest expenditures. If these data were linked directly to harvest data on an individual basis, it would be possible to test numerous hypotheses about the interrelations of harvesting, wage employment, social welfare, income, expenditures, and the life-cycle of harvesters, and to monitor changes in these relationships. All of this information, like the participation rate data mentioned in the previous subsection, could be very useful in setting departmental policy and designing socio-economic programs.

Criteria for Reliability and Comparability

Most users either could not specify reliability criteria for harvest statistics in conventional scientific terms, or attached little practical importance to doing so. The only ones who did were some of the technical staff of both resource management and economic development agencies. For example, a few specified that they would be pleased to have data that was accurate to within $\pm$20%, whereas others suggested that it was unrealistic to expect much better than $\pm$50%. Only one individual ventured to specify the acceptable confidence limits (5-10%), and this was based on general principles rather than an intimate knowledge of harvest survey methodology. Some technical personnel drew attention to the fact that most other statistics derived from survey data such as sport harvest and wildlife population estimates have no greater accuracy than the specifications mentioned, and that it is unreasonable to expect, or to pay for, highly accurate estimates which would then be used in conjunction with other, less accurate data.

Others in both government and industry were inclined to the view that if the resource management agencies were satisfied with the quality of the data, then they too would be satisfied. Some users, again in both government and industry, suggested that if Native harvesters had confidence in the surveys, as indicated by their willing participation, then they themselves would have confidence in the results. Another approach to reliability was simply whether the survey method produced better results than the other methods tried to date. Some users, more often those involved with economic planning and impact assessment than those responsible for resource management, expressed the view that the accuracy of the numbers themselves was less important than that whatever bias existed be held more or less constant so that at least the trends could be reliably identified. (The extent to which trends in harvest survey results may be real or merely artifacts of the sampling procedure is discussed in Appendix C.)

There is a general consensus that, while allowing for local differences in the particularities of the studies, the overall results should be comparable from one region to another, to enable the identification and monitoring of trends and relationships across very broad areas such as the Northwest Territories as a whole, the eastern Arctic as a whole (e.g., Labrador, Nouveau Quebec, Baffin Island, and all associated waters), or the entire North.

Data Presentation, Access, and Report Format

The level of detail at which the data should be available for analysis is a matter of some contention, although there is widespread agreement about the extremes. Everyone wants, at the very least, tables showing the annual kill by species and by community, as part of or accompanied by a report that clearly describes the survey methodology, the system of data aggregation, and such manipulations as the projection of total kills from reported kills, and a description and evaluation of the sources and magnitude of bias. Similarly, almost everyone agrees that the personal identity of harvesters should be confidential, presumably meaning that not only should names be withheld, but also that any published data should not be so disaggregated as to reveal the identity of the harvester.

Of several intermediate possibilities, one is that, so long as the names are deleted, bona fide users should have access to the community spread sheets to conduct whatever detailed analysis of the data they consider appropriate, or that they should be able to request that such analysis be done. Another possibility is that the survey reports should contain much more detail, such as harvests by month, by location, by certain hunter characteristics; response rate broken down by species and month; and so on.

The demand for more-detailed reporting and for access to the spread sheets comes from both resource management and economic development agencies. It can also be expected to come from independent researchers and scholars, both in the private sector and in academic life. Industry, for its part, appears satisfied with annual community totals by species, although those companies that believe they are operating in environments in which their operations may affect individual interests rather than whole communities are more inclined to see a need for some independent agency, if not themselves, to have access to individual harvest data.

The Native organizations take a proprietary stance towards harvest data, most wanting only the summary tables released, and the control and analysis of raw data left to them. However, many, including some government agencies, do not have a clear idea of what they mean by raw data, making no distinction among the individual hunter reports, the community spread sheets, and aggregations of raw data that have not yet been analysed or manipulated. There are varying degrees of willingness to negotiate on these issues, as discussed under "Options," but negotiation to the satisfaction of all parties will be necessary before harvest studies can be undertaken, let alone produce reliable results.

The general concerns of user groups by category are summarized in Table 9. From this review it appears that the concept of Native harvest statistics is by no means clearly defined, and that it implies somewhat different results or products to different users.

TABLE 9

User requirements

Requirements	Participants			
	Resource management agencies	Economic development agencies	Industry	Native orgs.
Target harvesters	domestic	Native	affected	claims beneficiaries
Target species	by jurisdiction	all	affected	all
Target quantities	kill	consumption	various*	uncertain**
Duration	open-end	open-end	project	uncertain
Reporting interval	monthly	various	various	uncertain
Timeliness	within 1 year	within 2 years	various	uncertain
Geographic coverage	population or species range	complete	project	complete
Location	various	various	various	various
Effort	various	important	various	various
Socio-economic data	unimportant	important	unimportant	various
Reliability	accurate numbers	accurate trends	acceptable to management agencies & harvesters	acceptable to harvesters
Comparability	important	important	uncertain	various
Access to data	spread sheets	spread sheets	reports & tables	reports & tables

* Various = no consensus.
** Uncertain = no firm opinions.

OPTIONS FOR NATIVE HARVEST SURVEYS

THE PROBLEMS

The collection of Native harvest statistics in the North has reached a critical point. Although a substantial amount of harvest data is already on record, most of it has been generated with such varied objectives and from such different premises that it is either unknown, or unintelligible, to other potential users. The results often require more careful reconstruction and interpretation than most users are willing or able to undertake, and quite often even the best results are either not sufficiently generalizable, or are not presented in a form usable for the required purpose.

In northern Quebec, a new, co-operative and comprehensive approach used a model that proved highly successful for the purpose at hand. Since 1980, this model has been used in the Nunavut region of the Northwest Territories, but with much less success, due partly to an insufficiently critical and sometimes even careless application of the model, but also to the significantly different political and institutional circumstances that prevailed. A growing number of parties are finding that they have a direct interest in and use for Native harvest statistics, and are specifying these requirements with greater precision, based on their experience with both the surveys and their resulting statistics.

Since 1980, at least $1.5 million has been invested in these surveys, and the sponsoring agencies now seek to expand their coverage in the North and to provide a regular basis for funding them. Yet, unlike in northern Quebec, there is a widespread view that the NWT surveys have not produced the results that had been hoped for, and each of the sponsoring agencies, as well as some using agencies, have reservations about the quality and value of the data made available to date.

To some extent this is because no data at all were available until late 1983, nearly four years after the first survey began, but that is by no means the whole story. The process has rarely achieved the level of co-operation and mutual respect that characterized the JBNQ surveys. The results, when finally presented, have not always been of a high professional standard. Both the survey methodology and the analysis of the data have sometimes been so unclear that the scientific staff of the sponsoring agencies have had severe doubts about their validity. As well, the data actually made

available have been so generalized, or presented in such an idiosyncratic form, that many users find they do not meet their particular needs.

At the same time, the Native organizations that have been contracted to undertake the research and to produce the results are not entirely happy, and some feel that the process has somehow got off track. Those Native organizations that have not yet undertaken harvest surveys, but are seriously considering the prospect, have some deep reservations about entering into agreements to do so, despite the fact that they consider the process potentially beneficial and the results useful.

This situation has developed for two fundamental reasons. The first reason is that Native harvest statistics, despite the apparently self-explanatory nature of the term, in fact mean different things to different people, and have done so for the 30 or so years that people have been collecting and using these statistics. Nowhere in the record has sufficient attention been given to this fact or to its implications. The differing needs for Native harvest statistics are entirely real and valid, but they affect both the design of the survey and the presentation of results. There has been a great temptation to achieve many things from one survey, especially in view of the expense and complexity of these surveys. While in some cases that is possible, in many it is not, and the authors believe that it is the attempt to do so that has, in part, led to the disappointing results of the NWT surveys. So the first problem that must be resolved is to clarify the objectives of Native harvest surveys, and, on that basis, to choose among the several possible options for their design.

The second reason, which is clearly related to the first, is that there has been inadequate recognition of, let alone resolution of, the question of who controls these surveys, and who has the right to do what with the results. The crucial difference between the JBNQ and the NWT surveys was that the former occurred as a consequence of a claims settlement, whereas the latter have occurred in anticipation of one. In the JBNQ surveys, certain fundamental issues had already been resolved through negotiations, and the surveys proceeded on the basis of certain agreed principles. The negotiation of the terms of reference for the surveys, their continuing conduct and modification, and the presentation of the data, all took place within certain already determined parameters. These included, not least, a funding formula which placed all parties on an equal footing, and a funding commitment for the entire life of the project.

In the Northwest Territories, however, the Native organizations that initiated the surveys (especially BRIA), quite correctly recognized that the results of harvest surveys would be an important weapon in what was then, at least in their view, an adversarial situation concerning both major resource development and the settlement of claims. None of the issues that had been resolved by the James Bay and Northern Québec Agreement had been similarly resolved in the Northwest Territories. The gathering of harvest statistics was seen as one of many means of arriving at that point. This fact resulted in quite different approaches to the funding, organization, and control of the surveys; to the implementation and review of the survey process; and to the release and interpretation of data and results. Instead of a co-operative process among equals, the relationship in the Northwest Territories has variously been one of donor-supplicant, a contractual obligation on the part of one producer to many clients, and even, in effect, employer-employee, with the funding agencies not surprisingly holding the upper hand in every case. However fair this arrangement may be, it has not produced optimum results. Hence, the second problem to be resolved is who controls these surveys, and who determines what is done with the results.

It is up to the participating agencies to negotiate among themselves what the answers to those questions should be. The authors' objectives here are first, to set out the options clearly and precisely, so that those who do negotiate these matters may have a common base of information for doing so; and secondly, to identify the basic technical criteria that Native harvest surveys must meet if they are to provide useful information for at least the basic purposes, and reasonable value for the money they will cost.

REVIEW OF THE BASIC CONSIDERATIONS

Before examining the options for Native harvest surveys, it is necessary to review some of the basic facts about them.

Importance of Recall Surveys

For most species of fish and wildlife, there is no alternative to a recall survey for ascertaining harvests, whether or not harvesting occurs under authority of a permit. Sport fishing, big game hunting, and waterfowl hunting by non-Natives all require permits, but the actual success of the

permit holder can only be ascertained through surveys. The primary requirement for successful surveys is the perception by permit holders that the use of the resulting statistics for management purposes will not only be beneficial in general, but that the benefits and costs will be fairly borne by all participants. The use of coercive authority by wildlife management agencies (for example by penalizing failure to report by fine or non-renewal of permit) may ensure that the permit holder provides an answer, but it cannot ensure a truthful answer.

Most management agencies believe that bringing Native harvesting under a permit structure, either by abolishing aboriginal hunting and fishing entitlements or by negotiating new arrangements about them through the settlement of Native claims, is essential to obtaining the harvest statistics they require for management. Whether such a permit structure is a necessary condition of meeting this objective (and the authors are not convinced that it is), it is certainly not a sufficient one. Like the non-Native harvester, the Native harvester must be convinced that participation in harvest surveys is in his or her best interest.

There are circumstances in which recall surveys are not required to obtain Native harvest statistics, but they are exceptional. They include the following.

Species whose harvest is controlled by quota. In the Northwest Territories., these species include polar bears, muskoxen, narwhals, walrus (in the major harvesting communities), and beluga (in Cumberland Sound only). Kills of the first three species are regulated through a tag system. Each community is issued a certain number of tags, and unused tags must be returned to the game or fisheries officer. In principle, because the tags may be transferred, and they are in demand, there is an obvious assumption that the difference between tags issued and tags returned is the number of animals actually killed and retrieved. In practice, there are some specific problems, especially with the narwhal hunt, although these are to some extent being resolved. In the other cases, the quotas are controlled through monitoring by fisheries officers, rather than a tag system, and the degree of error is probably greater.

Species whose circulation is controlled by permit. This refers chiefly to fur-bearers. Because controls exist on the purchase, export, and commercial processing of pelts, all these events are recorded. As most fur species are taken only for their commercial value, this recording system is presumably accurate. The chief problem arises with those species whose pelts are frequently retained for domestic use, or are valued

independently of their pelts for food. Examples of the former are wolverine and wolf; examples of the latter are beaver and seal. In these cases, the existing record-keeping system cannot be relied on to produce an accurate estimate of the harvests of those species.

Species with harvests concentrated in time and space. These harvests can be recorded by an independent observer. The leading examples are the large marine mammals. Others include nesting colonies of seabirds, although in fact no such statistics are kept on a continuing basis. Even in these cases, however, there are a number of incidental kills outside these areas of concentration, which current recording systems do not track.

Recall surveys are essential for obtaining harvest statistics on all other species. In the North, this means practically all of the species that are the staple food supply of the Native population: most big game, including caribou and moose, all seals, all fish, practically all birds, especially ducks and geese, and all small game, especially hare. It also means some fur-bearers.

Recall Surveys as Social Surveys

Because harvest surveys are intended to determine the number of animals taken, there is sometimes a mistaken belief that they are biological surveys, but they are in fact social surveys. It is people, not animals, who must provide the basic information, and even if the survey is to be supplemented in some way by observational data, it is the activities of people, not animals, that are under observation. Yet the record demonstrates that quite often, neither fisheries and wildlife scientists nor management agencies recognize this fact, and only rarely do they draw upon the expertise of social scientists when designing, conducting, or interpreting the results of such surveys.

There are several reasons for this. On the one hand, there may be an assumption that harvest surveys are a simple matter of asking a few seemingly obvious questions. Wildlife scientists are not routinely trained in social scientific methodology and, until recently, have had no reason to be professionally familiar with it. One of the standard references in wildlife biology, the Wildlife Management Techniques Manual (Schemnitz 1980), included a discussion of human surveys from a social scientific point of view for the first time only in its fourth edition. On the other hand, there may be a perception of social science as dealing only

with "soft data" and therefore "unscientific" by nature, as well as a presumption of the incompetence of social scientists in matters seemingly biological.

Stereotypes aside, biologists may, in practice, have found relevant social scientific studies deficient in both methodology and results. Social scientists cannot escape responsibility for this perception, because too often they have given insufficient attention to rigour in survey methodology, or at least to documenting that rigour. Most wildlife personnel recognize that response bias is a problem in harvest surveys. Some may consider it so intractable that they do not believe, on the basis of their experience, that the technical assistance of social scientists can be of much aid. Finally, because agency surveys of Native harvests have had low priority, they are underfunded and understaffed; there is no provision for external peer review of the design or the results; and indeed too often there are no verifiable results because the data have not been processed by a biometrician. Despite the fact that in the Northwest Territories, over half of the total harvest by weight of all species (including the Great Slave Lake commercial fishery) is accounted for by the Native domestic harvest, no agency has yet developed a sophisticated and consistent system for recording or estimating that harvest.

However justified these reasons may have been in the past, the authors believe that in view of the money that agencies are now spending on these surveys, and the uses to which the results are being put, there can no longer be any justification for failing to employ all relevant expertise in the design of the surveys, and in the analysis and interpretation of the data.

Co-operative Approach to Surveys

The fact that the reporting of most harvesting events must be entrusted to the harvesters themselves requires a high level of co-operation and trust between those undertaking the survey and those responding to it. In years past, the reliability of some surveys depended on little more than a presumed obligation by harvesters to co-operate, in deference to authority, real or perceived. This condition is no longer widespread in the North, and cannot be relied on to produce results in the future.

The alternative is a genuine co-operative approach to harvest surveys. This view now appears to be widely held by all major participants in, and users of, harvest surveys. In particular, it appears that the fish and wildlife management agencies operating in the North recognize that an

authoritarian, enforcement-type approach is neither feasible nor desirable. They simply have neither the funds nor the personnel, and probably not the political authority, to pursue that option. More important, they now generally believe that co-operation or "co-management" will lead to better and more effective wildlife management and conservation. However, although nearly everyone agrees that co-operation is a good thing in principle, there is probably less agreement about how to put it into practice.

Of the many requirements for achieving reliable harvest statistics, discussed in the next section, all but one are essentially matters of technique. That one is the question of strategic response bias. Any social survey can assume that at least a small proportion of respondents engage in strategic bias, for a variety of reasons. The possibility of major and systematic strategic bias, however, is a central cause of concern because it completely undermines the credibility of the results. The likelihood and causes of strategic response bias are predicted easily enough, and there are in many cases technical means for detecting its actual occurrence. There is, however, no technical basis for eliminating it.

The only way of reducing strategic bias to manageable levels is to ensure that the survey occurs in the absence of circumstances likely to induce it, or more simply, that the surveyors have the confidence of the surveyed. The reasons to be truthful must outweigh the reasons not to be, or at least, the reasons to be untruthful must be sufficiently varied that no single strategic bias is unambiguously to one's advantage.

In considering this problem it is important to distinguish between the interests and perceptions of harvesters themselves, and any organization that may represent them. However well HTAs, or regional or territorial Native organizations, attempt to represent their members, their willingness to participate in harvest surveys does not necessarily mean that all harvesters thereupon abandon all their personal reservations. There should be no assumption that because a Native organization authorizes a harvest survey, or even conducts one, that the problem of response bias has been automatically eliminated, although in all probability it has been reduced.

THE OPTIONS

Four major options for harvest surveys each reflect the priorities of a different sponsoring agency or group of agencies. Each calls for a somewhat different design or model, and produces results in somewhat different form. Each has its own integrity and logic. The authors make no value judgement about which has the greatest merit. Instead, these models are first set out (interpreting the user agencies' stated requirements), to show what each entails, and to draw attention to the advantages and disadvantages, and possible uses or misuses, of each. Then the authors identify the most common elements to each, and which differing objectives and designs are the most easily reconciled. However, not all objectives can be met by the single instrument of a harvest survey, and choices will have to be made. The authors suggest how some particular objectives might more readily be met by means other than harvest surveys.

Priority to Levels of Native Harvest

The JBNQ surveys sought to document, in the first instance, existing levels of Native harvests as a basis for negotiating guaranteed levels of harvesting. The BRIA survey also sought to document existing levels of Native harvests, first of all to assert the rights of the Inuit to those resources, and secondly, once these rights were recognized, to determine basic levels of need. Although Native organizations have other reasons to want Native harvest statistics, many of them in common with other agencies, these objectives are not only primary ones for them, but are indeed theirs alone. No other party wants these data to support the assertion of what it considers to be a fundamental political and proprietary right.

A survey for this purpose alone needs only to generate harvest totals by species and by specified geographic unit. The following principles are most likely to guide the design of the study.

a) Harvesters will be identified on the basis of social, cultural, and legal criteria. The survey will be limited to those who have the aboriginal rights asserted, or who are the beneficiaries of a negotiated agreement.

b) Species to be included will be all of those taken and used in some way by the harvesters.

c) Harvest will probably be equated with economic production, to show what the group in question derives from the land to its benefit. Neither kill nor consumption (i.e., what the harvesters remove from animal populations or how they dispose of their product) are of central concern. Production, or numbers killed and retrieved, is what harvesters are most likely to be willing and able to report. Reported harvests need not be recalculated on the basis of independently determined correction factors, so long as the questions are clear and precise.

d) The survey will be of finite length, but sufficient to smooth out such factors as animal population cycles, chance abundance or scarcity of certain species, rotational harvesting practices if they exist, or socio-economic factors temporarily affecting hunter effort, which in practice, usually takes four or five years. However, it must run continuously during that period to achieve proper coverage. There may also be a concern to link this data run with historical statistics.

e) The primary reporting interval should be annual. In practice, recall may be enhanced by more frequent reporting intervals, but monthly or seasonal subtotals will not necessarily enhance the achievement of the primary study objectives.

f) Geographic coverage will be desired primarily for the area in which the Native group in question asserts an interest. Within that area, the important geographic units will probably be the community land-use areas. Harvests will therefore be aggregated on the basis of harvester residence and community land-use areas.

g) Neither additional biological nor socio-economic data are required for a survey of this type. If such information is sought, it will be for purposes other than the primary one.

h) The primary product of the survey will be the annual community summary tables. There is no intrinsic need to present data at any lower level of aggregation, or to link these data with any other phenomena, at either the community or the individual level, although the organization may for other reasons wish to do so. In all likelihood, the Native organization in question will place an equally high priority to local participation in the survey for the purposes of legitimation, education, training, and employment, as well as to provide essential local knowledge and perceptions in guiding the design and conduct of the survey.

Because of the high priority on harvester participation, and the limited duration of the survey, there is usually an effort to attain complete coverage of all hunters by a census approach. In practice, it seems reasonable to expect 70-90% coverage with this approach, and rarely does it fall below 60% (on an annual basis). However, similar levels of reliability could be achieved through a carefully selected sampling approach. In northern Quebec, the Phase I surveys, based on a one-third stratified sample, produced acceptable results.

