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THE ECONOMIC PERFORMANCE OF THE COMMERCIAL SKIFF FISHERY IN WESTERN CANADA

by

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ABSTRACT

Thompson, P.C. 1981. The economic performance of the commercial skiff fishery in Western Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1037: v + 21 p.

The economic performance of the approximate 2300 skiff enterprises is evaluated by means of a revenue and cost analysis of 434 sampled enterprises. The gross performance, variable and fixed costs and the net performance of this segment of the fishery are evaluated. The capital budgeting analysis indicates that the economic performance of the industry is poor. Less than 45 percent of sampled enterprises appeared able to earn sufficient revenues to ensure market returns to labour and capital. Fisheries are broadly classified as to their potential for economic viability. The implications of this viability for fisheries management and government programs, incentives and subsidies are discussed.

Key words: fishing economics; economic viability: long-run, short-run; cost analysis; capital budgeting; commercial fishing; freshwater fishing.

RESUME

Thompson, P.C. 1981. The economic performance of the commercial skiff fishery in Western Canada. Can. Tech. Rep. Fish. Aquat. Sci. 1037: v + 21 p.

On évalue le rendement économique des quelque 2300 entreprises à embarcation en analysant les coûts et revenus des 434 entreprises échantillonnées. L'analyse porte sur le rendement brut, les frais variables, les frais fixes et le rendement net de cette partie de l'industrie de la pêche. L'analyse de la budgétisation des investissements indique que l'industrie connaît un faible rendement économique. Moins de 45 pour cent des entreprises considérées semblaient retirer un revenu suffisant pour leur assurer un rendement sur la main-d'oeuvre et le capital investis. Les pêcheries sont généralement classées selon leurs possibilités de rentabilité économique. Les répercussions de cette rentabilité sur la gestion des pêcheries et sur les primes, les subventions et les programmes gouvernementaux font l'objet de discussions.

Mots-clés: économie de la pêche; rentabilité économique: longue période, courte période; analyse coût-rendements; budgétisation des investissements; pêche commerciale; péche en eau douce.

INTRODUCTION

PROFILE OF THE COMMERCIAL FISHING INDUSTRY

This study examines the primary sector of the commercial fishing industry (fish harvesting) of the Northwest Territories, Alberta, Saskatchewan, Manitoba and Northwestern Ontario.[1] Fish are harvested on an annual or periodic basis, from more than 500 lakes, ranging in size from just a few square kilometers to over 28 500 km^2. Annual fish harvests, which are comprised of over twenty freshwater species, have averaged 20 600 tonnes (45.4 million pounds) since 1972. Harvests and gross revenues earned by commercial fishermen for 1977-78 are summarized in Table 1.

Table 1. Total Fish Harvests and Gross Revenues, Northwest Territories, Alberta, Saskatchewan, Manitoba and Northwestern Ontario, 1977-78 Fishing Seasons.

Species (grade)	Live Weight Equivalent ('000 lb)	Delivered Weight ('000 lb)	Gross Revenues ($'000)
Whitefish	16,715	13,826	4,632
Walleye	10,079	8,332	6,702
Pike	8,143	6,198	1,034
Sauger	3,333	2,755	1,423
Trout	1,815	1,499	517
Others[1]	7,006	5,959	951
Total	47,091	38,569	15,259

[1] Others include by volume, mullets 51%, carp 22%, tullibee 16%, arctic charr 4%, inconnu 3%, buffalofish 2%, perch 2%. Sturgeon, catfish, goldeye and fish roe account for less than 1% of harvest volume.

Fish harvesting occurs throughout the year, on both open water and through the ice. Summer harvests have been significantly greater than winter harvests, usually representing more than 70 percent of total fish harvests. The harvesting sector employs four different "fishing platforms", the "whitefish" boat (a type of gillnet tug), the skiff (an open boat), snowmobiles and power toboggans. Fishing enterprises typically employ either a summer or a winter technology, and to a lesser extent both winter and summer technologies.

The skiff is the predominant type of fishing vessel used in Western Canada. Of the approximate 2520 enterprises, which operated during the summer of 1977, 2315 or 92 percent are classed as skiffs for the purposes of this study.