One of the strengths of this option is its simplicity. Both the hunter file and the survey questionnaire itself can be kept short. Participation can be determined purely on the basis of hunter success: if an individual has no harvest to report, he or she does not belong in the sample population, for it may be safely assumed that in Native communities, no one who actually hunts fails to procure any harvest of any species during a one-year period. Consequently, if the reporting is annual, there is no need for a hunter participation file to track the monthly activity, and the estimation of total harvests from reported ones is greatly simplified. If the survey is positively perceived locally, then, as was done in northern Quebec, continuing encouragement in, and assistance with, recording will probably bring recall accuracy to a satisfactory level, and avoid excessive response burden. The finite duration is also a benefit in this regard. Harvester self-interest becomes a clear inducement to participation. Although a strategic bias toward over-reporting might logically be expected, experience to date suggests that this does not in fact happen, although this should be verified periodically.

The model described is essentially that used in James Bay and northern Quebec, which is proven and workable and can produce reliable results. The authors believe that this model will gain the widest acceptance among harvesters with the least effort on the part of the sponsoring agencies. Further, a survey that seeks to document harvest levels alone, for the purposes noted, will probably produce the best results, so long as the basic rules of survey methodology, as outlined earlier, are followed.

The chief weakness of this approach is that the survey results are of limited application to other possible uses, because of the generality of the questionnaire, the reporting interval, and the form in which the data are presented.

Priority to Resource Management Objectives

Resource management agencies require Native harvest statistics primarily for the purpose of conserving and enhancing the stocks of fur-bearers, fish, and game within their jurisdictions. With responsibility divided among four different agencies in the Yukon and Northwest Territories, the interest of any one of them is limited not only geographically but to a specific set of species. Within that set, given the political priorities of the day and limited resources, the focus is likely to be on "high profile" species or populations: those of greatest economic significance, or whose health or numbers are in some way at risk. The focus on the management of discrete species and populations is unique to these agencies, not only by virtue of constitutional and legislative responsibility, but also of the scientific, ethical, and economic philosophies that prevail in these agencies. Other parties certainly share a concern with the survival and health of fish and wildlife, but not necessarily the same approach to achieving those ends. Secondary, but by no means unimportant, concerns of resource management agencies include the allocation of harvests among different user groups; the effects of, and possible compensation for, development activities upon wildlife; and public participation and involvement in conservation.

To be useful for management purposes, Native harvest surveys ideally should produce a substantial amount of detailed information, and to that end the following principles are particularly important.

a) The harvesters to be surveyed should include all those who for any reason kill animals other than are recorded through existing commercial and recreational recording systems. There is less concern with the ethnic identity or legal rights of harvesters than ensuring comprehensive coverage of harvesting activity.

b) Species to be included may be limited to those under the jurisdiction of the sponsoring agency (although the KHTA survey, for example, includes some species not under the jurisdiction of the GNWT Wildlife Service).

c) Harvest will ideally be equated with kill. In practice, however, the number of animals killed and retrieved is generally considered satisfactory, so long as there is some basis for estimating total kills from that number. In general, wildlife managers prefer to rely on direct observation through adjunct but separate studies, rather than on recall interviews, for data on wounding, crippling, sinking, or other loss rates.

d) In principle there is a continuing requirement for management data, and harvest surveys for that purpose should continue indefinitely, in the same way that national censuses or surveys of economic activity do. However, comprehensive surveys need not necessarily be conducted continuously at the same level of intensity. More-detailed surveys may be required for particular species, where or when there is considered to be a management problem. Less-detailed or occasional surveys may be adequate for monitoring the status of wildlife resources either where no problems are evident, or when there is no need for statistics at the standard of reliability required for active management intervention.

e) Annual harvest totals alone are insufficient for the management of most species. Optimum reporting intervals will vary with the species, but range from, say, weekly for certain fisheries, to monthly or seasonally for many of the species that are taken during much or all of the year.

f) Geographic coverage should relate primarily to species or population ranges, or to particular events within those ranges such as breeding, wintering, or calving. Precision of kill location depends upon the species in question, but in principle should enable a reliable identification of particular populations or species, based on their known ranges. A variety of systems have been used, including grid squares, place names, and river systems, but no single one appears adequate for all cases. In practice it would be necessary to design separate geographic locational systems for each group of fauna having similar life histories. If a harvest survey is intended to cover several such groups, the recording, processing, and presentation of locational data could become a complex problem.

g) Additional biological data are considered desirable and perhaps even essential, including precise taxonomic or population identification. Depending upon the species in question, this identification could be made "subjectively" by the harvester, or from such evidence as wing collections for waterfowl, if these can be arranged. Harvester identification can be used in addition to, or in place of, geographic location in some instances, especially if there is substantial agreement between harvesters and wildlife scientists about the identity, range, and life history of the species in question. However, such is by no means always the case. Resource managers commonly want information on age and sex of kills. For birds and mammals, harvester identification of sex and of basic age categories such as young of the year or adult, is usually adequate.

h) Effort data are highly desirable for certain species, in particular those whose populations cannot be reliably estimated by direct census, such as fish, seals, fur-bearers, and small game. Together, catch and effort data provide the basis for inferring the size of a particular stock. These estimation techniques are common in fisheries management (Ricker 1958), but are less well developed for mammalian management. The most useful kind of effort data concern the type of harvesting gear used and the duration of actual use (e.g., the "unit of effort" in fisheries). These data can often be obtained by direct observation and, therefore, do not necessarily require an addition to the questionnaire itself. Effort and catch data were successfully tracked on an individual basis over several years through interviews with Banks Island hunters, with special reference to trapping, during the late 1960s and early 1970s (Usher 1971, 1973). However, these data were obtained on a geographically restricted basis through intensive field effort. The authors strongly doubt that they could be replicated on a widespread and continuing basis through routine survey research. Some combination of interview and observational data is usually required, and this is most likely to be successful if the objectives are limited, e.g., by species or season, as in the domestic fishery surveys.

i) In view of the data requirements already enumerated, the problem of excessive response burden cannot be discounted. Resource managers see the inclusion of an additional protocol for socio-economic data as more likely to detract from, rather than enhance, the results of a harvest survey for their purposes, however interesting such findings might be. To make projections from reported harvests, the only essential data for a hunter file would be participation and success in hunting, on a species-by-species basis. However, although these data are not intended for socio-economic analysis, they are nonetheless socio-economic data. Hence, other government agencies, and possibly third parties, will inevitably demand to use them as such.

j) The desired survey product is not so much summary tables, however carefully explained, as a data base for management, at least by those agencies with the capacity to use one. The implication is of sharing between harvester and management organizations of, if not raw data, then probably the spreadsheets or minimal aggregations of them. The management agency views harvester participation in the design, execution, and analysis of the survey as a priority only insofar as it enhances the acceptance and credibility of the process, and the reliability of the resulting statistics.

Because of the lower priority that at least some management agencies give to harvester participation, vis-à-vis the statistics themselves, there is some disposition toward a sampling rather than a census approach. In principle, sampling is a feasible approach to a resource management-oriented harvest survey, and indeed is commonly used by such agencies to obtain sport harvest data. In practice, it would be necessary to use a stratified sampling approach (see Appendix C), which in turn would require a pilot study similar to "Phase I" of the JBNQ surveys before embarking on the general survey.

The biggest advantage of this model is that, if successful, it would provide resource managers with a data base for which quality and extent of coverage is unmatched by anything at present available to them. It appears now that at least the more senior management agencies are capable of using such a data base to their advantage.

The chief problems with this model are its potential complexity (depending on the variety of species to be included, the reporting interval, the need for a hunter participation file, and the degree of geographical specificity) and its acceptability to harvesters. Because it has never been applied on a broad basis, there is speculation to some degree about its costs and benefits. The complete model, as set out, is likely to encounter difficulty by virtue of the complexity of the questionnaire and the burden of data processing and analysis. Response burden is almost certain to be a problem, but could be reduced by setting priorities on the categories of data, and either eliminating some or surveying for them occasionally over time or among a subsample of respondents. For example, one management agency indicated its priorities as follows: numbers, location, times, age-sex data, effort.

More important is the acceptability of a management-oriented survey to harvesters, and the implications for strategic response bias, which is by no means an insurmountable problem. However, it will require the establishment of substantial trust between managers and harvesters, which probably can be achieved only through extensive negotiations, and which may require prior agreement on certain other issues.

Priority to Economic Planning Objectives

Agencies primarily concerned with economic planning in the North need data for specific social and economic assistance and development programs. Although other parties share an interest in the social and economic development of the North, certain government agencies have a unique responsibility for, and approach to, those questions.

To be useful for economic planning purposes, a Native harvest survey need not include much of the biological information required by the resource management model, but on the other hand requires substantial socio-economic data. The following principles are particularly important.

a) Harvesters will be identified on the basis of social, cultural, and legal criteria which must bear some relationship to the people to whom the agency has a particular responsibility.

b) Species to be included will be all of those taken and used in some way by the harvesters.

c) Harvest will ideally be equated with consumption. In practice, however, the number of animals killed and retrieved may be satisfactory so long as there is some basis for estimating consumption from that number. This estimate may be made through independent observation, or by adding relevant questions to the survey, or through a separate protocol along the lines of a dietary or nutrition survey based on daily recording or short-term recall of household intake.

d) For management purposes, there is, in principle, a continuing requirement for data. In practice, however, there is no requirement to conduct continuous surveys at a high level of intensity. More-detailed surveys can be designed for particular problems, but a data base can be obtained through periodic surveys, along the model of the Census of Canada, of particular communities or groups of harvesters predetermined to be reasonably typical of their class, from which useful generalizations can be made. However, to smooth out chance variations and especially to identify significant trends in both harvest and socio-economic data, a minimum five-year data run is required.

e) Although monthly or seasonal reporting may provide useful information for some purposes, annual aggregation of harvest data is appropriate for most planning purposes.

f) While geographic coverage can be limited to sample communities or regions, as indicated in (e) above, there must be a reliable basis for generalizing those results for the region or jurisdiction as a whole. For economic planning purposes, geographic identification of harvests with community land-use areas or other economic planning regions is sufficient.

g) Biological data are of use to economic planning agencies only insofar as age-sex data and accurate taxonomic identification might provide a more precise basis for the calculation of the total weight of available food.

h) Effort data are useful for economic analysis, but the particular indices of effort required relate to participation and expenditure. The participation index should provide a basis for calculating the time devoted to harvesting vis-à-vis other activities such as wage employment. Expenditure data are useful as a measure of the benefit-cost ratio of harvesting, in comparison with data on the value of production, and as an indicator of individual economic choice and decision making. Basic participation data can be obtained from the hunter participation file required for any of the survey models based on a monthly reporting system, as described above. More precise data on time allocation, expenditure, or gear, require either additions to the questionnaire, or a separate survey.

i) For purposes of socio-economic analysis, at least the following types of data could usefully be linked to harvest data: age and sex of harvester, household composition, employment, and income (amount and source). The priorities among these variables were not stated. Obtaining these data would involve substantially more than the hunter characteristic and participation files required in the other models. There would need to be an additional section to the questionnaire of some length and complexity. To perform detailed analysis and cross-tabulations of the entire data base, all the data would need to be linked for individual harvesters.

j) As in the case of the resource management model, the desired product is a data base at least as much as a set of annual tables, with harvester participation being a secondary, though not necessarily an unimportant, consideration.

Again there may be a preference for sampling rather than a full census. However, the number of variables may require that the minimum sample size, in small communities, is that currently attained by the existing census approach (see Appendix C).

The advantage of this model is that, if successful, it would provide economic planners and analysts with a data base the quality and extent of coverage of which is unmatched by anything at present available to them. How effectively they could use it, in terms of either their financial and personnel resources or their interest in formulating precise and testable hypotheses, is not entirely clear, however.

The chief problems with this model, as with the resource management model, are its complexity and its acceptability to harvesters. Again, no such comprehensive survey based on this model has ever been conducted on a continuing basis in the North. However, strategies similar to those suggested for the resource management model could reduce the problem of response burden.

The acceptability of this model to harvesters would be a significant problem. No similarly comprehensive survey has been administered on a continuing basis to such a large sample anywhere in Canada on a voluntary basis. Respondents would in effect be asked to fill out the rough equivalent of the long version of the Census of Canada, plus the Agricultural Census, not once every five years but several times a year.

Harvesters would probably resist a general survey of this type on two grounds. First, many would not wish to reveal their incomes, and possibly their employment status and harvesting expenditures, especially in view of recent attempts by Revenue Canada to crack down on trappers in the North, and of the apparently widespread belief among them that social service agencies would have access to the data. Already, some trappers are not participating in support programs because of the documentation required.

Secondly, there would be additional resistance to the linking of so many variables on an individual record, even if there were undertakings about the confidentiality of respondents' identities. If such a survey relied only on those who freely wished to respond, the sample size might be too small to produce valid results, and non-response bias might become significant. The sample might also suffer from discontinuity of participation, from item non-response, and from variable quality of item response that might be difficult to detect.

Although the BRIA project attempted to obtain certain socio-economic data (not including income), these attempts were neither comprehensive nor sustained, and produced data of rather limited value. The attempt to obtain a broad range of socio-economic data through questionnaires on a consistent basis would very likely inspire a level of resistance that would jeopardize the primary purpose of a harvest survey. Consequently, the authors believe that it would be better to obtain such data through separate and unrelated surveys or studies, and to forego the direct linking of data on an individual basis.

Priority to Impact Assessment and Compensation

Impact assessment. The use of harvest surveys for impact assessment is of interest chiefly to industry, and to those government agencies responsible for northern development and its effects. Harvest data covering five or so years prior to development are essential for prediction and for monitoring. However, in most cases, developers will not have collected these data in the appropriate area for such a lengthy period before initiating their activities. Thus, the impact assessment process must rely chiefly on harvest data available from other sources, whether these be Wildlife Service records, existing literature, or the results of the comprehensive surveys that are the subject of this report. Although some impact assessment reports have generated their own data, it is usually on the basis of a critical evaluation of agency data, or a one-time, annual recall survey as part of a larger socio-economic data-gathering program, or a seasonal monitoring of the harvest of one or a few key species (e.g., beluga in Mackenzie Bay), as described earlier. The need to reconstruct or reinterpret past harvest statistics assumes greater importance for impact assessment than for the other models.

Of the models already described, the resource management model would be of greater use for environmental impact assessment, whereas the economic planning model would be of greater use for socio-economic impact assessment.

Impact assessment has some distinctive requirements usually related to a particular project, place, and time. A more focused and less comprehensive approach to gathering harvest data is therefore both feasible and desirable. The population of harvesters and the range of species can be restricted to the area likely to be affected. The problem of locating harvests is thus simplified, and the duration of the survey is clearly finite, and is related to key aspects of the project being assessed. The basic requirement is that there be adequate and continuing data for monitoring purposes. As there is a tangible objective to such a survey, beyond resource management and economic planning, harvesters may participate more willingly and extensively with the survey. Thus, it might be feasible and desirable to incorporate some of the supplementary biological, effort, and socio-economic parameters in the survey.

To the extent that specific harvest surveys are undertaken in the context of socio-economic impact assessment, the principles of their organization would be different. There would presumably be some arrangement between the harvesters and the proponent, whereby the latter funded an independent survey, or the two parties conducted a co-operative survey. There would be less need for standardization and co-ordination among surveys because the objectives would be limited and specific to each. Nonetheless, such surveys should meet the basic technical criteria that are outlined in the next section.

Assuming that a Native harvest survey is already underway in the affected region, there would be no need for an additional full-scale survey for impact assessment purposes. At most, a small-scale survey focusing on very specific issues might be useful.

Compensation. On the usefulness of harvest survey data for compensation, there appears to be a broad consensus in the North that incidents of loss of access to wildlife by Native harvesters resulting from development activities are sufficiently possible that some means of dealing with them should be in place in advance. Indeed, it seems likely that the documentation of Native harvests over the last decade through both the special purpose studies reviewed, as well as the NWT survey results, has contributed to the understanding and recognition of the importance of this issue.

Government, industry, and Native organizations alike have all prepared positions on wildlife compensation systems, and in some cases these have been negotiated among the various parties. At least one system has the force of law (the Inuvialuit Final Agreement -- section 13: Wildlife Compensation), and the GNWT has adopted a specific policy on compensation, although it is not and cannot be legally binding. As well, there are mutual agreements between developers and affected communities.

Despite the number of compensation systems or proposals on the record, none specify the required data base in other than the most general terms. All parties have acknowledged that harvest statistics could be useful in the event that development activity results directly in the loss or reduction of harvests. In the territorial North to date no such loss or reduction of harvest has occurred that has been directly attributable to a specific cause and party, and for which the party has either accepted (or been forced to accept) legal liability or volunteered ex gratia payment (although there have been cases in which developers have acknowledged liability for damage to the works or property of harvesters). No-one has yet stated precisely what information would be required, or in what form, in such an event. Fortunately, there has been no incident comparable to the one that occurred on the English and Winnipeg rivers in northwestern Ontario, which were closed to commercial fishing in 1970 as a result of mercury pollution. The outcome was the almost complete loss of the domestic, commercial, and sport fisheries by the Indian bands there. Fifteen years later, responsibility and compensation for these losses have not yet been resolved. Therefore, the use of Native harvest statistics for compensation purposes is somewhat speculative.

Data requirements may vary depending on whether the claimant has suffered a property loss or simply been injuriously affected, and whether the claimant is an individual or a group, such as an Indian band, a community, or a Hunters and Trappers' Association. Some industry representatives interviewed indicated that the data already available from the NWT surveys, or from government records, would be satisfactory for resolving foreseeable claims against their companies, whether by individuals or by groups. Considering the comprehensiveness of the GNWT Wildlife Service historical statistics, they should be compiled and interpreted for use as a data base, especially in view of their historical depth.

Although these statistics already provide an essential reference point for considering both impact and compensation, the authors have taken a more conservative view in considering the use of harvest data for compensation, on the assumption that at least some companies, or their legal counsel, would do the same if any substantial disagreement arose. Consider, for example, a situation not covered by specific prior agreement or legislation, in which mediation has failed, and the injured party resort of proof would be on the claimant, who would have to provide evidence not only of loss or hardship, but cause as well. Proof of loss would undoubtedly require evidence not only of actual harvests before and after the event, but also of effort. Even if the claimant were a group, it would have to provide such evidence for each of its members to justify the amount of the claim, possibly with precise geographical documentation as well, so as to be relatable to the alleged cause.

Such a level of recording detail has not been envisaged even by the biological or economic models, at least with respect to effort (including gear) and location. Only in one instance in the territorial North have such detailed records been obtained for hunter effort and success over a multi-year period, with specific reference to impact of this type: namely, the effects of possible seismic activity on fur trapping on Banks Island (Usher 1973). However, as no significant impact was detected in this instance, such evidence has never been tested in adversarial proceedings. Thus, the requirements for, and use of, such data remain speculation.

Effort data are also required in some scenarios of injurious affectation, when, rather than suffer a loss of income, the harvester expends greater effort to obtain equivalent harvests, because animals are fewer or are further away. Where costs have risen and returns stay the same, the harvester may still be entitled to compensation but harvest data alone will not be useful for evaluating it.

Another difference with the other models is that compensation, especially if it is likely to be paid to specifically affected individuals, requires that all affected harvesters be included in the survey. A sampling approach will not be adequate, because whereas total harvests may be projected from a sample of individual ones, for compensation purposes, the harvests of unsampled individuals cannot be inferred from either the records of other individuals or from community averages.

Thus, an effective system of compensation will depend more on the institutional arrangements for it than the quality or comprehensiveness of the data base, because without the former, no amount of data will bring victory, especially in a courtroom. If a mutually acceptable administrative system of compensating harvesters for their losses can be put in place, then the data requirements will become much clearer, and the data obtained by any one of the three models already described would probably suffice.

In any event, the issue of compensation must be seen in a broader context than simple proof of economic loss, at least as far as Native harvesters are concerned. It cannot be reduced to dollar value of harvests without reference to the broader issues of Native claims, where these have not yet been settled, and of the biological assessment of the environmental productivity of the affected area. Consequently, although harvest data are undoubtedly useful for compensation, they cannot alone solve this very complex problem.

Choosing the Models

The only one of the four models that has been tested, and shown capable of meeting its objectives, is the first; namely, levels of Native harvest. The others involve some significant difficulties that suggest they should not be tried on a wide scale without first experimenting with them. To some extent, the NWT surveys provide a basis for evaluating a few of the innovations required, and the indications are that some, at least, could be added on to the first model successfully.

Biological add-ons, and a limited level of mapping, are considered to be the most easily grafted to the first model, which is in large measure the JBNQ model. The socio-economic add-ons should be approached with great caution.

Any of the first three models can be effectively used for impact assessment, but the possibility of using harvest data gained through any of them for specific compensation claims, in the event of serious disagreement between parties, is very limited. Given the wide recognition of the problem that now exists among harvesters, they may be well advised to start keeping more extensive records of their own, on both catch and effort, or be prepared to have their activities vouched for by others in the community. Many Canadians have to do this if they want compensation; for example, taking pictures of and listing household effects for insurance purposes. Possibly the HTAs and similar organizations could play a role here. As well, the use of existing government records for compensation purposes, limited as it is, should not be ignored.

NEGOTIATING CONTROL AND DIRECTION OF SURVEYS

Control

The history of the JBNQ and BRIA surveys shows two approaches to control and ownership, each rational in the political context in which it occurs. If the organization seeks harvest data to assert a right unrecognized by other parties, then there is an adversarial and advocacy situation in which information is a weapon, and each side seeks to have better information than its opponent. That is why BRIA began with such a proprietary view of its project, and why some Native organizations that have not yet undertaken surveys feel the same way. However, if rights have already been recognized and enshrined in, for example, a claims settlement, as in Quebec and now in the Western Arctic, then it makes sense to undertake co-operative surveys in which the data base can be shared by all for common technical purposes.

In Quebec, the right to a guaranteed level of harvest had been established in law, but the problem was to determine what the level should be, based on the surveys. Depending on the claims settlement, crucial questions of access to resources, and perhaps especially controversial ones like migratory birds, or caribou, will have been settled, and harvesters will not feel so strongly that it is against their interests to reveal numbers. In effect their activities will have been made lawful, and protected by law, at which time there can be a common interest in management. In such an event, both the Native organization itself would have accomplished its political goals, and individual harvesters would find it in their own self-interest to participate in harvest surveys, knowing that by revealing data they will not undermine either their individual or collective rights.

Even though harvest data may be useful to the process, it may be unrealistic to expect a harvest survey to be initiated, designed, and controlled in the same way before the settlement of claims, as after. Thus it has been with the Inuit surveys, because they anticipated claims settlements rather than followed them. To some extent the KWF survey seems to be an exception, possibly because it originated in the context of the negotiations on the Wildlife Provisions of an Agreement-in-Principle,[1] so that there was an assumption (unwarranted in the outcome) that these questions had already

[1] NWA, AiP, 1981, Op. cit.

been resolved. As well, the establishment of the Caribou Management Board in 1982 placed the KWF in the position of generating data for a clear and immediate management objective. For those reasons, the HTAs probably felt appropriately involved in management and more confident of their ability to direct and use the data that their members were generating.

Consequently, although harvest surveys can proceed successfully prior to settlement of claims some basic issues must be resolved, or appear to be well on their way to resolution, before it is realistic to expect workable co-operation. Thus any Native organization thinking about getting involved in a harvest survey at this point will probably want to think very carefully about the political context in which it does so.

The co-operative model produces the best technical results, that are the most credible and useful to all parties, given a realistic basis for co-operation among them as equals. However, it is entirely possible for a Native organization or community to undertake a small-scale survey and to produce valid results fairly cheaply for its own limited purposes.

Organization

There are, in effect, three approaches to the organizational structure of a harvest survey. The best is the co-operative model along the JBNQ lines, which follows a claims or similar settlement, which uses sound technical procedures under intensive joint scrutiny, and which makes available not only summary tables but a data base, under mutually controlled circumstances.

The second approach is for a Native organization to undertake its own, simpler model, which would not necessarily produce unsatisfactory results. However, if technical credibility becomes a central issue, the money saved on the survey itself might have to be spent on subsequent negotiations or adversarial proceedings. On balance, although this option is feasible, Native organizations would be ill advised to undertake anything more ambitious in the way of a harvest survey on their own. Although a rudimentary survey might provide useful results for advocacy purposes, it would be less acceptable for management and allocation issues.

The third approach is best exemplified by the BRIA situation, in which a Native organization is placed in an employee capacity to give legitimacy to a survey that could not otherwise have taken place; in which the employers are continually critical of the results, having added a range of secondary tasks on to the project; and in which, by virtue of the contract, the Crown can determine the uses to be made of the data. The question of proprietary access to the raw data seems to have been given little attention, yet is often ambiguous and open to unforeseen consequences. Therefore, the authors recommend that all parties obtain legal opinions on the status of the data, under whatever arrangements they propose to enter in. The results to date are not necessarily any better than the second approach, but cost a lot more money, and, in the long run, may result in a negative reaction from harvesters and sponsoring agencies alike.

Access to Data

Assuming a co-operative approach, the question arises as to what should be made available to the parties, for there must be confidentiality of individual harvest reports. On the other hand, the summary reports and tables coming out of the existing NWT surveys to date do not adequately demonstrate the credibility and reliability of the results. Thus they are not necessarily as useful as possible for the several legitimate purposes that user agencies have in mind. There has to be some reasonable relationship between money spent and results achieved.

If a reasonable amount of relatively unprocessed data is made available to all parties, under the co-operative model, then they can interpret them as they please, but still be agreed on the basic numbers. What is a reasonable amount of data? One approach is to make the community spreadsheets available under strict controls, with names and identification deleted or masked. This approach would probably be more acceptable to harvesters if the survey did not include socio-economic data. Another approach would be to make available community totals, by reporting interval, of reported harvests, plus the necessary hunter file data, in aggregated form, so that each agency can make its own projections of total harvests, or at least be satisfied about the basis on which somebody else made those projections. This approach removes the technical questions of analysis from being the basis of criticizing the survey itself, and makes projections the user's responsibility. All that the study has to guarantee then is that the question of response bias has been reasonably dealt with, and that the basis of sampling has been made clear. That seems the minimal approach to making data available, and one

that all parties should be able to live with. For harvesters and Native organizations in particular, that may be an entirely reasonable tradeoff for ensuring the general credibility and acceptability of the surveys.

Third party access to bona fide researchers could be determined on the merits of each application, based on pre-established guidelines, as a matter of good will and credibility, and to encourage independent verification of survey results. All these matters should be negotiated to the mutual satisfaction of the parties before embarking on, or perhaps even continuing with, harvest surveys of the current model.

Funding

The JBNQ funding formula must be seen as peculiar to the circumstances of northern Quebec. Development was essentially the monopoly of two public corporations, and the proposals in question were the direct, and indeed virtually the sole, impetus to the settlement of Native claims. In the territorial North, many companies, most of them private, operate in a wide variety of circumstances, and the question of Native claims can no longer be seen as a consequence of the particular actions of a single industry.

Having established that harvest surveys along the recommended lines are primarily to resolve issues outstanding between governments and Native peoples, and to provide data for management on a periodic or possibly continuing basis, it follows that industry should not be responsible for paying for these surveys. However, industry should have the independent means to satisfy itself of the reliability of these data where needed, and it should be assured that the surveys are producing results of reasonable quality. This could be effected by co-operating on a more informal basis, and by ensuring that the appropriate industry personnel are reasonably aware of how the surveys are being done. Some companies may already have a good sense of this at the local level where they have field operations. If industry is asked to provide technical advice, it should do so on an agreed basis, but industry should not press for that.

In view of the special requirements for impact assessment and compensation, perhaps industry would want to, or should be required to, undertake special surveys in project impact areas, in co-operation with the affected communities. Government agencies would become involved in the design and administration of such surveys only if the two parties so requested.

DISCUSSION OF, AND RECOMMENDATIONS ON, TECHNICAL ISSUES

Assuming that harvest statistics will continue to be collected by survey, this section focuses on the best methods of doing this. The assumption is made also that these surveys will be done on a co-operative basis, if for no other reason than that harvesters themselves are the ultimate source of the statistics, so that if they do not choose to participate, then there will be no surveys. Depending on what levels of effort the participants choose to devote to these surveys, or what level of funding might be obtained, there is a range of options suited to various levels of effort.

In the following sections, the authors make recommendations based on the detail provided in the earlier chapters, but these are not intended as a detailed blueprint which all future surveys should follow. They believe that the present regional approach to harvest surveys is a good one, and that many of the administrative and methodological details should properly be left to each regional survey to work out. Nonetheless, if harvest statistics are going to be used for public purposes (and that seems both inevitable and desirable), then they are going to have to meet certain commonly accepted standards. This study is intended to serve as a standard technical reference manual for those who undertake harvest surveys, and recommendations are made first, for the basic design criteria for individual projects, secondly, for specific technical problems related to surveys and their interpretation, and finally, for the co-ordination of surveys across the North.

PROJECT DESIGN

Scope and Duration of Surveys

The regional organization of harvest surveys, consistent since the original JBNQ surveys, has proven both appropriate for survey objectives, and practical for management and administration. The authors recommend that the practice continue. Full coverage of the Northwest Territories would probably involve an additional Inuit survey in the western Arctic, and at least three in the Mackenzie Valley (for example, Great Slave, Central Mackenzie, and Delta). There would presumably have to be a regional breakdown in the Yukon as well if surveys are begun there.

The appropriate duration of harvest surveys is a function of whether they are for specific and finite purposes such as determining allocation levels or providing a data base for impact assessment or compensation, or whether they are for continuing resource or economic management needs.

Whatever the purpose, the surveys should run for four or five years at minimum, to account for natural environmental variations, relevant life history parameters, or local variations in harvesting effort for social and economic reasons. This time may vary from region to region: for example, while Arctic fur-bearer cycles tend to be about four years, the Subarctic cycle is more like 9 to 11 years. Certainly the harvest surveys in the Subarctic do not have to run for that length of time, but these factors must be adequately accounted for in interpreting the results.

The four- to five- year minimum does not include the "Phase I" or pilot stage that has been absent from the NWT surveys but which the authors recommend. One reason for not exceeding five years is that it seems unlikely that the surveys can be sustained at full coverage much beyond this, on a regional scale. There needs to be some clear purpose that people can identify with for participating. The authors are not convinced that people can be persuaded to participate in full-coverage surveys indefinitely for management purposes, however much one might think they should be so motivated. Thus it may not be possible to design a continuing data-gathering system for management purposes on the basis of the present JBNQ and NWT model.

In any event, there should be a major re-evaluation of the surveys after no more than five years. This re-evaluation should consider not only the technical results of the surveys and the prevailing data needs of users, but the attitudes of Native harvesters toward these surveys and the basis on which they might at that time be willing to continue participating in some kind of modified survey.

Possibly in some regions at least, the use of self-administered questionnaires on a sample basis might be feasible, more along the lines of conventional mass harvest surveys such as the National Harvest Survey for waterfowl. Once the shorter-term concerns have been taken care of, such as negotiating claims and allocations pursuant to them, establishing a data base for impact assessment and compensation, and involving harvesters in a co-operative management system by means of harvest surveys, then perhaps harvester attitudes to harvest surveys will be quite different. (Admittedly it may be unduly optimistic to suppose

that this can happen in a five-year period.) It may be that increasing familiarity with survey research, to say nothing of the growing incidence of informant fatigue, would cause many harvesters to look very favourably on the prospect of a continuing survey that is greatly reduced in scope and coverage.

Pilot Phase

A key problem identified earlier was that the NWT surveys have proceeded, wrongly, as though a satisfactory working model was in hand and needed only to be implemented in their particular region without further review or refinement. None of the NWT surveys have employed the two-stage design that was used in the JBNQ surveys. The first year of the BRIA survey in 1980 represented more of a start-up period in which administrative and field-operation bugs were ironed out. To date, no results have been produced for that year, yet neither were the basic flaws of the project corrected.

Any major survey should be preceded by a preliminary phase consisting of a review of all existing data sources and an experimental design trial, in effect, the equivalent of "Phase I" in the JBNQ surveys. The Northwest Territories has a unique resource unavailable in any other jurisdiction, which is the very long set of GHL returns and export permit returns. They provide a basis both for establishing some key parameters of the survey and for linking historic harvests of at least fur-bearers and big game to a new data series obtained through surveys. The identification and resolution of common methodological problems among regional surveys should also be a part of this initial phase. The extension of harvest surveys to new areas in the Northwest Territories and Yukon would require substantial modification to any of the existing models because of the very different environmental and cultural circumstances in which they would be operating.

Funding and Budgeting

It would be inappropriate to recommend specific levels of funding, however, comment can be made on present budgets. The fact that current models of harvest surveys are costing $100-200 per harvester per year suggests that they are not appropriate models for a permanent system of collecting management-type data. This cost level seems justified only for finite surveys with a specific purpose, such as obtaining a five-year data run for allocation purposes for all communities, or for specific management problems like dealing with a caribou crisis or designing a hunter support program, in which case there can be geographic and time restrictions on the survey.

For the existing model, there are no significant opportunities for cutting costs. Given the small size of most communities, the relatively large samples that are required to ensure valid projection estimates, and the relatively small proportion of the budgets that is actually devoted to collection of field data, only minimal savings can be achieved through a sampling rather than a census approach. However, there should be some additions to the budgets. First, more money should be devoted to project design and peer review. More time spent in designing the NWT surveys at the outset, and a continuing system of progress review, would have saved much money and grief, and produced a much more useful and useable product. Secondly, more money should be devoted to presentation and publication, and especially to getting the results back in a form useful to both user agencies and the communities. Thirdly, salaries for field-workers and co-ordinators should be increased commensurate with a more regular job status rather than piece work.

As for sources of funding, if the participants are to have anything approaching equal status in controlling the surveys, then each should contribute to it from their own funds. This was the case in the JBNQ surveys, although, in the case of the Native organizations, it seems a more likely development after claims are settled than before. This problem should not be insurmountable.

Alternatively, if Native organizations decide to go it alone, then funding independent of government, or from internal sources, is essential. Either there must be no strings attached, other than technical criteria, as in a foundation grant, or they must buy control by contributing funds. The present relationship is inappropriate.

Whatever the arrangement, it is essential to ensure continuity of funding for the life of the project, and to ensure that funds are actually forwarded on schedule. Failure in this regard results in high staff turnover, low project morale, interruptions in data flow, and lower-quality data.

Organization and Steering Committee

Assuming a co-operative study, the authors recommend the establishment of a steering committee along the lines of the JBNQ model, that is primarily a technical steering committee. The government representatives on it should not be defending their particular agency's administrative or policy interests, they should be there as technical experts who are ensuring quality control of the product. Thus, they have a

responsibility not only to critically review the progress of the survey, but also to provide the expertise they have in assistance to the project. By the same token, the Native representatives cannot expect to retain sole control of the technical direction of the survey, nor can they refuse access to the data to the other steering committee members.

Staffing and Community Relations

More effort should be directed to implementing the principle of involving local hunters in the actual design and review of the surveys, not just as low-level technicians in employment. As well, careful thought should be given to the relationship of community field-workers to the whole project. There must be adequate liaison with head office staff, and with the progress of the project as a whole. A greater use of the telephone, including conference calls, could help to keep field people in constant touch with the project (and possibly could reduce travel costs). Experience in Native organizations has shown that the field-worker's job is a difficult one to sustain in isolation. Consequently, the purpose of frequent contact must not be simply to keep after them for their interview data, but to build esprit de corps and identification with the project.

Perhaps there needs to be a middle level of field co-ordinators who have a greater responsibility than just the routine gathering of data. These people would be expected to provide their own professional evaluation of the data they are getting, and of how things are going in general, as would a trained social scientist. Qualifications akin to those of individuals graduating from the Thebacha College Renewable Resource Technology Program in Fort Smith might be appropriate. As well, there would have to be a strong commitment to on-the-job training and to minimizing turnover.

So far, only KWF approaches the desirable standard of getting results back to the HTAs. Theirs is the only report that has been translated, yet that should be integral to each project. However, it is not enough to send data back, **there should be annual meetings in each community at which the results are presented to, discussed with, and interpreted for (and by) the members at large. The Inuit Land Use and Occupancy project procedures provide an appropriate model.** Although it is probably too late to do this now with the early BRIA data, perhaps it could still be done with results from the previous year or two.

With respect to professional staffing, there should be much more provision for use of outside expertise on a short-term consulting basis. It is unreasonable to expect a small staff to have all the necessary skills in the social and biological sciences, as well as in the computer processing of data. In the NWT surveys, the professional staff have had almost exclusively biological training and experience, which alone are insufficient for the task. Nor can it be expected of steering committee members to do more than attend meetings and review materials occasionally, unless the organization they represent seconds them to the project on an as-needed basis.

Data Management

A harvest survey produces not only a final report and a few tables, but also the millions of data generated during the survey. How these data are to be entered, retained, and controlled for use by the project and its sponsors, and for release to others should be determined before the survey begins, not as an afterthought. Again the JBNQ surveys provide the model, in principle if not in specifics. No time is too soon for the existing or proposed surveys to resolve these issues.

Data Processing and Analysis

An important difference between the JBNQ and NWT surveys, as a consequence of rapid technological development, is that the JBNQ data were processed on mainframe computers in the South, whereas the NWT data (except for the first year of the BRIA survey), have been processed on microcomputers at project headquarters in the North. The key benefits of this are, or could be, much greater local involvement in, and control over, what is going on, as well as an excellent learning and training opportunity for local people not only in the use of microcomputers, but also in techniques of data management and processing. These fields are evolving very rapidly, however, and the BRIA experience illustrates the problems created by getting locked into inadequate software. Therefore more expertise needs to be made available to the projects locally.

The existing study plans and budgets constitute continuing mechanisms to gather data rather than to analyse it. For the data to be worth getting in the first place, the analysis cannot be simply an afterthought. It appears, especially in the case of BRIA, that because there was a continuous data flow, there was never time to step back and to think about what was coming in and then to analyse it in a considered and useful way.

A project director can hardly do an effective job of both administering the survey and writing up the results if inadequate arrangements were made at the outset. Many researchers find it necessary to plan for two days in the office for every day in the field, or twice as long to analyse data and prepare a report, than it took to gather the data. **There must be greater recognition that adequate analysis of data is time consuming, and so must be planned for and built in to project designs and budgets.**

Format and Presentation of Results

Every survey should prepare a detailed technical report on methodology to accompany its annual summary tables. It is, perhaps, unnecessary that each survey produce a report equivalent in bulk to the final Cree volume (811 pages), but of the NWT surveys, only the KWF report begins to approach the desirable technical standard. Sloppily prepared and poorly presented technical reports serve only to undermine the credibility of the surveys, which, in view of the money and effort that have gone into these surveys, is inexcusable.

Continued funding for a survey project should depend on the timely and adequate delivery of a product, and the chief advantage of the current contract arrangements with BRIA and KWF is to make this connection clear. However, it is also necessary to build in both a commitment and a budget to publish the survey results to reasonable standards. **There should be an external review process for publication, certainly of the project methodological report if not of each year's tabulations.** If there are no such provisions, there will be less incentive for the project director to prepare a high-quality report.

SURVEY DESIGN

Survey Targets

Essential to survey design is the definition of survey targets. Thus, the definitions of what is a harvester and what is harvest are necessarily functions of the choice of survey model as outlined previously. These definitions have clear implications for the study design, the acceptability of the survey to harvesters, the form and quality of the data that come in, and for the subsequent use of the results. Thus, they cannot be left solely to the technical staff to work out, nor

can they be left to the discretion of the field-workers themselves, since they may have idiosyncratic views about who is a hunter and who is a member of the community, which are thus subject to change whenever a new field-worker replaces an old one.

Having defined the population about which the survey seeks to draw conclusions, it is then necessary to determine its size. Whether a census or sampling approach is employed, only a sample (whether random or fortuitous) will be drawn. To project estimated totals from reported harvests for a finite population, it is necessary to know the size of the finite population.

At the start of every survey, and every so often thereafter if the study continues on a regular basis, master lists must be drawn up in each community of who is potentially in the survey. This job is not large for someone who knows the community well, for there are very few communities with more than 100 households or 200 hunters. It does, however, require a careful evaluation of the materials used, and a consistently applied method. If lists such as GHL holders are to be used, they must be verified independently. In most communities, it should be possible to draw up a complete list of households and their membership, and to identify those meeting the criteria for inclusion in the survey. When a survey continues over time, a clear procedure is required for updating the community lists, and for accurately tracking the entry and exit of age cohorts. It must also be decided whether reporting is to be done on an individual or household basis. In sum, the criteria and methods for defining and tracking the population must be made clear to field-workers, survey respondents, and readers of survey reports alike.

If surveys are extended to Yellowknife and Whitehorse, it may be necessary to develop new methods for determining and sampling a population in such large centres. Unfortunately the existing NWT survey reports say practically nothing about the problems which must have been encountered in the large communities of Frobisher Bay and Rankin Inlet.

Sampling Strategy

The authors recommend a census approach, rather than a minimum sampling strategy, for at least the first five years of any survey, except possibly in the largest centres such as Yellowknife. However, under existing circumstances, the census approach in fact produces a sampling result.