Skiffs or yawls, as they are known, are open boats, ranging in size from 4 to more than 7 meters (14 to 24 feet). Generally, skiffs are powered by one (or two) outboard engines, although it is also common that inboard engines with stern drives are used (Moshenko et al. 1978). In addition, canoes powered by outboards have also been classed as skiffs.

Skiff enterprises primarily employ two crew hands. The crew is commonly made up of an owner-operator (self-employed fisherman) and a hired crew hand, although one man operations are not uncommon. The estimated average crew size, including the owner-operator is 1.9. Approximately 60 percent of skiff enterprises employ hired crew hands. A small proportion of skiff enterprises are made up of (1) partnerships of two or more owner-operators operating a single vessel enterprise, and (2) multi-vessel enterprises. It should be noted that the large multi-vessel enterprises that are cooperatives or companies have been excluded as being classed as part of the skiff population in this study.

The principal method of fish harvesting is the manual lifting and setting of gillnets from the skiffs. Because of gear restrictions imposed by the Fisheries Act and its various regulations, gillnets are the only gear that may be utilized by skiffs. The standard length of gillnets used by skiffs is 92 m (100 yd). The depth of the nets, the mesh size and the number of standard lengths fished are variable among enterprises and fisheries.

The depth of gillnets used is dependent on the species of fish sought, the time of year, the depth of water being fished and the judgement of the operator. The mesh size used is also regulated by the Fisheries Act. Varying from lake to lake according to resource management requirements, mesh sizes range from 7.6 cm to 13.3 cm (3 to 5.25 in). The number of standard lengths or total yardage may also be regulated. Common regulations restrict skiff enterprises to a maximum daily set of 925 or 1385 m (1000 or 1500 yd). These restrictions (size and length) are used as a control on fishing effort.

Fish harvest by skiffs represent nearly 58 percent of total landings and nearly 62 percent of total gross revenues. In 1977, they harvested 11 933 tonnes of fish (26 303 000 lb) that earned a gross landed value of $9 495 000. Harvests and revenues by major species are summarized in Table 2. In terms of summer harvests skiffs harvested 75 percent of the fish caught and earned 79 percent of the gross revenues. This comparison is presented in Table 3.

PERFORMANCE OF THE INDUSTRY

The performance of the primary sector of the fishing industry is as variable as the dispersed geographic nature of the industry. Generally, it may be characterized as poor. Low average gross returns and the requirement for public sector assistance and incentive programs is symptomatic of the poor performance.

Table 4 outlines a frequency distribution of harvests and resultant gross revenues for all commercial fishing enterprises during 1977-78. The mean harvest for enterprises was 2511 kg (5536 lb) delivered weight, while mean gross

[1] The geographical area included in this study coincides with the jurisdiction of the Crown Freshwater Fish Marketing Corporation.

Table 2. Skiff Fishery Harvests, Northwest Territories, Alberta, Saskatchewan, Manitoba, Northwestern Ontario, Summer 1977.

Species (grade)	Live Weight Equivalent ('000 lb)	Delivered Weight ('000 lb)	Gross Revenues ($'000)
Whitefish	10,035	8,245	2,500
Walleye	7,679	6,265	5,033
Pike	3,915	2,917	446
Sauger	2,283	1,732	946
Trout	1,465	1,210	405
Others	926	758	165
Total	26,303	21,127	9,495

Table 3. Comparison of Skiff Harvests to Total Summer Fishery Harvests, Summer 1977.

Species	Total Summer Harvest[1] ('000 lb)	Skiff %ge	Total Summer Gross Revenues ($'000)	Skiff %ge
Whitefish	13,381	75.0%	3,565	70.1%
Walleye	8,933	86.0	5,880	85.6
Pike	4,728	82.8	555	80.4
Sauger	2,357	96.9	976	96.9
Trout	1,763	83.0	500	81.0
Others	3,728	24.8	532	31.0
Total	34,890	75.4%	12,008	79.1%

[1]Live weight equivalent

revenue was $2063. Indicative of these low means, more than 85 percent of all enterprises harvested less than 9072 kg (20 000 lb) delivered weight and earned gross revenues less than $8900. Fish harvests ranged from only 11 kg (24 lb) to 326 776 kg (720 264 lb) delivered weight, while revenues ranged from $5 to $275 540.