It is therefore essential that the issue of sample representativeness be addressed, because there is a strong possibility that harvests are not normally distributed among harvesters. Such is the case in two typical communities, one Inuit and the other Dene, for which the authors obtained data by individual harvester (see Appendix C), and Finley and Miller (1980) discovered the same tendency in three North Baffin communities. Historically, the harvests of Native households in any community may have been normally distributed, but there is a growing tendency for a few harvesters to account for the bulk of the harvest of any species in any region. Consequently, the possibility of error resulting from sampling bias will likely increase in future harvest surveys.

Variability in hunter success was investigated in two communities in the Northwest Territories as part of an experiment in sampling strategies for this project undertaken by Smith, Patterson, and White (see Appendix C). Their distribution plots (Figures C.2 and C.3) of harvest data showed that specialization of harvest by species is occurring in these communities, and that a few harvesters are probably taking a substantial proportion of the total harvest of any one species. This specialization occurs to a lesser degree with respect to total edible weight of harvest. The two communities in question were selected on the basis of the availability of data rather than their representativeness, but the authors have no reason to believe that they are atypical in this regard. However, some harvest distribution plots by Graf (1984) suggest that high variance is not always the case. It is thus necessary to verify the situation in each community before drawing any conclusions about the representativeness of any sample therefrom.

The analysis further demonstrated that stratification on the basis of hunter specialization can reduce the standard error of estimate considerably. However, a sample representative for the harvest of one species will not necessarily be representative for another species, which is the risk of adding more variables to the surveys. A pilot project during the first phase of a harvest survey, on the model of the JBNQ method, would allow for the testing of sampling methodologies. Despite any implied claims to the contrary, none of the NWT surveys has yet properly addressed the crucial issue of sample size and representativeness.

The question therefore arises as to whether the surveys should continue to use a fortuitous sample, albeit a large one, or whether some other strategy should be considered. Because there is a strong possibility that harvest quantities are not normally distributed among harvesters, failure to ensure

adequate coverage of the few top harvesters in any community may seriously bias the results. **It is therefore necessary, through some preliminary investigation, to determine the pattern of distribution and variance, and to sample on that basis.**

Stratification on the basis of hunter activity or success levels (see Appendix C), requires a preliminary phase to the survey, in which the top hunters are identified by some means. If the survey extends over a number of years, the basis for stratification must be periodically re-established. These requirements may be relaxed if only the total weight of the harvest is sought (e.g., for economic analysis). However, the evidence available suggests that no such relaxation is appropriate if the objective is to obtain species-specific management data.

For every harvest survey project that continues beyond the initial five years of comprehensive data collection, there should be a re-evaluation of the sampling strategy. Shifting to a minimum sampling approach should be carefully considered. The possible advantages would include reduced costs and response burden, or alternatively, the possibility of a more intensive survey of those included in the sample. The disadvantages would include the need for substantially greater rigour in survey design and interpretation. Unless corrected, the methodological sloppiness and imprecision identified in the existing surveys would merely compound the unreliability of their results if such a sampling approach were used.

Whatever strategy is adopted, it is essential that the survey reports clearly state the method by which the sample is chosen, and what it represents.

Reporting Frequency

The monthly reporting system has certain advantages in that it provides data useful for management, reduces the recall period and the need for recording aids, and maintains the profile of the survey in the communities (this last is only an advantage as long as people continue to identify with the purposes of the survey).

A significant disadvantage of the monthly reporting system is that the data flow is increased by twelvefold over the year, which increases both the response burden and the office burden. Thus, if a monthly system is used, it becomes essential to maintain a hunter participation file, linked to the harvest file, to track respondents throughout the year to

ensure continuity of the sample, and to increase the accuracy of the projection method. In this way the problems that BRIA seems to have run into can be avoided.

The monthly reporting system is disturbing in that it requires all adult males (and some females) to report, and data to be maintained on, their activities each month in a manner unparalleled by any other group of Canadian citizens except perhaps paroled criminals. How then can the original data sheets be retained, and the computer entries be sufficiently masked for personal identity, especially in small communities, so as not to jeopardize the confidentiality of individual information that will in all likelihood have to be guaranteed to harvesters to secure their co-operation. The authors are not convinced that local projects can maintain the desired level of security over the long run. **To adhere to the ethical requirement of informed consent in administering social surveys (ACND 1978), harvesters must be made fully aware of these problems before they participate in surveys that require monthly reporting.**

An alternative to the monthly reporting system might be to improve on the JBNQ annual reporting system, which depended on periodic recording assistance by the field-workers so as to ensure the production, at the end of each year, by each harvester, of a complete harvest record. A monthly or similar periodic breakdown of the record could be included in this annual record without necessarily requiring an accounting of activity by month.

Non-response Bias

Non-response bias has to date been an inconsequential factor in harvest surveys, because so few individuals have refused to be interviewed. However, it could increase in some communities, and would be especially important if there were a shift to a minimum sampling strategy. **Non-response should be continually monitored, and the survey reports must explicitly demonstrate either that it is not a factor, or that it is appropriately compensated for.**

Response Bias

Strategic response bias cannot be eliminated by technical methods, because it is a function of how the respondents perceive the survey and how they believe its results may affect their interests. Ideally, there should be a sufficient variety of incentives to respond accurately (and enough disincentives

to mislead), that there is no unambiguous advantage in systematic bias. This "climate" is primarily determined by the political context in which the survey occurs. It is necessary to be explicit about these factors in the survey reports, so that readers can be assured either that response bias was not a systematic factor or that it was properly accounted for.

Geographic Location

No single system of locating hunter success seems suitable for all species, nor is there a demonstrated need for locating the harvests of all species, especially on a continuing basis. Consequently, it appears necessary only to develop an appropriate system for a few key species.

The determination of these key species, and the most appropriate means of locating their harvests, can, to some extent, be left to local discretion. However, there is a clear need to co-ordinate between regions that share common management problems. For example, the various Dene and Inuit regional surveys should have a common, or at least comparable, system for recording caribou harvests within the herds they use in common.

The NWT surveys have already adopted, or are in the process of adopting, different and probably incompatible systems for recording harvest locations. These systems will be difficult to change once fully implemented, which reinforces the need for an overall co-ordinating body to vet such local initiatives.

Before incorporating any elaborate geographical recording system directly into a harvest questionnaire, alternative sources of information should be thoroughly explored. These sources might include already recorded land-use data, periodic updates of same in co-operation with the HTAs or Band Councils, and, if harvesters and biologists can agree on life histories of the species or populations in question, reliance on harvester identification of these. A careful examination of the requirements for locational data may show that it is land-use data, or species identification, that users really require, and not kill locations as such. It must be clearly understood, especially with respect to land-use issues, that to map hunter success (location of kills), is not necessarily to map Native land use, and certainly not to identify special or important areas in which Native harvesters have an interest.

Supplementary Biological Data

Without jeopardizing the primary objective of quantifying the harvest, it is feasible to obtain data on such matters as sex and basic age classifications, at least for big game and marine mammals. To minimize response burden and resistance, it may be appropriate to gather these data on a sub-sampling basis or for occasional communities and years. It may also be feasible to add on the collection of biological samples on a paid but limited basis, as is sometimes done with recreational harvesters in other jurisdictions. However, such matters as loss, crippling, and retrieval rates should be identified through separate surveys as is already done. It is generally agreed that such information is not reliably obtained through recall surveys.

Effort Data

It is essential to be precise about what is meant by effort, e.g., gear and time, participation, or expenditure, and the purpose for which effort data are to be collected. In most cases, these measures are not well developed, and, hence, careful technical consideration should be given to the problem before including effort items in the survey questionnaire.

It may be even better, however, to get effort data separately through independent surveys, as has commonly been done in the past. Gear surveys need only be done every few years, and a substantial amount of data on purchases and expenditures can be obtained through retailers rather than from individual harvesters themselves, or at least as a cross-check to individual reporting. For most purposes, what is important are community totals, or estimates of the operating and maintenance costs of "typical" outfits.

Such information need not even be obtained for every community as a few representative communities may suffice. There is no need to include gear and expenditure questions on a harvest survey, most especially not if it is administered monthly, as more reliable data can be obtained by other methods.

As for the need for effort data in individual compensation cases, it is probably necessary for harvesters to keep their own documentation, independently of harvest surveys. That is particularly important for those harvesters not included in census or survey coverage. Whatever information is collected on effort by harvest surveys will be more useful for developing mitigating or corrective measures than for individual compensation.

Socio-economic Data

The authors recommend strongly against the inclusion of such socio-economic questions as employment, income, or household composition on the same survey instrument or as part of the same survey process. Their chief reasons are the undue response burden it would impose on harvesters, thus jeopardizing the primary objectives of the survey; the risk that the specific variables sought and especially their linkage among files might pose what many harvesters might see as an unacceptable invasion of privacy; and the sheer cost and complexity of managing the resulting data base.

In the past, reliable information has been obtained through special studies in individual communities, and this tradition should be maintained in preference to trying to obtain it through the blunt instrument of a general survey. Participant observation combined with extensive, open-ended interviews over a long period has been shown repeatedly to be a superior method of undertaking research in small communities. This method has the advantage, for the community itself (under current NWT legislation), of requiring the researcher to state the objectives, nature, method, and uses of the study, and to obtain formal permission from the community. Whether such research is done by senior scholars, graduate students, or trained local people, it would almost certainly be more cost effective and productive than trying to add it on to harvest surveys.

SURVEY PROGRAM NORTH OF 60°

Co-ordination of Surveys

Generally, it is important that survey design and administration be in keeping with local practices and concepts to encourage participation and to avoid misleading or ambiguous questions or procedures that would reduce the precision of the responses. At the same time, however, if the surveys are to be Territory wide, there must be some means of comparing results, especially for overlapping species or populations. There should be provision for all of the regional studies to co-operate on issues of mutual importance.

This suggests the need to establish an overall co-ordinating body, on which all of the regional surveys would be represented. This body should, among other things:

- be constituted and funded independently of the regional surveys;

- hold periodic technical and progress workshops, at which methodological issues are discussed and mutually agreeable solutions are worked out (these workshops should not, however, be seen as merely an in-house operation by the financial sponsors);

- have the same access to independent advice as the individual surveys; and

- have the authority to co-ordinate key technical criteria and procedures so as to ensure inter-survey comparability, and in particular to review and approve the design of new projects or components, and the technical results of established ones.

It is entirely inappropriate that each survey should devise its methodology on an ad hoc basis, with minimal reference to either the very substantial literature available, or the practices of neighbouring surveys. Both the institutional arrangements and adequate funding for such a body, or at least a series of workshops that it would conduct, should be worked out in advance of new surveys.

Continuation of Surveys in Progress

Currently three surveys are in progress, with the oldest being now in its fifth year. Three or more new surveys could begin in the next few years. Assuming a five-year life span for each, some would be completed before others have even started.

Since some regions are much more advanced than others with respect to harvest surveys, yet there have been significant problems with the results, one possibility is to treat all existing surveys and their results as part of Phase I. There could even be a temporary hiatus in regional surveys in the eastern Arctic, most especially in the Baffin region, where the survey is in its fifth year and is surely due for major re-evaluation. After two or three years, the various regions would be on a more equal footing, and it would be easier to implement and evaluate harvest surveys simultaneously and comparatively on a territory-wide basis.

Short of this, a two-phase approach should nonetheless be incorporated into all new regional surveys. If the existing surveys continue without a break, a substantial effort should be made to salvage and analyse the mass of existing data that has not been effectively used. A salvage endeavour of this type would be useful both for modifying the future development of the present surveys and for obtaining better value for the money that has already been spent on those surveys. Indeed, in comparison to the roughly $1.5 million already spent, only a small additional investment would be required to provide a much fuller and more useful set of data. As present budget and staffing arrangements clearly do not allow for an adequate salvage operation on an in-house basis, this should be contracted out. A steering committee structure would ensure results satisfactory to all parties. However, strict controls on the use and dissemination of data would have to be arranged in advance with representatives of the hunters and trappers who have participated in the surveys to date.

APPENDIX A

THE INTERVIEWS

During the course of this project, Usher, Wenzel, and DeLancey interviewed the individuals listed in Table A1, using the relevant sections of the interview guide. These individuals included representatives of organizations that currently sponsor or use Native harvest surveys in the Northwest Territories and Yukon, or which propose to do so; representatives of organizations actually conducting harvest surveys in the Territories; and independent individuals (usually harvesters themselves or scientists familiar with harvest and related surveys) in the Territories. As well, a few other individuals with special interests in harvest surveys outside the Territories (chiefly in Quebec and Labrador) were interviewed.

The list in Table A1 is ordered by date of interview. The name of the person or persons (on some occasions, several representatives of the same organizations were interviewed at once) is given, followed by the name and location of their organization, or if independent, their status. This is followed by an affiliation:

Govt	government
Insty	industry
Nat	Native organization
Local	local govt. e.g., hamlet or settlement council
NGO	other non-government organization
HSP	harvest survey project
Ind	independent

TABLE A1

List of individuals interviewed between May and October, 1984

Name	Organization	Location	Affiliation
H. Myers	GNWT Ren.Res.	Yellowknife	Govt
R. Peet	DFO	Winnipeg	Govt
R. Cole	CWS	Yellowknife	Govt
M. Fisher	Esso	Calgary	Insty
R. Quaife			
C. Sikstrom			
G. Leitch	Petro-Canada	Calgary	Insty
R. Cattenach	Dome	Calgary	Insty
D. Lang			
D. Molstad			
J. Ward			
B. Hubert	consultant	Yellowknife	Ind
R. Binne	GNWT Ren.Res.	Cambridge Bay	Govt
K. Jingfors	GNWT Ren.Res.	Cambridge Bay	HSP
S. Naylor	KIA	Cambridge Bay	Nat
L. Jones	GNWT Ren.Res.	Cambridge Bay	Govt
H. Maksaga	KHTA	Cambridge Bay	HSP
R. Schweinsberg	GNWT Ren.Res.	Yellowknife	Govt
D. Dowler	DFO	Yellowknife	Govt
R. McSkimming	Gulf	Calgary	Insty
R. Morrison			
L. Callow			
A. Elias	Holman HTA	Holman	NGO
I. Aleekuk	Holman Council	Holman	Local
R. Ames	TFN	Ottawa	Nat
F. McFarland	DIAND	Ottawa	Govt
G. Robins	DFO	Ottawa	Govt
G. Abrahamson	DIAND	Ottawa	Govt
D. Bissett	DIAND	Ottawa	Govt
D. Saigaonkar			
F. Hill			
B. Myers			
R. Stirling			
S. Curtis	CWS	Ottawa	Govt
R. Bell	GNWT Ren.Res.	Yellowknife	Govt
R. Farnell	Yukon Ren.Res.	Whitehorse	Govt
H. Jessop			
V. Mitander	CYI	Whitehorse	Nat
H. Dick			
S. Gaunt			
G. Grady			
J. Jacquot			

TABLE A1 (Cont'd)

Name	Organization	Location	Affiliation
A. James			
G. Smith			
P. Green	COPE	Inuvik	Nat
W. Kowalzyk	DFO	Inuvik	Govt
V. Gillman			
F. Wolki	Tuk. HTA	Tuktoyaktuk	NGO
E. Henderson			
F. Pokiak			
Dn. Raddi			
Db. Raddi			
V. Steen			
A. Voudrach			
A. Redshaw	DIAND	Yellowknife	Govt
S. Raddi	Inuvik HTA	Inuvik	NGO
J. Blake	MDRC	Ft. McPherson	Nat
J. Charlie		Ft. McPherson	
C. Snowshoe		Ft. McPherson	
J. Wilson		Ft. McPherson	
F. Greenland		Aklavik	
E. Pascal		Aklavik	
R. Clarke		Arctic Red R.	
A. Norbert		Arctic Red R.	
N. Norbert		Arctic Red R.	
P. Benoit		Inuvik	
C. McCauley		Inuvik	
J. Pattimore	BRIA	Frobisher	HSP
S. Arnatsiak			
M. Ferguson	GNWT Ren.Res.	Frobisher	Govt
J. Ell	harvesters	Frobisher	Ind
B. Ell			
J. Sakiasse	Parks Canada	Pangnirtung	Govt
T. Eevic	BRIA	Pangnirtung	Nat
D. Eevic	harvester	Pangnirtung	Ind
J. Kilabuk	harvesters	Pangnirtung	Ind
R. Kilabuk			
M. Wilson			
W. Ferre	GNWT Ren.Res.	Pangnirtung	Govt
R. Wooley	GNWT Ren.Res.	Frobisher	Govt
J. Shaefer	NWT HTF	Fort Smith	NGO
J. Mauro	MDRC	Inuvik	Nat
E. Palituq	BRIA	Clyde	HSP
J. Japoody	BRIA	Clyde	HSP
J. Tigulliraq	GNWT Ren.Res.	Clyde	Govt
A. Anggasik	Clyde HTA	Clyde	NGO

TABLE A1 (Cont'd)

Name	Organization	Location	Affiliation
M. Audlakiak			
A. Iqaqqialuq			
J. Illauq			
J. Sanguya			
A. Tigulliraq			
N. Cournoyea	GNWT Ren.Res.	Yellowknife	Govt
K. Spence	NWT Métis As.	Yellowknife	Nat
P. Nahanni	Dene/Métis Sc.	Yellowknife	Nat
R. Overvold	Dene/Métis Sc.	Yellowknife	Nat
M. Wallus	So. Slave DIZ	Fort Smith	NGO
J. Japuty	harvesters	Clyde	Ind
A. Kautuk			
S. Palituq			
J. Qillaq			
D. Japoody	Clyde Council	Clyde	Local
M. Qillaq	harvester	Pond Inlet	Ind
J. Tongak	GNWT Ren.Res.	Pond Inlet	Govt
E. Mitchell	DFO	Montreal	Govt
R. Reeves			
J. Theriault	DIAND	Frobisher	Govt
K. Taylor	Polar Gas	Toronto	Insty
L. GAmble	KWF	Rankin INlet	HSP
B. Threadkill	GNWT.Econ.Dev.	Rankin Inlet	Govt
J. Barnaby	Dene Nation	Yellowknife	Nat
P. Scott	Deh Cho	Ft. Simpson	NGO
R. Spaulding	De/Mé Sect.	Yellowknife	Nat
S. Smith	researcher	Ft.Good Hope	Ind
G. Barnaby	FGH Council	Ft.Good Hope	Local
E. Grandjambe			
M. Mackey	researcher	Montreal	Ind
G. Finney	CWS	Ottawa	Govt
F. Filion	CWS	Ottawa	Govt
J. Donaldson	BRIA*	Boston	HSP*
J. Rowell	LIA	Nain	Nat
H. Feit	JBNQ*	Hamilton	HSP*
J. Fall	Alaska Dept.	Anchorage	Govt
R. Wolfe	Fish & Game		

The following interview conducted in connection with an earlier project was also used:

W. Kemp	Makivik	Montreal	HSP

* Former position or status.

TABLE A1 (Cont'd)

Additional information was obtained for this project in conversations with the following individuals:

R. Bergeron	DIAND - Northern Research (Ottawa)
K. Crowe	DIAND - Office of Native Claims (Ottawa)
R. Graf	GNWT Ren. Res. (Yellowknife)
A. Haller	DIAND - Northern Research (Ottawa)
M. Hoefs	Yukon Ren. Res. (Whitehorse)
W. Johnson	DIAND - Office of Native Claims (Ottawa)
D. Langille	Thebacha College (Fort Smith)
D. Moll	DIAND (Yellowknife)
H. Monagran	GNWT Ren. Res. (Yellowknife)
D. Pollock	CWS (Ottawa)
P. Richard	DFO (Winnipeg)
T. Strong	DFO (Winnipeg)
N. Weeks	COPE* (Ottawa)
S. Wendt	CWS (Ottawa)

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* Former position or status.

Abbreviations of non-government organizations, in the order they appear in the table above:

KIA	Kitikmeot Inuit Association
KHTA	Kitikmeot Hunters and Trappers Association
TFN	Tungivuk Federation of Nunavut
CYI	Council for Yukon Indians
MDRC	Mackenzie Delta Regional Council
BRIA	Baffin Region Inuit Association
NWTHTF	Northwest Territories Hunters and Trappers Association
So.Slave DIZ	South Slave Development Ipact Zone Group
KWF	Keewatin Wildlife Federation
Deh Cho	Deh Cho Regional Council
De/Me Sect.	Dene-Metis Negotiations Secretariat
LIA	Labrador Inuit Association
Makivik	Makivik Corporation

Interviews were conducted with the aid of an interview guide devised at the beginning of the project. It was intended to provide a qualitative information base with which to analyse user needs and experience with respect to Native harvest surveys. The questions were framed so as to provide information to respondents when necessary, as a means of guiding the interviews, because many of those interviewed were not fully familiar with the range of issues covered.

Neither the questions themselves, nor the selection of respondents, were designed to elicit "value-free" or "unbiased" responses, consequently, a guided but open-ended interview format was chosen in preference to a pre-set or standardized questionnaire. Where feasible and appropriate, the interview guide was sent to respondents for their consideration in advance of the interview. As the intention was to get information from knowledgeable individuals, rather than sample a larger population, no quantitative tabulations or correlations of interview results were attempted.

The interview guide follows.

Part One - General

1. What do you understand by the term "harvest study"?

Note: our basic definition is the total harvest, by species, of a defined set of harvesters (usually by community), over a set period of time (usually a year), in a specific area (usually assumed to be the traditional land use areas of the community). There are, however, essentially 3 types of harvest data:

1 - based on govt. records, often limited to fur trade records and estimates of big game kills.

2 - one-time surveys based on harvester recall, usually over a single year.

3 - continuing surveys which involve regular and frequent recording of the entire harvest of every hunter in every community over a broad area.

This study is concerned especially with the last type, which for convenience is referred to as global harvest surveys in this interview guide.

2. What is your interest in Native harvest statistics, and what objectives of your organization are or might be served by harvest survey results (or by the process of collecting these data)? What would you use these data for?

   Note - chief possible uses include
   a) biological management
   b) allocation to user groups (e.g., in Native claims settlements)
   c) conservation education/management participation
   d) economic planning and development
   e) preparation and evaluation of impact statements, use in public hearings
   f) project modification and impact mitigation
   g) compensation

3. Have you or your organization ever
   a) actually conducted a harvest survey? (if yes, see parts 2,3,4)
   b) financially supported a harvest survey and/or sat on a study steering committee? (if yes, see parts 2,3,4)
   c) wanted to conduct, or now plan to conduct, a harvest survey? (if yes, specify problems, constraints, uncertainties, see parts 2,3,4)
   d) used Native harvest statistics? (if yes, specify type used [as in Q.1 above], specify purpose, see parts 4,5).

   Note - parts 3 and 5 are similar, but 3 is intended for those who have participated in surveys, while 5 is intended for those who use the results. Use one or the other section accordingly.

4. Specify if your interest in harvest data includes all species or only one or some of the following groups of species in particular: big game, fur-bearers, small game, migratory birds, marine mammals, fish.

5. Specify the geographic area which you are especially concerned with, or in which your organization operates.

Part Two - Organization of studies

1. Most of the global harvest surveys have relied on a cooperative approach to project design and data collection, including all funding agencies along with the representative organizations of the harvesters. Do you feel this approach should be continued? If so, much as is, or modified in some way? What terms and conditions might your organization attach to such participation?

2. What are your views on the utility, composition, and terms of reference of joint steering committees to oversee the design and progress of harvest surveys? Should they be purely technical and scientific in nature, should they be administrative, or both?

3. Has participation in harvest surveys to date been of benefit to your organization in terms of improving communications and co-operation with other parties? Have harvest surveys improved or assisted in your decision making? Has comprehensive participation by Native harvesters served a useful educational purpose with respect to management and conservation?

4. Do harvest surveys meet a continuing need or a once-for-all need, i.e., should they continue indefinitely like the census or the cost of living index, or should they be limited to a certain number of years? If the latter, what would be the appropriate minimum?

5. Funding and costs:
   a) who should fund harvest surveys, and in what proportion?
   b) roughly what level of funding is appropriate? Are harvest surveys now too expensive, or should more funds be allocated for that purpose?
   c) if you have funded harvest surveys, do you feel you have got your money's worth?
   d) can you suggest any criteria for determining the cost-effectiveness of harvest surveys?

6. Demands on time and effort:
   a) have harvest surveys demanded too much of your organization's time and effort, for what you got out of them? How could this be improved?
   b) have harvest surveys been viewed by harvesters in your community or area as an unwarranted demand on their time? How could this be improved?

7. What are your views on the confidentiality of informants, ownership and control of survey data and results, and authorizations for or restrictions on use? Have you experienced any problems in this regard? If so, specify.

Part Three - Design and conduct of surveys

Note - these questions are intended to expand on, not duplicate, the information contained in the published reports of these surveys. In all cases, find out what problems the project ran in to, how the research and administration changed in progress as a result, and how they would do things differently if starting again.

1. What were your reasons for undertaking this survey?

   Note - probable reasons include political objectives such as Native claims, responding to a particular development project, producing certain data and reports, involving people in resource management and research.

2. Was the research initiated and/or conducted by a Native organization, government, private industry, or a combination of these?

3. Was the study aimed at statistical, qualitative, or both types of data?

4. Was your original budget realistic in terms of the total requirement, and the specific allocations?

5. Describe your organization of work, especially local fieldworkers, training and responsibilities, their payment and working conditions, travel needs, central office staffing and equipment, importance of microcomputers and software.

6. Describe your data recording system, especially the use of recall and reporting aids, such as calendars or diaries, frequency of data collection, and methods used by fieldworkers. Provide sample questionnaires and data forms.

7. Describe your system of data tabulation and processing, verification and quality control of data, analysis and write-up. Was adequate provision made for this work at the outset of the project?

8. Discuss the method of local involvement of harvesters and of the communities as a whole, e.g., through HTAs, Band Councils, etc. How much influence did they have on the study design, and on employment of fieldworkers?

9. How receptive were harvesters, fieldworkers, and sponsors to the conduct and results of the survey?

10. How did you define your universe of harvesters? What were the criteria by which people were selected to be interviewed? Did you draw up a precise list at the beginning, and did you continually update it?

    Note - get some idea of how much they relied on the fieldworkers' judgement in each community on this, and how they handled the situation in large communities like Frobisher and Rankin.

11. How consistent were hunter reporting rates, and how did this change over time? Do you have any particular observations about the types of people who tended to report or not report? Were there outright refusals to participate?

12. How frequently did you record individual harvests? Why did you choose this interval? What were the advantages and disadvantages of it in practice?

13. How reliable do you feel the reporting was with respect to fur-bearers, big game, small game, large marine mammals (e.g., whales, walrus), seals, migratory birds, fish? If you believe that there was a tendency to over or under report in any of these categories, have you identified any reasons? How significant do you think this bias has been?

14. Discuss method of locating kills, if done.

15. Discuss method of obtaining information on age and sex of kills, if done.

16. Did you obtain any socio-economic information such as age of hunter, employment status, income, etc.? If so, why did you select these particular characteristics?

17. Did you obtain any information on hunter effort, i.e., recording of unsuccessful hunts, time spent, gear used, costs of hunting?

18. Did the inclusion of any or all of items 14-17 on the survey questionnaire affect, positively or negatively, the quality or usefulness of the survey results? If so, discuss.

19. How do you intend to release the results of your project, if at all?

    Note - examples are the large and complex reports of the JBNQ Cree surveys, at one extreme, to the brief summary reports of BRIA and KHTA at the other. Most often, what is released seems to be summary tables of annual community harvests, with a brief explanation of study methods. If they have more than this in mind, would it include detailed discussion of project methodology and history, detailed statistical tables and cross-tabulations, analysis and interpretation of harvest or other data?

20. What is your policy on releasing raw data or internal reports to other agencies or users on request?

21. Have the results of the project met your expectations? (Refer back to Q.1).

22. Have there been any unanticipated or unintended effects of your harvest survey, positive or negative?

Part Four - Presentation and use of data

1. Are the currently available harvest survey reports adequate in terms of:
   a) explanation of methods and data sources.
   b) presentation of data (i.e., are the tables at a suitable level of aggregation, are the cross-tabulations adequate and informative, or do you need this material in a different form?).

   If not, how would you improve them?

2. Do you have any requirement for the raw data by individual hunter, or are monthly or annual totals by community adequate?

3. What have global harvest statistics in their presently available form enabled you or your organization to do that would not otherwise have been possible? Or what would they enable you to do if they were available in the form you prefer?

4. If harvest survey data were unavailable, are there any other available sources of data you could use in their place? If not, how would you go about getting the information you need? Do any of these alternatives meet the reliability criteria you identify in Q.4 of part 5?

5. How soon should harvest data be available to users once they have been collected? (same month, same season, same year, doesn't matter). How would you make use of the data if available at the frequency or timeliness you prefer?

6. In general, what access if any should other agencies or individuals who were not party to the original project agreement have to the data? On what basis, in terms of payment, acknowledgement, permission, use, etc.?

Part Five - Technical issues

1. Definitions
   a) How do you think that "Native harvesters" should be defined? Should it include only Native people, all licence holders even if some are non-Native, all heads of households, all individuals who hunt, including women and young people?

b) How do you think that "harvest" should be defined? Should it include the numbers killed, including animals wounded or lost, the numbers killed and retrieved (which is the effective definition in current surveys), or the numbers brought home and made use of?

c) Should "harvest" include commercial as well as domestic harvests (e.g., should it include commercial fishing and trapping)? If so, should it distinguish between commercial and domestic harvests?

Note - commercial records, if kept, serve as a partial cross-check of survey data. Also, these commercial records could be subtracted from total harvest to determine domestic harvest.

2. Accuracy of reporting (response bias)

a) Do you believe that people report their harvests accurately, too high, or too low? If you think this varies by species and/or place, be specific.

b) If too high or too low, what is your explanation for this? What causes people to bias their response? Is it a memory problem or deliberate evasiveness?

c) Is it possible to get people to report more accurately, and if so, how?

d) If that is not possible, is the direction and degree of bias sufficiently predictable that standard correction factors could be devised to estimate actual harvests from reported ones?

e) What would or should motivate people to participate in harvest surveys and to report their harvests as accurately as possible?

3. Representativeness of reporting (sampling error and non-response bias)

a) Harvest surveys try to get information from all harvesters in each community, but even the most successful miss 10-20% of the hunters. If you think that the non-reporting hunters are somehow atypical, and that this would bias a simple proportional projection of reported harvests, be specific.

b) Do you think this bias is important enough to cast serious doubts on the results of harvest surveys, and if so, how should it be corrected? Should hunters have more incentive to participate? Should fieldworkers have more incentive to track them down? Do you think that some hunters deliberately avoid reporting?

c) If you to not think this bias is significant, why not, and how do you respond to those who do?

4. Considering all of the possible sources of bias in harvest statistics, how reliable do you expect the results to be in order to be useful to you?
   a) Can you specify an acceptable margin of error (e.g., ±20%, 50%, 100%)?
   b) Can you specify the degree of confidence you require (e.g., are you prepared to have this acceptable margin of error exceeded once every 10, 20, or 100 years)?
   c) If you are able to answer these questions, or consider them appropriate, how reliable, by comparison, are the other key data you work with (e.g., fish and wildlife populations, recruitment and mortality data, social and economic data)?

5. Is it important to have independent sources of harvest data which can be used to verify or cross-check the reliability of Native harvest survey data? What data sources would you suggest, and how reliable are they?

   Note - existing studies rely chiefly on fur trade records, and parallel but independent studies such as university thesis research.

6. How often should harvest totals be reported (e.g., monthly, annually)?

7. Should the location of harvests be indicated? If so, as part of the survey itself or by some other means? How specific do you require this information?
   a) by exact point (e.g., 100m - 1 km accuracy),
   b) by grid square (e.g., 10 - 100 km per side),
   c) by community land use area?

   Note - the existing surveys assume, in effect, that there is an identifiable community land use area within which harvests can be inferred to have taken place, on the basis of knowing the place of residence of the hunter. Is this assumption always valid? What about places like Yellowknife or Whitehorse where people travel a lot by road, or smaller communities from which people now fly long distances to harvest certain species?

8. If it is important to identify the fish or wildlife stock, herd, or population from which harvests are being taken, how should this be done? Is geographic location of kill sufficient? Are you willing to rely on the harvester's "subjective" identification?

9. Is it important to collect data on harvesting effort? If so, as part of a harvest survey or by independent means? What kind of data would be useful (e.g., who harvested and who didn't, who was successful and who wasn't, time spent harvesting, census of harvesting gear, product of time and gear [unit of effort as in fisheries], harvesting expenditures [costs of operation and maintenance, depreciation])?

10. In your opinion, are harvest data alone sufficient for dealing with compensation issues, or are effort data also necessary? If so, what kind? What criteria or standards must harvest data meet in order to be useful as a data base for compensation?

11. Is it important to collect social and economic information along with harvest data? What kind of information is important (e.g., age, employment, sources of income, harvesting expenditures)? Should these be obtained through harvest surveys or separately by some other means? How would you use such data? Do you have some hypothesis in mind that you wish to test? If so, specify. How important is it to be able to link harvesting and socio-economic data by individual, i.e., for cross-tabulations, as opposed to, say, the community level?

12. Is it preferable to have Native harvest data for all parts of the North, or just a particular part of it. If the latter, which part? Should the data be comprehensive, or a representative sample (i.e., a few selected "typical" communities, or all communities)? Should the basic methodology of harvest surveys be standardized across the North to ensure comparability? Or if the surveys are to be conducted on a regional basis as they are now, should each be designed to meet local conditions and perceptions foremost, with standardization only a secondary consideration?

13. Census or sampling. Do you think that harvest surveys should try to reach every hunter, or do you think that a random sampling approach might be better. Comment on the merits of each approach with respect to:
    a) credibility of results among harvesters themselves (do they or could they accept the sampling approach as valid?).
    b) involvement of harvesters in conservation education and management participation.
    c) effects on cost and administration of survey.
    d) effects on reliability of results.

e) utility of results for compensation purposes, where individual harvesting records may be required.
f) effect of adding additional data such as location, effort, or socio-economic status on sample size and reliability, especially in small communities?

What about the roughly 20% of NWT Native people who live in large centres like Yellowknife and Inuvik, or the roughly 50% of Yukon Native people who live in Whitehorse? Would a sampling approach be more appropriate there? How should this be done, and what problems do you see? If you prefer a census approach, how should it be done in these places? If you prefer the census approach, do you see this as a permanent measure, or as a temporary means of getting people involved in harvest surveys? How would you feel about eventually shifting to a sampling approach?

14. Fieldworkers versus self-reporting. Is it desirable or necessary to continue to rely on fieldworkers in each community or region to physically collect harvest data from harvesters, or is this merely a useful temporary strategy? Should any attempt be made to shift harvest surveys to a self-reporting system in the long run, e.g., where people mail or turn in their reports every so often?

APPENDIX B

DESCRIPTION AND EVALUATION OF NWT HARVEST SURVEY METHODOLOGY

This appendix provides reference material as a background to the review of the NWT surveys. It contains a discussion and evaluation of the methods employed by each of the Native harvest surveys currently underway in the Northwest Territories, as indicated chiefly by their published reports, because those are what most users of the results must rely on. The authors have also relied on related documents, and on interviews with project personnel, where these clearly add to an understanding of the survey methodology. In the first three parts the BRIA, KWF, and KHTA surveys are considered in turn, and specific topics are dealt with in the same sequence in each review. The final part contains some comparative tables. Some commentary on specific aspects of methodology are presented in this appendix.

PART 1: BRIA

1.1 Objectives

The stated objectives of the BRIA harvest survey in the 1983 report are:

> "firstly,to design a system to collect harvest statistics from the hunters of the entire region, secondly to implement that design, and thirdly to develop and implement a computer system for processing this large data base."(1983:1)

The stated objectives of the BRIA harvest survey in the 1984 report are:

> "firstly,to develop a system to gather and process harvest statistics from the 1500 hunters of the region, secondly, to implement this system in order to estimate harvest levels and related statistics, and thirdly, to interpret the significance of the findings."(1984:1)

1.2 Coverage Details

Project Period:
1980--no reported results
1981--Donaldson: November 1983
1982--Donaldson: February 1984
1983--no report as yet, however a special study on operating costs of hunting in the communities of Hall Beach and Pangnirtung (May 1983) was written August 1983.

Geographic Coverage: 14 communities and 24 outpost camps in the Baffin Region. Reported total regional population of 8,333 (1981 Census).

Number of Species: 26 (see Table B-3)

Data Collection Interval: monthly.

1.3 Definitions

Harvester: the following definitions of hunter appear in the harvest study reports:

> "A hunter is defined as a man or a woman at least 18 years of age who hunts at least once per year. This definition includes nearly all of the region's men, with the number of women varying considerably among communities."(1983:4)

"The proportion N represents of the total population in each community should be close to the proportion of males over 18 years represent in the population. The 1981 Census figures for Cape Dorset, Igloolik, Pangnirtung and Pond Inlet indicate that males over 18 years represent approximately 24% of the population."(1983:13)

"N = number of hunters in the population, approximately, the number of males over 18 years." (1984:4)

Comment: the hunter definition which specifies that either sex can be a hunter (1983:4) is not repeated in the 1984 report. The only definition of hunter in the 1984 report is the one included as explanation of the formula used to estimate total harvest (1984:4).

The hunter definition used by BRIA is not precisely stated. Because of the hunter definition is confused it is difficult to know the number of potential hunters in the Baffin region and the number of hunters sampled in 1981 and 1982.

Harvest: harvest is not precisely defined, other than to state that it is the "number of animals caught." (1983:7)

With respect to the harvest of marine animals the following observation is made in the 1983 report:

"The estimates of the harvests of marine animals should...approximate the harvest that hunters bring home. The estimates do not take into account those animals that were shot but sank."(1983:60)

1.4 Hunter Population

One of the major problems with the 1983 and 1984 BRIA reports is that the total number of hunters and the number of hunters sampled are never clearly stated. Discussion of the hunter population which accompanies Table 1: Population and Sample Size of Baffin Region Communities (1983:14; 1984:10) is confusing and frequently misleading. The numbers appearing in the text do not always agree with the numbers in the table.

The reason that the 1981 Census data were used to establish the expected hunter population is not explained. The method used to compare BRIA hunter population to the 1981 Census data is not discussed. When comparisons between BRIA hunter populations and 1981 Census data are made, the method used is inconsistent and the results, as presented, are misleading.

BRIA Hunter Population: although both table (1983:14, Table 1) and accompanying text (ibid:13) indicate the number of hunters in 1981 to be 1,358, the data in the table actually sums to 1,342 hunters. No outpost hunter population is provided. The sex distribution of hunters is unclear. The only mention of the sex of the hunter population is footnote #7 for Lake Harbour where female hunters are excluded.

The report states "The number of hunters taking part in the study in 1982 was 1,514 or 21 percent of the region's population."(1984:9) This statement confuses the difference between the number of hunters and the number of hunters sampled.

The hunter population increase from 1981 to 1982 is stated to be 96 hunters (1984:10, Table 1). The actual difference between 1,358 and 1,514 is 156 hunters; and between 1,342 and 1,514 is 172 hunters.

The outpost camp hunter population of 66 shows an increase of 6 hunters from 1981 (1984:10, Table 1). The outpost camp hunter population for 1981 was not given (see 1983:14, Table 1).

No mention is made in the 1984 report of the distribution of female hunters in the Baffin region, and there is no reference to the Lake Harbour female hunter population (1984:10, Table 1).

BRIA Hunter List: the BRIA reports do not adequately describe how the list of hunters in each community was determined. The 1983 report states that GNWT records and field-worker knowledge were used to establish lists of hunters (1983:5). Further,

> "Two of the sources used to determine the communities' hunters population were the lists of General Hunting Licence holders and the fieldworker's knowledge of their communities."(1983:61)

The report should include a more precise statement of how the lists are drawn up and maintained.

1.5 Verification of Hunter Population

The 1981 Census data were used to establish the maximum size of the hunter population in the Baffin region (all males over 18 years). The rationale of the use of the 1981 Census data and the methodology used to compare the Census data to BRIA hunter population size are not explained. The descriptions of the use of the 1981 Census data in the 1983 and 1984 reports are confusing and the results of comparisons are misleading. For example, the 1981 Census data are used in the

explanation of the estimation of total harvest formula to define hunter population (see hunter definitions quoted above). In other sections of the reports the 1981 Census data are used to establish the maximum limits of the hunter population.

The BRIA hunter populations of 1,358 [sic] and 1,514 when compared to the 1981 Census population counts are found to represent 19.1% and 20.4%, respectively, of the Baffin region's population. "The 1981 Census for Cape Dorset, Igloolok, Pangnirtung and Pond Inlet indicate that males over 18 represented approximately 24% of the population....Based on the above criteria, most of the communities appear to be missing some hunters."(1983:13)

The problems with this comparison include the following:

1. The BRIA hunter population by definition may include both male and female hunters. The "expected" hunter population is derived from the male population over 18 years at the time of the Census.

2. The way the Inuit population was determined is not consistent. First, the criteria used to establish Inuit origin in the Census is "mother tongue neither English nor French." The ethnic origin data would have been a more appropriate measure. These data were released April 1983 and so were available at the time these reports were written. Secondly, the percentage Inuit as stated in the Census data is not used except for the communities of Nanisivik and Frobisher Bay. In Nanisivik and Frobisher Bay the number of BRIA hunters is compared to the percentage of the population determined by the Census to be Inuit. In all the other Baffin communities, however the number of BRIA hunters is compared to the total population of each. There is no explanation as to why this procedure was taken.

Although there is nothing intrinsically wrong with using census data to obtain age and sex cohort sizes, users should be aware of the limitations of census data. Census data are of limited value for small population studies because of the rounding factor employed by Statistics Canada. Census coverage in rural and remote areas can be incomplete. Errors caused by response bias in the ethnic origin and mother tongue questions can be more acute in small populations. Furthermore, it is not appropriate to use Census data to establish the populations of the outpost camps. Population of these camps is not constant and fluctuates considerably during the year. Census counts for these camps will reflect the population of the camp on the day of enumeration. This may have little bearing on the population size of the camp at other times of the year.

To conclude, it is never made clear why the Statistics Canada data would be more reliable than the various GNWT and settlement records, especially for years subsequent to 1981. None of the other harvest surveys have resorted to using outside information sources to verify the list of community hunters obtained from such sources as local Hunters and Trappers Associations, GNWT GHL lists, GNWT Local Government and Hamlet records as well as field-worker knowledge and continual improvement to the community hunter lists. In particular, accurate information on the size of the outpost camps and small communities is best obtained by field census. BRIA's preference for Statistics Canada data seems inappropriate.

1.6 Outpost Camps

BRIA sampled outpost camp hunters separately from the hunters who had a usual residence in one of the 14 Baffin communities. In 1981 and 1982 the average number of outpost camps in operation was 24.

> Coverage of the outpost camps is explained in this way: "We [BRIA Harvest study] collected data from 14 of these camps for an average of 9 months per camp. The number of camps from which we received harvest data increased during the year."(1983:17-18)
>
> "Among outpost camps, a mean of 15 camps were sampled each month out of an average 24 possible camps. This represents an increase in sample size from 1981 when a mean of only 10 camps out of 24 were sampled per month. The 1982 sample size varied little between the months."(1984:11)

Sampling the outpost camps presented a measure of difficulty for BRIA that seems to have resulted in incomplete coverage of outpost hunters, especially in 1981. For example, the 1983 report does not state the number of outpost hunters. However, the 1984 report shows an increase of 6 outpost hunters to bring the number up to 66 outpost hunters.

As well, the 1983 report gives all harvest totals from the outpost camps in terms of number of outpost camp days. It is therefore not possible to compare the hunting success of the outpost camp hunter to the other hunters of the region because the unit of measurement is not directly comparable.

1.7 Field Survey Methodology

BRIA survey methodology is described in the 1983 report. The 1984 report directs the reader to consult the 1983 report:

> "The study design and method of data processing are described in the report of the 1981 harvest statistics. The statistical analysis is also the same as that for the 1981 results except for missing data and outpost camps."(1984:4)

> "[Harvest] information was gathered by local Inuit fieldworkers who either were elected by the community's hunters or whose appointments were approved by the Hunters and Trappers Association's executives. The fieldworkers met in Frobisher Bay once a year for a three or four day workshop in order to discuss study design, rationale and problems with data collection.
>
> These fieldworkers attempted to survey one hundred percent of the hunters in the communities on a monthly basis."(1983:4)

> "Hunters were given calendars in January 1981...for each month there were spaces by the species names to record the catch. Hunters were also given pocket-size notebooks in which they could record their kill when they were on the land. Lists of hunters in each community were prepared from GNWT government records. By each name the fieldworkers could record whether the individual had hunted or not in a particular month. If a hunter had been successful, his harvest was recorded on a separate data sheet printed with the names of the species."(1983:5)

Hunter activities were classified (see Table B-4) and the field-worker was to indicate for each month the activities of the hunter. On another sheet which listed species, the field-worker was to record the numbers of animals harvested. From this description it would appear that BRIA recorded the number of animals killed on a list that was independent of the activities of the hunters.

1.8 Sample Size

The BRIA reports do not clearly state the number of hunters sampled each month. In 1981, "the mean sample size was 72%" consisting of 915.7 hunters (1983:14, Table 1). The only explanation of the mean sample size is footnote #3: "Excludes those hunters reported as out of town for the month."

Comment: 915.7 is 67.4% of 1,358 [sic], and 68.2% of 1,342, not 71.5% as indicated in the table (1983:14). The variance and standard deviation, had they been provided, would have given an indication of the variability evident in the monthly hunter sample size.

There is less information about hunter sample size for 1982. Table 1 (1984:10) gives no mean sample size, although the mean percentage sample size is stated to be 79.1%. The only indication of the variability in monthly hunter sample is Table 2A (1984:12) which shows the regional hunter sample in 1982 to range between 68% and 90% of the hunters. Also there appears to have been a steady increase in the size of the sample during the year.

The information on sample size and monthly variability provided in the BRIA report is not adequate for the reader to judge sample reliability and consistency. The required information includes, at a minimum, the mean and standard deviation of sample size for each community; the number of months per year that hunters were sampled; and the sampling intensity each month. As well, the report should indicate any attempts to backdate the harvest results of hunters who were not sampled at regular intervals.

1.9 Data Processing

"Data was filed by community on a monthly basis. After a year's data was collected it was stored on floppy disks. Visicalc was used to input the data ...which was later converted by means of a 'custom program' from the the bulky Visicalc format to files occupying a fraction of the space."(1983:6-7)

"The data was checked for inputing errors against a master report that had been prepared independently summarizing the monthly harvest figures for each community and species." (1983:7)

1.10 Reported Harvests

Reported harvest is the
"sum of the animals caught by those interviewed. The total or regional reported harvest is the sum of the community figures." (1984:7)

1.11 Estimation of Total Harvest

As the sample harvest totals each month represent only a part of the total harvest it is necessary to estimate total harvest. In each of the NWT surveys, estimation of total harvest must be done each month as data are collected at monthly intervals.

BRIA estimates each community's harvest by month from the reported harvest, the sample size (the number of hunters interviewed) and the number of hunters in the population. This method projects the sample harvest counts onto the unsampled population using Equation B-1; the assumption being that the unsampled population is not significantly different from the sampled population. The equation follows:

$$\hat{y}_{ij} = \frac{(N_{ij})\,\xi_y}{n_{ij}}$$

$\hat{y}_{ij}$ = Estimated harvest in month i, in community j
ξ_y = Harvest reported by those interviewed
n_{ij} = sample size in month i, community j
N_{ij} = number of hunters in the population in month i, community j

Estimation of Variance and Standard Deviation: the formula used by BRIA to calculate the variance and standard deviation of the estimated mean are sound and include a sample size correction that is appropriate in this case.

Comment: there are several points at issue.

1. The value of N. Given the documentation in the two reports it would appear that the community hunter totals of 1,358 in 1981 and 1,514 in 1982 are being used as the N value. In all likelihood this value would result in an under-estimation of total harvests as this total hunter value is below the predicted value of 24% of the region's population.

2. The estimation of harvests by female hunters. BRIA's definition of hunter includes both male and female hunters. There is very little information in the two reports on female harvesting levels and the number of female hunters involved. The only information is given in the 1983 report for Lake Harbour. Donaldson notes: "In Lake Harbour, a large proportion of the hunters were women. As they hunted less than men and were less likely to be included in the sample if they did not

hunt, I treated them separately. I first estimated the harvest by men for the year, then added to it the harvest reported by women "(1983:8). No further explanation is given for other communities. The female hunters of Lake Harbour are not discussed in the 1984 report.

3. The projection method used by BRIA makes the assumption that the unsampled population is not significantly different from the sampled population. To be certain of such an assumption, independent verification of estimated results should be undertaken. The sample of hunters used by BRIA is not a random sample. It is a fortuitous sample and like all of the other harvest survey samples it is influenced by field-worker effort and diligence, availability of hunters in the community during the interview period each month, and willingness of the hunter to participate in the study.

1.12 Evaluation of Bias

The 1983 report discusses sampling error and biases (1983:56-64).

> Sampling error: Donaldson concluded that:
> ". . . the sample sizes in 1981 were generally large enough to ensure a low probability of sampling error except for those species which are harvested in only a few communities during a short period of time or for which there is a high variance among hunters in their individual harvests. If sample sizes happen to be low under either of these conditions sampling error can be high." (1983:57)

Appendix C suggests that high variance in hunter kill may be the norm for most species, thereby necessitating a large sample size or a stratified sample. On the experimental data it was found that to reduce the error of estimation to below 20%, a sample of 70 to 80% was required for most species. In 1981, the community sample sizes in the BRIA survey were barely 70%, and several communities had annual sample sizes of less than 60%. Further, the BRIA reports do not show the monthly variation in community sample size, and hunter activities are not followed on a month by month basis. Thus there is no way to judge the representativeness of the BRIA hunter sample.

Response bias: reporting biases were discussed with reference to species and to period of recall but no conclusions were drawn.

The possibility of strategic bias with the intent of altering or averting government action with respect to hunting or economic regulations is noted, but is not addressed directly. Also, anecdotal evidence of Inuit cultural reluctance to over-estimate is presented (1983:59).

There is some discussion in the report on the effects of wounding and losses of marine animals to the total number of animals killed. However, this discussion was confused with possible biases in recalling the number of animals recovered.

The effect of field-workers on hunter response is not specified and only general comments are made.

Some clear cases of response bias were noted (1984:63), but neither were they explained, nor were their effects on reported harvests accounted for.

Both sampling error and response bias have been poorly addressed in the BRIA reports to date.

1.13 Derivative Statistics

Mean kill or harvest per person: the mean kill per person interviewed, including those who did not hunt, or were unsuccessful that month as well as the successful hunters. This statistic is not a measure of hunting effort. The size of the mean, in this case, is dependent on the number of hunters interviewed. The BRIA monthly sample size varied considerably each month. There does not appear to have been any attempt to adjust for sample size fluctuation or bias in field-worker effort, for example interviewing only the successful hunters.

Mean harvest per hunter: the mean kill per hunter is defined as:

> "a success rate [which] should give a better indication of the relative abundance of wildlife than the previous mean [mean harvest per person]. The statistic calculates the average number of animals killed by the number who hunted."(1983:10)

The problem with this summary statistic is that it appears to apply indiscriminately to all those who hunted, but is used in reference to species where it is not at all clear if it means the sucess of those hunting the species in question or whether it applies to all successful hunters in that year.

For example, the average regional kill of arctic foxes in 1982 is stated to be 3.98 foxes per person who hunted. Does this mean an average of 3.98 foxes per hunter of foxes, or does it refer to the total number of hunters who could have hunted in the year? Any example could have been used and this point applies to all species listed by BRIA.

The suggestion that this success rate [mean harvest per hunter] should give a better indication of the relative abundance of wildlife than the previous mean [mean harvest per person interviewed] is quite wrong. It does not in fact measure availability of species.

1.14 Verification

Estimated Harvest Statistics: BRIA used the GNWT records of tag returns for polar bear, narwhal, and beluga to substantiate BRIA reported and estimated harvest data. Table B-1 summarizes the results.

Table B-1 suggests that since BRIA's estimated harvests have such a wide band of confidence, they are of limited use for management purposes, especially for species whose harvests are otherwise well monitored, such as narwhal, beluga, and polar bear.

Other types of verification that could have been used by BRIA include spot checks, independent studies, and cross-checking with studies done by others. However BRIA never compared its own survey data to those obtained by Finley and Miller (1980) in the 1979 pilot study.

TABLE B-1
Comparison of BRIA data with
GNWT and DFO counts

Species	BRIA reported	BRIA estimated (with standard error)	Govt. counts
1981			
Narwhal	276	386±23.8 (1SE) 339–433 (2SE)	388
Polar Bear	231	321±14.3 (1SE) 293–349 (2SE)	311
1982			
Narwhal	372	416±11.9 (1SE) 393–439 (2SE)	372
Beluga	169	227±18.1 (1SE) 191–262 (2SE)	208
Polar Bear	221	293±13.6 (1SE) 276–320 (2SE)	258

Source: Donaldson (1983,1984)

1.15 Update (Based on interview with Pattimore and Arnatsiak)

1. Switch from Visicalc to DBase system.

2. Field-workers meet twice a year, considerable telephone communications occur.

3. Calendar has been simplified following the model of KHTA.

4. Hunter population includes males and females, also non-Natives, especially in Frobisher Bay.

5. Hunters lists were drawn up from GNWT GHLs and HTAs and were updated as needed. The general impression is that the lists are two years out of date.

6. Would like harvest to include all kills without qualification as to retrieval, loss, or use, and would like to see commercial harvests included.

7. Non-reporting hunters -- the suspicion is that non-reporting hunters might be the most active and they are often missed because they are out. The 20% of hunters that are missed is a major concern.

The 1984-85 contract calls for a system of identifying the locations of harvest of each species, and for the development of standard approach to estimating the harvest of bird eggs.

PART 2: KWF

2.1 Objectives

There are five stated objectives:

1) To determine by survey techniques the hunter kill by Inuit living in the District of Keewatin communities and outpost camps.

2) To develop an approach for the collection of timely, reliable data on wildlife harvesting which could be undertaken by an agency such as the KWF upon completion of the preliminary study.

3) To determine the number of Inuit directly participating in subsistence harvesting in each community and to compare the proportion of harvest taken by hunters of different ages.

4) To provide an estimate of the harvest sufficient to determine a measure of its value to each community as food or income.

5) To analyse and publish the data collected in a timely manner and in a scientifically acceptable format.

2.2 Coverage Details

Project Period: 1981, 1982, and 1983 data -- Gamble:1984

Geographic Coverage: the study area is the Keewatin Region of the Northwest Territories, about 386,000 km^2. There are seven permanent communities involved in the study. The 1983 population of the region based on GNWT Local Government and Rankin Inlet Hamlet office data is 3,769.

Number of Species: 39 species (see Table B-3). All kill locations are geocoded, and the sex and herd affiliation of all caribou are reported. The location data, however, are neither presented nor analysed in the KWF report.

Data Collection Interval: monthly

2.3 Definitions

Harvester:

> "Included in the term hunter are Inuit males and females over 16 years who hunt (they may or may not have a general hunting licence), Inuit youths who hunt regularly, and some long term residents in the area of other ethnic origins who hunt." (Gamble 1984:1)

Harvest: harvest is not defined other than as "kill."

2.4 Hunter Population

The percentage of hunters reporting each month is given for each community in tables. Overall or annual participation levels are not reported. The absolute number of hunters participating in the KWF study is reported to be 1,175 men and 156 women. This level of participation is about 35.3% of the total regional population (males 31.2%, females 4.1%).

Comment: the KWF hunter population compares to the BRIA hunter population which was estimated to be about 20% of the Baffin region's population.

2.5 Verification of Hunter Population

The hunter population is never explicitly verified in the report. The large proportion of the region's population participating in the study would suggest that most of the hunters do appear to be part of the KWF study.

2.6 Outpost Camps

All outpost camp data are collected from the hunter when he or she returns to the community of usual residence.

2.7 Field Survey Methodology

Survey methodology is well described in the KWF report.

> "In each of the seven communities, an Inuit was hired as a field-worker to interview hunters and collect data. Duties included explaining the project to hunters, distributing the study materials (calendars and fieldnote books) to hunters, keeping an up-to-date list of hunters; interviewing hunters beginning on the first day of each month to collect harvest statistics from the previous month and recording this information on the appropriate data sheets, making sure the data collection was as accurate as possible; and promptly forwarding a monthly report following an interview period to the Project Manager located at Eskimo Point."(1984:4)

> "Beginning on the first day of each month the field-workers began interviews so they could divide the hunter population for each community into the categories of: successful, unsuccessful, didn't hunt, hunted but not interviewed, out of the hunt area, activities not known, and list the number of animals killed per species for successful hunters that were interviewed."(1984:9)

Each month the field-worker submitted the harvest statistics for the hunters in his community to the Project Office where the data were summarized each month against a master list of hunters for individual communities and then entered into the computer. If necessary, categories would be up-dated if the hunter was interviewed and provided data for the months in which he or she had not been interviewed.

2.8 Sample Size

The report does not state the annual level of hunter participation. Harvest data sheets for each community give the monthly sample size in percentage terms, however. Table B-2 (derived from Gamble, 1984, Tables 1-13) shows the variability in monthly sample size for each community.

TABLE B-2
Monthly reporting rates by community, 1983 (%)

Community	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Baker Lake	99.6	85.5	91.8	95.7	93.2	94.5	92.3	95.9	92.7
Chesterfld	62.0	56.0	28.0	58.0	88.0	100	90.0	100	100
Coral Hbr	31.4	32.4	35.2	18.1	no fieldworker until Jan.84				
Eskimo Pt	97.8	97.0	100	97.5	96.7	95.5	96.2	98.4	97.7
Rankin	84.5	89.1	84.5	95.9	33.7	19.2	34.2	55.4	61.1
Repulse	70.0	73.3	71.1	25.6	53.3	53.3	73.3	57.8	53.3
Whale Cve	62.0	80.0	40.0	no fieldworker until Jan. 1984					

Because a period well into the second year of the survey has been selected, one might expect reporting rates to have levelled off to a near maximum. It is therefore of some concern to find that only two communities consistently reported at a rate exceeding 80%, two achieved this level only half of the time, whereas three never reached this level at all (with the exception of Whale Cove in February). The Coral Harbour reporting rates are so low as to be nearly valueless.

Another indication of sample size is the monthly theoretical kill factor, as imputation values are higher in the months which experienced low sample size. For example, the monthly kill factor in March 1983 for Chesterfield Inlet was 3.57, in June for Rankin Inlet the factor was 5.22, and in April for Repulse Bay the factor was 3.91. In these months of low hunter sample size it would appear that only reported kill figures are used in subsequent calculations, but the report is ambiguous on this point.

2.9 Data Processing

KWF used a microprocessor and related software to store and analyse the harvest data. The software used was a data base system by Stoneware with additional verification of data using Basic programs developed by Hayward Computer Systems, 1983 (1984:9).

The harvest data system was organized "...into eight interrelated subsystems: entry, participation, hunters, zones, animals, transfer, annual and monthly.... Each subsystem consisted of a DB Master data structure which was used to enter, modify and search the data, and to generate various reports." (Gamble 1984:11)

Data Entry: entry each month of data obtained from monthly interviews

Participation: monthly involvement of hunters in various harvests and calculation of monthly kill factor are contained on this subsystem.

Hunters: this file lists all hunters participating in the study. The study does not record the harvest by the individual's name. Each hunter is assigned a code. The hunter's file includes a community code, birthdate, age current year and month, as well as the hunter identifier code.

Zones: the zone subsystem locates each kill. The study area is divided into zones of equal size and each kill is reported by zone. New zones can be added as required or old ones dropped.

Animals: all species are listed. The subsystem contains an arbitrary maximum kill for each species which is used as a check on the validity of a hunter's reported harvest.

Transfer: this edit subsystem receives the hunters' monthly interviews previously processed by the entry subsystem, verifies

them against the list contained in the hunter, animal, and zone files, generates an edited report and transfers the information to the monthly and annual files.

Monthly and Annual: these two subsystems generate reports and statistics for the study, such as reported harvest, estimated harvest, mean and standard deviation of the estimated harvests.

Edible Weight: all reported and estimated harvests are converted to edible weight equivalents. The report gives the conversion factors used to establish the edible weights of reported and estimated harvests. Edible weight of meat available per community member is also computed.

2.10 Reported Harvests

Reported harvests are the total number of animals killed by those successful hunters that were interviewed. The KWF report gives reported harvest data for monthly and annual periods, and the reported totals are converted into edible meat equivalents.

2.11 Estimation of Total Harvest

For each month the hunter population is classified into one of the following groups (see also Table B-4):

A successful hunter
B unsuccessful hunter
C didn't hunt
D hunted but not interviewed
E out of the hunt area
F activities not known.

Calculations:

1. The known number of hunters who hunted = A + B.

2. The success ratio of the hunters that hunted and were interviewed = A/(A + B)= G.

3. The estimated success of those out hunting but not interviewed = (G x D)= H.

4. The total number of hunters whose activities are acounted for = (A + B + C + E)= I.

5. The total number of hunters that could have hunted = (I + F)= J.

6. The estimated success ratio of successful hunters interviewed in relation to the total hunters whose activities are unknown = (A/I)= K.

7. The estimated success of hunters whose activities are unknown = (K x F)= L.

8. The estimated total success = (A + H + L)= M.

9. The theoretical kill factor = (M/A)= N.

10. The participation ratio = (A + B + C)/J x 100.

11. The estimation of mean monthly kill by species = N x number harvested for each species from the field-workers' reports for each hunter in Category A.

Comment: there are several points at issue regarding the algorithm used by KWF to estimate total harvest.

1. Topolniski and Thompson (1984) have pointed out that a more accurate method of estimating the success of hunters whose activities are unknown (in #7) would be

F=(A + B + C)/(A + B + C + D + E)

Although the authors concur with this point, the actual number of community members in category F is quite small in relation to other categories of activity, such as C (did not hunt). The definition of C is sufficiently ambiguous that changes in the determination of C would likely affect the projection of total harvest far more than would the misrepresentation of the success rate of individuals in group F.

2. This issue has been raised that the KWF method results in a consistent under-estimation of the total number of species harvested. This position is at this point inconclusive as no test or pilot projects have been undertaken to verify the estimated values derived by the KWF study.

However, an area of potential bias and under-estimation could be introduced by the projection of reported harvests of hunters interviewed to the harvests of hunters not interviewed. For example, are the groups D and F more unreachable than groups A and B because they spend more time hunting? The authors are not convinced that the identification of hunters and non-hunters is reliably and consistently made each month.

3. KWF also notes that the theoretical kill factor is not used when those hunters that were successful were the only data supplied by a field-worker for a given month. This would simply adjust the reported harvest by a multiple of total hunters whereas nothing would be known about the involvement of all hunters in the harvest. Instead, in such an instance, it was assumed that the reported harvest was a better estimate of the actual harvest for a community in that particular month.

The procedure employed when part but not all of the information is supplied by the field-worker is not explained.

2.12 Estimation of Bias

The KWF report does not directly discuss bias. However, the following factors which could effect the accuracy of the reported and estimated harvests are reviewed: collection of data by field-workers, desire of hunters to participate in the study, retrieval of data for months in which a hunter was not interviewed, field-worker turnover and inexperience, effect of species on hunter recall, use of diaries and calendars, place names and translation difficulties, financial and management considerations, and information flow from the field-worker to the project office.

All of these factors were expressed as being of concern as to the effects they could have on the KWF harvest results, however the parameters of these factors were not estimated. Moreover, there are several assumptions put forward in the report for which there is no verification or explanation.

The report discusses high- and low-profile species and asserts that high-profile species are reported more accurately than low-profile ones. No evidence is provided, however, concerning the hunters' own identification of high- and low-profile species.

The report also makes reference to a drop-off point of six weeks after which time the recall of hunters is significantly diminished. There is no indication as how this was established or if it applies universally to all species for which recall was required.

2.13 Derivative Statistics

KWF is the only NWT harvest study to convert kill statistics into amounts of edible meat. These amounts of meat are really measures of the total amount of meat, fish, and game available for consumption by regional residents. It is not a measure of the meat actually consumed. Amount of edible meat available per community member is also computed.

The KWF report does not give the variance and standard deviation for the total estimated kill, only the mean and standard deviation for the mean annual kill per hunter are provided. Comparison between study reports is facilitated when comparable statistics are made available.

2.14 Verification

KWF does not compare the harvest statistics obtained in the harvest study to outside sources of data, such as GNWT fur and tag returns or to DFO data, or to the results of studies done for other purposes such as socio-impact assessments.

2.15 Update (based on interview with Gamble)

Harvest definition: it is impossible to include data on hunting losses, however KWF is considering doing a pilot study to estimate hunting losses.

Calendars: it is Gamble's impression that only 30% of the calendars are used each month. He suggests an evaluation be done of their use.

Field-workers: there is an annual field-worker workshop prior to the major spring caribou hunt.

The 1984-85 contract calls for the development of a standard approach for estimating the harvests of bird eggs, and to design a program to sort information on harvest location.

PART 3: KHTA

3.1 Objectives

KHTA recognised the importance of obtaining reliable harvest information and to establish "basic needs levels" for Wildlife Provisions of an Agreement-in-Principle between the the Inuit Tapirisat of Canada and the Federal Government. A request was made to the Federal Government for a five year study to be funded. In October 1982, the GNWT, Department of Renewable Resources initiated a harvest study on a limited scale and in close co-operation with the KHTA.

3.2 Coverage Details

Project Period: October 1982 to November 1983 (Jingfors 1984).

Geographic Coverage: the Kitikmeot region of the NWT includes seven communities.

Number of Species: 14 (see Table B-3). In 1984, white, cross, and red fox were added to the list. Data were collected on the sex and location of caribou and musk-ox kills. However, these data are neither presented nor analysed in the published report.

Data Collection Interval: monthly.

3.3 Definitions

Harvester: "A hunter is defined as a GHL holder who hunts at least once a year." (1984:3) The KHTA field diary which is distributed to hunters themselves, however, defines hunter as "anyone who hunts." The second definition is more inclusive than the first. It was formerly the case that women, and children under 18, hunted under the male head of household's GHL (assuming he had one). This would suggest that the only women who report to the survey directly, under the first definition, are those who are themselves the head of household, otherwise they are not included in the survey. Under the second definition, all women who hunt would report. There is some evidence that the patterns of GHL holding are changing in the Northwest Territories for social and economic reasons, thus altering who in fact would be included in the survey.

Harvest: the report does not define harvest other than to call it kill. The report however leaves the impression that harvest is actually the number of animals recovered.

3.4 Hunter Population

Lists of GHL holders were updated for every community and each active hunter was assigned a number with the master list kept by the field-worker.

The total number of hunters included in the harvest study for the period October 1982 to November 1983 was 623 ± 26 (SD). The variation is explained by the absence of hunters from their communities when involved in rotational employment. These hunters were not included in the hunter population (N) for that particular month.

3.5 Verification of Hunter Population

The verification procedure used by KHTA to certify the size of the potential hunter population is similar to the method used by BRIA, however, the exact parameters of the test are different. KHTA concludes that the potential hunter population (623 ± 26) is reasonable and that the most active hunters were included in the harvest study because this number of hunters compares favourably to the proportion of male Inuit between the ages of 20 and 64 (22 and 21%, respectively). 1981 Census figures were used.

Comment: it is not clear why the age cohort 20 to 64 years of the 1981 Census was used to verify the potential hunter population. If the intent was to account for the period between when the Census was taken (1981) and the study period (1983), then it would have been more accurate to have compared the hunter population group aged 20 to 64 in 1983 to the Census data for the population aged 18 to 62 in 1981.

Another factor that detracts from the usefulness of this verification test is that both male and female hunters are included in the KHTA study. The report notes that 29 women are listed as being GHL holders and that 22 of them reside in Spence Bay. There, the KHTA potential hunter sample comprised 30% of the community's population, far higher than the Census data indicate.

3.6 Outpost Camps

Outpost camp data were collected when the hunter returned to community of usual residence. Three unnamed camps were operating in the region during 1983.

3.7 Field Survey Methods

Field-workers were encouraged to collect harvest information from as many hunters as possible on a monthly basis. Field-workers were also to update the list of community hunters obtained from the GNWT GHL records and each active hunter was assigned a number with the master list kept by the field-worker. Each month the field-worker would record the number of species killed, as well as the sex and location of kill for caribou and muskox. Field-workers also recorded hunter activity on a monthly basis, in the same way as the BRIA survey (see Table B-4).

3.8 Sample Size

On average over the year, 74% of the potential hunter population reported harvest data. However, two of the communities had a reporting rate of only just above 50%. The appendices indicate that in all of the larger communities, there was substantial variation in the reporting rate from one month to the next. Consequently, there may be rather greater bias in the sample than the overall reporting rate would suggest.

The KHTA report makes repeated reference to the monthly sample of hunters as being a "random sample" (1984:4, 19). Rather than being a random sample, it is a fortuitous sample, and as such hunters do not have equal chance of being interviewed each month. Factors such as availability to be interviewed, willingness to be interviewed, and field-worker diligence and competence all influence the size and composition of each month's hunter sample.

3.9 Data Processing

KHTA used a microcomputer and a data base management program, DB Master, to input the data in a monthly summary format. For each community, the reported harvest was entered together with the number of hunters present in the community that month.

3.10 Reported Harvest

The reported harvest is the sum of the animals harvested by the hunters who were interviewed. The KHTA report provides reported harvest data for all species.

3.11 Estimated Harvest

Estimation of total harvest was calculated only for caribou.

KHTA uses the same method as BRIA to estimate total monthly and annual harvests. The formulas are identical, as are the variance and SD formulas. Thus the methodological complications experienced by BRIA also apply to the KHTA estimates. The projection method used by KHTA (and BRIA) rests on the assumptions that the unsampled population is not significantly different from the sampled population and that the sample is large enough to contain a representative selection of the hunter population.

3.12 Estimation of Bias

Three areas of possible error resulting from response bias are discussed as part of the project evaluation section of the KHTA report. First, accuracy of reported harvest depended on the frequency of interview. For example, the number of months that hunters had to recall was considered to affect the accuracy of the reported harvest statistics.

Secondly, the hunter's ability to recall harvests was considered to vary by species. In particular, fish and bird harvest reports were thought to be suspect.

Thirdly, KHTA considered that the harvests of female hunters were under-represented. In addition, movement of residents between the communities of Spence Bay, Gjoa Haven, and Pelly Bay created difficulties for field-workers and so, frequently, hunters were missed.

Much of the discussion of error caused by hunter response bias and sampling is general in nature. No estimation of the degree to which response bias and sampling contribute to error in the harvest data is attempted.

3.13 Derivative Statistics

Number per capita: this summary statistic refers to the number of species killed per person resident in the community. It is a measure of the availability of meat, fish, and game in the community.

3.14 Verification

The only species that can be cross-checked against an independent set of statistics is muskox. In this case, tag returns collected by the GNWT were compared to the harvest statistics produced by KHTA. The reported number of muskox are just 49% of the number obtained by GNWT tag returns. If estimated, the number approaches that obtained from tags, however the variance gives the estimated value a very large range. This is because there is great variability in the harvest of muskox by the individual hunter.

KHTA also collects the geographical locations by zone of the harvests. However, these data are not presented or analysed in the published report.

PART 4: Comparative Tables

TABLE B-3
Species surveyed in NWT harvest surveys

SPECIES	BRIA	KWF	KHTA
Big Game			
Caribou	X	X	X
by sex			X
by herd			X
Muskox	X	X	X
by sex		X	X
Moose		X	X
Black Bear		X	
Grizzly Bear		X	
Fur-Bearers			
Wolf	X	X	X
Fox		X	
Arctic Fox		X	
White Fox	X		
Blue Fox	X		
Red Fox	X	X	
Muskrat		X	
Marten		X	
Wolverine		X	X
Small Game			
Arctic Hare	X	X	X
Rabbit		X	
Marine Mammals			
Seals		X	X
Ringed Seal	X	X	
Bearded Seal	X	X	
Harp Seal	X	X	
Harbour Seal	X	X	
Unknown Seal		X	
Walrus	X	X	
Whale			X
Narwhal	X	X	
Beluga	X	X	
Polar Bear	X	X	

Table B-3 cont.

SPECIES	BRIA	KWF	KHTA
Waterfowl			
Geese		X	X
Snow Geese	X	X	
Canada Geese	X	X	
Ross Geese		X	
Brant	X		
Geese unknown		X	
Ducks		X	X
Old Squaw	X	X	
Eider	X	X	
Mallard		X	
Swan		X	
Other birds			
Guillemot	X	X	
Murres	X		
Ptarmigan		X	X
Rock Ptarmigan	X		
Sandhill Crane		X	
Snowy Owl		X	
Unknown other fowl		X	
Eggs			
Fowl eggs		X	
Brant eggs		X	
Goose eggs		X	
Duck eggs		X	
Other waterfowl eggs		X	
Unknown fowl eggs		X	
Fish			
Char		X	X
Searun Char	X		
Landlocked Char	X		
Lake Trout		X	X
Cod		X	
Northern Pike		X	
Grayling		X	
Whitefish		X	X
Sucker		X	
Sculpin		X	
Other freshwater fish		X	
Other marine fish		X	

TABLE B-4
Designation of hunter activities by month

BRIA	KWF	KHTA
Hunted	Successful hunter	Successful hunter
Hunted but did not catch anything	Unsuccessful hunter	Not successful hunter
Did not hunt	Did not hunt	Did not hunt
Out hunting	Hunted but not interviewed	Out hunting
Out of town all month	Out of hunting area	Out of town all month
Could not reach	Activity unknown	Could not reach
Other		Other

APPENDIX C

ANALYSIS OF SAMPLING ISSUES IN NATIVE HARVEST SURVEYS

C.1 Introduction

The purpose of this appendix is to consider some problems of sampling and inference that arise in Native harvest surveys. It was prepared by M. Smith with the assistance of P. White and D. Patterson.

Issues to be addressed included the use of harvest estimates for identifying trends, identifying minimum sampling levels under specified circumstances, and identifying appropriate sampling strategies such as stratification. Since the existing "census" approach in current harvest surveys in practice yields large samples, the analysis was anticipated to have important implications for the interpretation of existing results.

In view of the objective of providing a useful manual for those designing and conducting harvest surveys, this appendix has been written in as simple and non-technical a fashion as possible.

C.2 Materials

To provide a realistic basis for examining sampling strategies, actual harvest data were obtained from organizations that had conducted harvest surveys. Ideally we had hoped to obtain sample data from BRIA, KWF, and KHTA. However, we were advised by members of the BRIA steering committee that because of staff changeovers and related difficulties, it would be unlikely that we could obtain a data set within our required time frame. KWF kindly provided a diskette with sample data, but due to software incompatibility, we were unable to use their data. KHTA provided sample hard copies of their monthly data sheets for one community (Cambridge Bay), which we used as experimental data. In order to have an additional data set, we had to go beyond the current NWT surveys. Through D. DeLancey, we were able to obtain an unpublished set of data derived from an annual recall survey at Fort Good Hope in 1983.

Both sets of data are thus roughly contemporaneous. One represents a mid-sized Inuit community, the other a mid-sized Dene community. We have no reason to believe that they are atypical with respect to harvesting patterns. Although each data set is in reality a sample from each community, the authors have treated them as representing the population of each community, on which a variety of sampling strategies could be tested. The purpose is to provide test results simulating a real, rather than wholly imaginary, situation. The use of these data sets for this purpose does not necessarily constitute an endorsement of the methods by which they were obtained, but we are nonetheless of the view that they are sufficiently representative to be useful for the present purpose, and to sustain the authors' conclusions in this appendix.

The data sets are referred to as communities A and B in the following text, since what is important here is not to analyse the situation in the specific communities, but to use them as examples.

C.3 Sampling: The Problem

In broad terms, the objective of harvest surveys has been to quantify the annual harvest of a community or region by species. In order to do this, one needs to:

i) define accurately and unambiguously the total pool of hunters;

ii) determine adequately the harvest of the "typical" hunter (e.g., by census or survey); and

iii) use a projection method, combining (i) and (ii), to arrive at an estimate of the community total.

Naturally there will be some degree of error in determining (i) and (ii), so that the final estimates will also be somewhat in error. In general, the fewer the number of hunters missed by the survey, the smaller the expected projection error. In the JBNQ harvest surveys, for example, the very large sample sizes generally resulted in negligible projection errors (Steiger 1981).

Whatever the error, whether it is important or not depends on the use to which the statistical data will be put. Unfortunately, none of the previous harvesting surveys has discussed the significance of error, or dealt with the issue of just how accurate the estimates need to be (e.g., for management purposes, population studies, food value, etc.).

Harvest surveys have to date employed a census approach. The surveys attempt to reach every hunter, although in many cases the results fall far short of this. If harvest surveys are to be repeated on a regular basis (e.g., annually), and/or expanded geographically, then it may not be feasible to continue with such a method. Perhaps time, effort and resources could be reduced by using a sampling approach.

Sampling is a common procedure, for in many types of investigations it is usually not possible to observe all of the individuals or cases. For instance, if we were interested in the height or weight of the population, it would be neither practical nor necessary to measure all instances of height or weight. What we would do in this case is to measure the heights of a "representative sample" of the population. If the sample selected properly represents the distribution of heights in the total population, then whatever we say about the sample will also hold true for the population as a whole.

Thus, if we wanted to determine the community harvest of caribou, for example, we could estimate this from a sample comprising a typical cross-section of hunters, rather than from a complete census of all hunters. An estimate of the total harvest which is based on a sample of hunters will not be exact, of course, but will be subject to some error (the so-called standard error described below). However, such an estimate of annual (or monthly) totals for a community might very well be adequate for resource management purposes or for environmental impact studies. However, since the purpose of collecting information from just a few individuals is not to describe these hunters in detail, but to say something about the larger population of all hunters, then naturally, samples could not furnish exact information about particular individuals unless they happen to have been included in the sample. This could raise some problems in matters of compensation pertaining to individual hunters.

C.4 The Identification of Trends From Estimates

If the main concern is with trends in annual harvest data, for example, one must be fully aware of the statistical limitations of the data. A simple example (Figure C.1) will illustrate the potential problems. Suppose we had a situation where the annual community harvest of caribou actually remained constant over a ten year period. Each year, the harvest was estimated on the basis of a 50% random sample of hunters. Because of the natural vagaries of sampling, the results illustrated in Figure C.1 could be typical: the estimated values go up and down, even though the actual value remains constant. Considering the first three years alone, one might

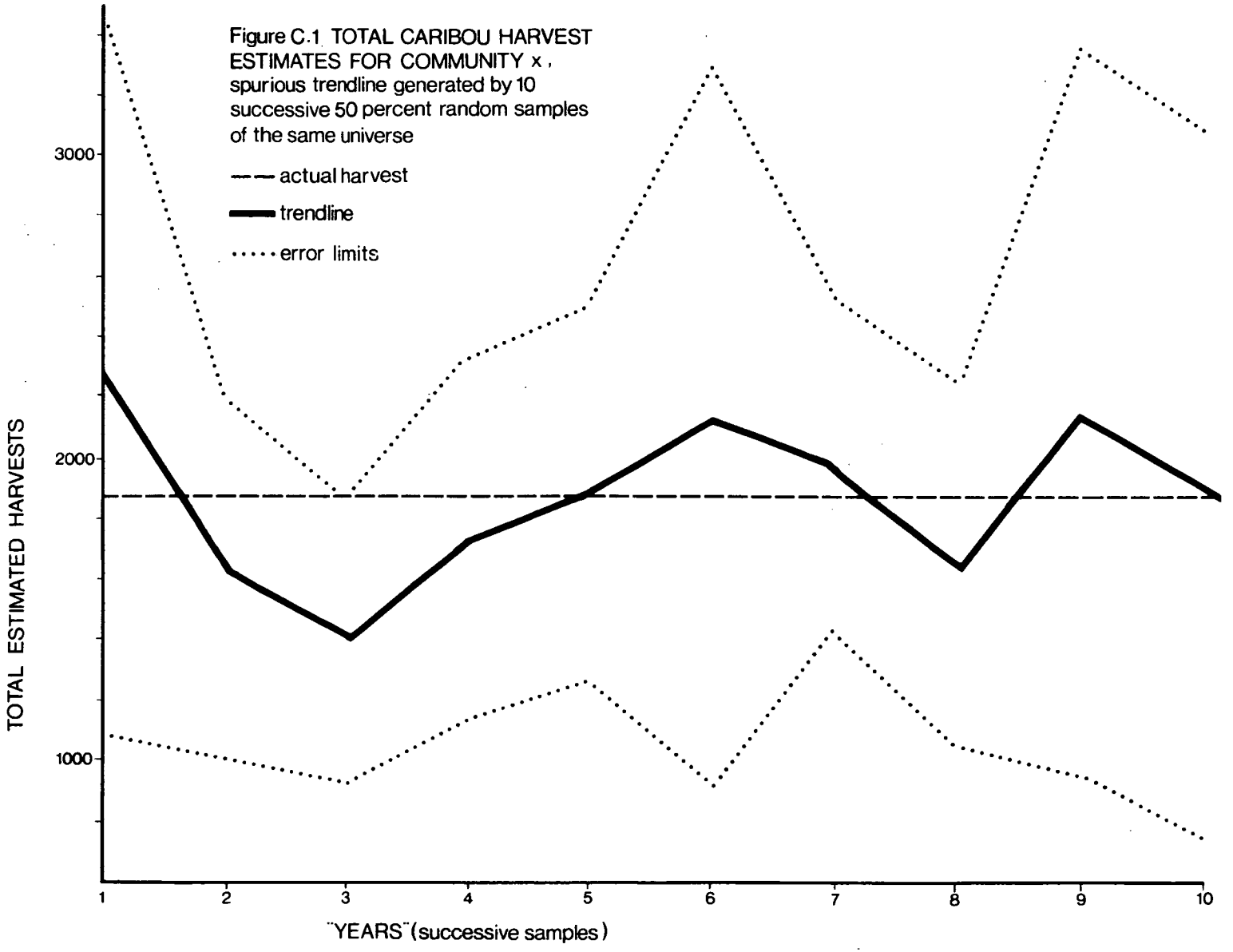


Figure C.1 TOTAL CARIBOU HARVEST ESTIMATES FOR COMMUNITY x, spurious trendline generated by 10 successive 50 percent random samples of the same universe
actual harvest
trendline
error limits
TOTAL ESTIMATED HARVESTS
3000
2000
1000
1
2
3
4
5
6
7
8
9
10
"YEARS" (successive samples)

easily be lured into seeing a downward trend -- an apparent decline of 40%, in fact. For the next three years, there is an apparent increase in the harvest of 50%. Of course, in both cases the "trend" is completely spurious, a mere artifact of the sample data. In truth, the best estimate we can make of the annual harvest in this case is shown by the error band around our sample estimates. Any variation that takes place within this band is statistically insignificant. Any estimate given without the associated error, therefore, is not useful.

C.5 Sampling and Accuracy

Whether or not the conclusions concerning the total population are correct or in error will depend exclusively upon our sample, since conclusions can be based only on whatever observations are made from the sample, and not on the conditions that actually exist among the total population. Thus, accuracy of results depends largely on whether or not the conditions in the total population are faithfully reflected in the sample. The accuracy of estimates based on sampling is affected by two sources of error: bias and sample size.

Inaccurate results, and consequently erroneous conclusions, arise from biased samples. By bias it is meant that the manner of selecting the sample is such that it touches only a specific part of the population which differs from the rest, so that estimates based on measurements of the sample do not reflect the properties of the population itself. For example, the selection of samples from a location in which they are easily available has with it the danger that such samples may be biased. In the case of harvest surveys, such might be the case if only those in town at the time of the survey were sampled, since the best hunters might be out of town. Bias can be avoided by proper sampling procedures.

There is one method by which one can assure oneself that the sample will be representative of the total population. If one selects a sample using a method by which each individual or instance in the total population has an equal chance to appear in the sample (random selection), then in most instances the distribution of observations in the sample will be a true reflection of the distribution of measurements in the total population. Any deviation from the true state of affairs is then due only to random sampling error. However, a random sample will only furnish a good estimate or description of the population with sufficient certainty if it is large enough. How large is this? Consider the following example (derived from Snedecor and Cochran 1967).

If we toss two tons of coins by some completely random process, and if these coins are not biased, we may expect roughly a ton of heads and a ton of tails. However, if we toss only five coins, and even if the coins are not biased and our method of tossing does not favour either heads or tails, it is still possible that all five coins could come up heads or tails, or in any combination of heads and tails. If we toss a coin five times and come up with four heads and one tail, are we justified in concluding that this coin is biased and will come up 80% heads and only 20% tails if tossed any number of times? Clearly, the degree of confidence we can place on any estimate is very much a function of sample size, and we must choose a sample that is large enough to provided us with the desired level of accuracy (e.g., $\pm$20%).

The desired level of accuracy (be it $\pm$20% or whatever), can be used to determine a suitable sample size by relating it to the so-called standard error (s.e.) of estimate. For a known population the value of s.e. is given by:

$$S.E. = \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}} \qquad \text{(Equation C-1)}$$

where σ is the standard deviation of the population, N is the total population, and n the sample size. Normally, we bound our estimate by $\pm$2 standard errors, since we can be reasonably sure that the true value will lie within this range. In all of the following examples, the error limits are given in terms of two standard errors.

From Equation C-1 it is clear that the standard error is a function of the intrinsic variation of the population (i.e., σ as well as the sample size (n). Estimates based on large samples should be closer to the true value and will not vary as much as those based on small samples. However, if the population data are highly variable (large σ), then a correspondingly larger sample will be required.

An examination of the experimental data suggests that high variance may be a common occurrence with Native harvest data. Distribution plots (Figures C.2 and C.3) indicate that per hunter harvests are not normally distributed. Although there are statistical methods of normalizing such data, these were rejected on the grounds that this would not appear to be a straightforward procedure amenable to local usage in the analysis of Native harvest statistics.

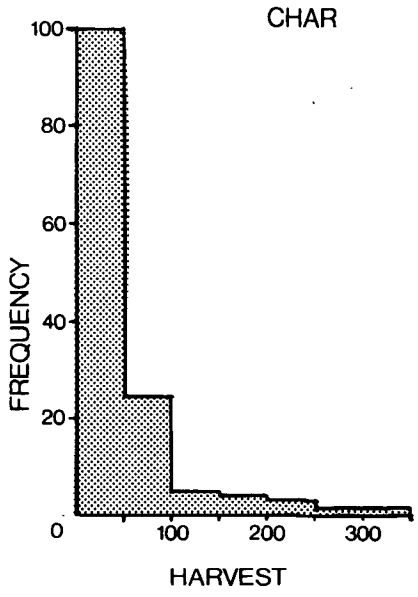
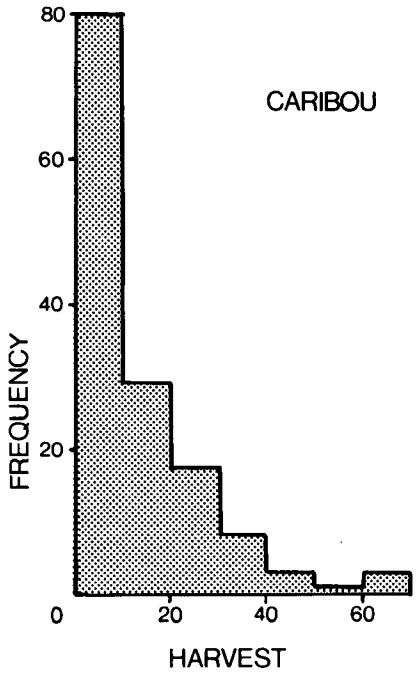
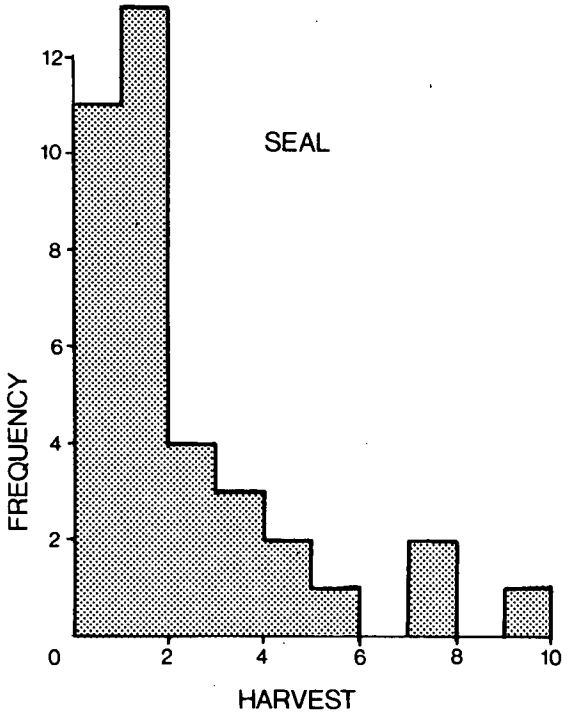


FIGURE C.2 CAMBRIDGE BAY HARVESTS – 1983

n= 141 hunters





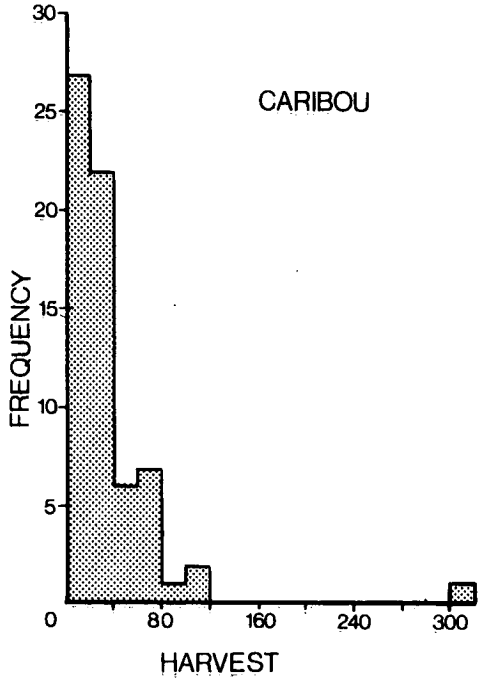
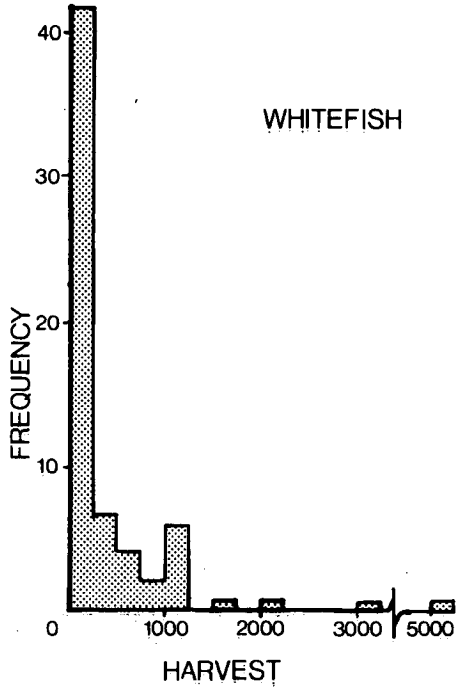


FIGURE C.3 FORT GOOD HOPE HARVESTS

n = 66 households



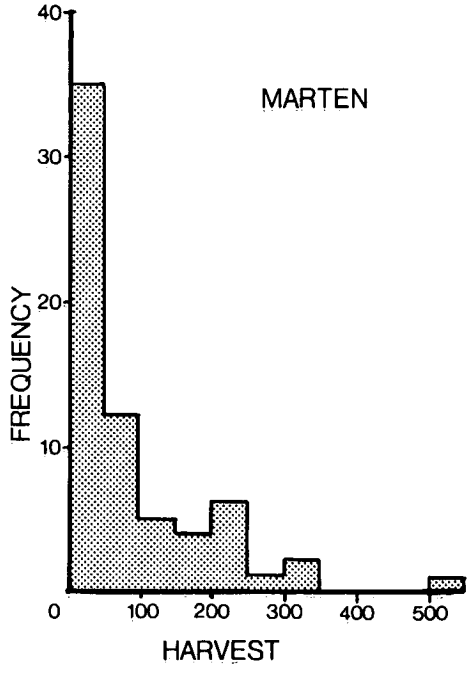


Table C1 shows the variation within harvest data for a variety of species based on a total of 141 hunters in community A. The values for the coefficient of variation, which is an intrinsic characteristic of the data, reflect the variation in hunting effort and success within the hunter group, for various species. Caribou are hunted the most widely, with the other species being subject to more selectivity and specialization. The last column of the table shows the sample size necessary to estimate the community harvest for each species to within an acceptable error of ±20%. Clearly, where the original data have a high variance, a much larger sample is required. This table has implications for the design of harvest surveys, particularly with respect to the range of species to be included and the size of sample to be taken. Table C2 shows similar characteristics for harvest data from community B (66 hunters).

In random sampling, then, there is error which will lead to inaccurate estimates, but these inaccuracies can be decreased by using a larger and larger sample, or by using a so-called stratified sample (see below). Bias in a sampling procedure cannot be corrected by making a sample larger. However, a biased sample will lead to inaccurate estimates of the values of the parameters, and these inaccuracies will only tend to stabilize if the sample is made very large.

Biased results are a distinct possibility where one relies on a fortuitous sample, rather than a sample selected for its representativeness. In the NWT surveys, the monthly harvest data are based on those hunters who happen to be reached by the survey (fortuitous sampling). Furthermore, the composition of the sample varies from month to month, again in a fortuitous way. Such bias can be avoided by selecting a sample that is representative of the population, and by ensuring the continuity of the sample from one period to the next.

C.6 Estimating Total Harvest

To estimate the total community harvest, $\hat{Y}$, from a sample of hunters, n, we can multiply the sample mean by the known total number of hunters, N:

$$\hat{Y} = N.\bar{X} \qquad \text{(Equation C-2)}$$

This projection procedure assumes, of course, that the sample, n, is truly representative of the total hunter population. Since the sample mean, $\bar{X}$, is itself only an estimate of the true population mean, (μ) , then there is some error associated with this, as discussed above. Based on the sample, this standard error is given by:

$$S.E. = \frac{s}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}} \qquad \text{(Equation C-3)}$$

which is similar to Equation C-1 except that σ is replaced by s, the sample standard deviation. (If we were to use a stratified sample, Equations C-2 and C-3 would be modified somewhat.) In all of the examples that follow, the error term is given as ± 2 s.es. Assuming that there is no bias in our sampling procedure, then from Equation C-3 we see that the precision of estimates can be increased by taking a larger sample, n. This is illustrated using the data for caribou from community A (Table C3), which shows that as the sample size increases, there is a steady improvement in the estimate of total community harvest. The magnitude of error declines from 33% for the 30% level of sampling to 10% for the 80% sample. (Note that these results are those that can be expected for infinitely repeated random sampling.)

A similar improvement of estimates for ducks, char, and seals is apparent in Tables C4, C5, and C6. In these cases, however, since the coefficients of variation are much higher, the magnitude of error remains higher at all levels of sampling -- as high as 33% for char at the 70% sample level.

C.7 Stratification

As an alternative to simply increasing the sample size in order to gain precision in estimates, stratified sampling is commonly employed. If we can form sub-groups (strata) so that a heterogeneous population is divided into more uniform parts -- e.g., full-time hunters and part-time hunters -- then we can expect a gain in precision over simple random sampling for the same overall size of sample. In stratified sampling we can choose the size of the sample to be taken from any group, and this gives us the scope to allocate the available resources efficiently to the sampling procedure.

When distributions are highly skewed, as is the case with the experimental data used in this analysis, stratification can be highly effective. The optimum allocation will usually be a 100% sample of the highest category, with the remainder distributed over the other strata (groups).

These points are illustrated in Table C7, using the data for caribou from community A. As an example, a 50% overall level of sampling has been used, with the following strategies:

i) 50% random sample of all hunters;

ii) 100% sample of the highest category of hunters (defined as those who exceeded the mean harvest plus five standard deviations; n = 7) plus 50% of the remainder;

iii) 50% sample of "full-time" hunters plus 50% sample of "part-time" hunters (full-time = four months or more of reported activity);

iv) 100% sample of highest category plus 50% of "full-time" hunters plus 50% of "part-time" hunters.

Stratification results in a significant improvement of estimates; comparing Table C7 to Table C3, one can see that in all cases a 50% stratified sample gives superior results to even a 70% random sample. Also, the higher the degree of stratification, the better the results.

Stratification implies some prior knowledge of the population, of course (e.g., full-time vs. part-time). In the interests of minimizing this requirement, the sample involving the top few hunters together with a 50% random sample of the remainder, is most appealing. In the present example, seven hunters out of the 141 total accounted for 24% of the community harvest of caribou. One imagines it should be a relatively simple matter to identify such individuals prior to the study and include them in the sample.

Such specialized hunting is the case for all the species listed in Tables C1 and C2, but unfortunately each species involves a largely different group of top hunters. Table C8 shows the harvest by the top hunters for four major species in community A; in only two cases does any hunter appear in more than one list, with a total of 17 different hunters being represented. (Similar data for community B are shown in Table C9.)

It was decided, therefore, to use a sample comprising these 17 top hunters together with a random sample of 54 of the remaining ones, so that the total sample represented 50% of the total population. Using this, estimates of the community harvest for the species listed in Table C8 were produced. These are shown in Table C10a, together with the estimates one can expect from a 50% random sample of the whole population. In all cases the error term is reduced with the stratified sample, and in some cases markedly so.

When the top hunters are removed from the population, the mean harvest per hunter is reduced for those hunters remaining; so is the standard deviation and standard error. Therefore, the precision of estimates for the four species is improved. However, if other species are "arbitrarily" added to the survey, no similar guarantee can be given of improved estimates, because of the skewed nature of all the distributions in question. Table C10b shows the estimates for the remaining species in Table C1; for trout and geese there is an improvement, but not for ptarmigan and whitefish. In the case of trout and geese, removal of the top hunters (defined for caribou, ducks, char and seals) just happened to reduce the mean, standard deviation, and standard error of the remaining population, thus improving the sample estimates. For ptarmigan and whitefish, however, the mean, standard deviation and standard error were quite fortuitously raised by this process, thus worsening the sample estimates.

One conclusion from this is that a sample that is selected to be representative for one purpose (to estimate the harvest of caribou, ducks, char and seals), will not necessarily be as representative for other species. This is a risk of adding more items to the survey questionnaire.

C.8 Conclusions

i) Nothing beats looking at everything!

ii) Depending on what you really need, however, it may not be necessary to look at everything (i.e., sampling would be better).

iii) Whatever is done, do it in a rational and consistent way -- a good quality representative sample is better than an ad hoc "census" (i.e., a large fortuitous sample).

iv) Because of intrinsic variation in harvest data, and particularly if high variation is the norm, samples will need to be quite large. Consequently some kind of stratification would be wise.

TABLE C1
Variation of Harvest Data by Species,
Community A (141 Hunters)

Species	Mean/hunter	Coefficient of variation (%)	Sample size for ±20% error
Caribou	11.1	125	75 (53%)
Ducks	5.4	211	107 (76%)
Seal	0.7	226	111 (78%)
Trout	19.8	250	115 (82%)
Ptarmigan	5.7	256	116 (82%)
Char	62.7	294	121 (86%)
Geese	1.9	326	125 (88%)
Whitefish	5.1	526	135 (95%)

TABLE C2
Variation of Harvest Data by Species,
Community B (66 Hunters)

Species	Mean/hunter	Coefficient of variation (%)	Sample size for ±20% error
Ducks	89.9	113	44 (66%)
Marten	76.0	128	47 (71%)
Caribou	30.9	137	49 (74%)
Whitefish	400.8	194	56 (85%)

TABLE C3
Effect of Sample Size on Estimate of Total
Annual Caribou Harvest for Community A
(μ = 11.1, σ = 13.9)

Sample size (%)	n/N	2S.E./μ
30	42/141	33%
40	56/141	26%
50	70/141	21%
60	84/141	17%
70	98/141	14%
80	113/141	10%

TABLE C4
Effect of Sample Size on Estimate of Total
Annual Duck Harvest for Community A
(μ = 5.4, σ = 11.4)

Sample size (%)	n/N	2 S.E./μ
30	42/141	55%
40	56/141	44%
50	70/141	36%
60	84/141	29%
70	98/141	23%
80	113/141	18%

TABLE C5
Effect of Sample Size on Estimate of Total
Annual Char Harvest for Community A
(μ = 62.7, σ = 184.3)

Sample size (%)	n/N	2 S.E./μ
30	42/141	76%
40	56/141	61%
50	70/141	50%
60	84/141	41%
70	98/141	33%
80	113/141	25%

TABLE C6
Effect of Sample Size on Estimate of Total
Annual Seal Harvest for Community A
(μ = 0.7, σ = 1.7)

Sample size (%)	n/N	2 S.E./μ
30	42/141	61%
40	56/141	49%
50	70/141	40%
60	84/141	33%
70	98/141	26%
80	113/141	20%

TABLE C7
Effects of Sampling Strategy on Estimate of
Total Annual Caribou Harvest for Community A
(50% sample level)*

Sample	n/N	$\hat{Y} \pm 2$ S.E.	2S.E./$\hat{Y}$
50% of total	70/141	1608 ± 336	21%
100% top + 50% remainder	73/141	1526 ± 213	14%
50% f-t + 50% p-t	70/141	1610 ± 177	11%
100% top + 50% f-t + 50% p-t	74/141	1549 ± 123	8%

* Results based on 10 sample replicates.

TABLE C8
Individual Top Hunters, Community
(by Identification Number)

Identification Numbers	Caribou	Ducks	Char	Seals
				3
	9			
	12			
		13		
		18		18
		21		
				31
				32
	50			
	58			
	67			
		74		
			80	
			95	
	98			
	110		110	
			131	
# hunters	7	4	4	4
% of community harvest	23.8	31.8	45.6	31.1

TABLE C9
Individual Top Hunters, Community B
(by Identification Number)

Identification Numbers	Caribou	Ducks	Whitefish	Marten
			2	
		8		
				10
			12	
			14	
		22		
				24
	30			
	35		35	
				51
				57
	64			
# hunters	3	2	4	4
% of community harvest	24.8	16.9	43.5	26.9

TABLE C10
Errors in Community Harvest Estimates Based on
50% Stratified and Random Samples

	Species	2 S.E./μ (%) Stratified	Random
a.	Caribou		
	bull	19.1	-
	cow	16.3	-
	calf	20.7	-
	total	16.3	21
	Ducks	30.6	36
	Char	15.7	50
	Seal	24.1	38
b.	Ptarmigan	45.6	43
	Geese	45.1	55
	Trout	23.4	42
	Whitefish	104.2	92

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