The reasons for this poor performance and for the enormous variation in harvests and revenues are diverse. Performance is considered to be a function of harvest control measures, transportation costs, the amount and type of technology applied, the physical productivity of the lake(s) being fished and the species composition of the harvest, among others. Harvest control measures (i.e. gear restrictions), used as stock management tools, may constrain the productivity of an enterprise, while high freight costs may place the financial position of an enterprise at the margin of economic viability.

The large range of harvests is also related to the above performance factors. The amount and type of fishing effort expended by enterprises and the level of entrepeneurial skill are also thought to be of importance. However, the size of enterprises may also be a major factor. Enterprises range in size from those with one fisherman operating a canoe or a power toboggan to large multi-vessel fishing cooperatives and companies.

Table 4. Distribution of Harvests, All Fishing Enterprises, 1977-78.

Harvest Interval ('000 lb)	Number of Enterprises	Mean[1] Harvest (lb)	Mean[1] Gross Revenue
0 to 5	1,322	1,473	$542
5 to 10	789	7,552	2,757
10 to 15	481	12,319	5,032
15 to 20	246	17,086	6,566
20 to 25	121	21,961	8,361
25 to 30	66	27,388	9,346
30 to 35	56	32,581	10,978
35 to 40	43	37,134	14,734
40 to 45	33	42,702	17,213
45 to 50	27	47,127	18,034
Over 50	98	81,659	25,670
All Enterprises	3,283	5,536	2,063

[1] The means used in this table and others are geometric means and are not equivalent to arithmetic averages. The geometric mean is the appropriate measure of central tendency with skewed distributions. See Appendix 1 for further details.

Considering the skiff, the variability of different types of fishing regulations has major significance with respect to the heterogeneity of this population. Most fisheries are governed by lake (or aggregate) quotas, where enterprises are left to compete amongst themselves for a share of the allowable aggregate quota. However, part of the Lake Winnipeg fishery is governed not by aggregate quota, but by individual, non-transferable enterprise quotas. Rather than allowing enterprises to compete for a share of the harvest, individual quotas fix an enterprise's share of the harvest at some given level. This difference is felt to be sufficiently significant to warrant treating the population as two sub-populations. Table 5 summarizes the harvests and revenues for the aggregate quota group and the individual quota group.

Even though the distinction has been made between the aggregate quota and individual quota groups the underlying causes of heterogeneity remain within each group. Examination of Tables 6 and 7 shows a wide range of harvests and gross revenues within each group.

The mean harvests by aggregate quota skiffs was 2174 kg (4791 lb) delivered weight while the mean gross revenue was $1863. Almost 90 percent of these skiffs harvested less than 9072 kg (20 000 lb) and earned less than $7800. Harvests and revenues ranged from 11 to 33 711 kg (24 to 74 305 lb) and $5 to $36 186 respectively. This performance is seemingly poorer than that presented for the aggregate fishery in Table 4.

The similar measures of performance for the individual quota skiff group are somewhat better, reflecting a more favourable species composition and proximity to market enjoyed by this group. The mean harvest was 3687 kg (8127 lb), delivered weight while the mean gross revenue was $5160. More than 99 percent harvested

less than 9072 kg (20 000 lb) reflecting the effect of fixed quotas. In fact 60 percent of individual quota enterprises harvested less than 4536 kg (10 000 lb). Eighty percent of individual quota enterprises earned less than $7,800. Harvests ranged from 39 to 12 535 kg (87 to 27 630 lb), while revenues ranged $66 to $15 671. The individual quota skiffs harvest distribution is presented in Table 7.

The harvesting sector's performance, as presented in Tables 4, 6 and 7, outlines the gross revenues of fishing enterprises. These revenues represent the funds that a firm has available to cover wage costs, variable operating expenses and fixed expenses including new investments. The inclusion of these costs in the estimation of economic viability makes the performance of the industry appear even poorer. It is clear that gross revenues earned by fishing enterprises cannot be examined in isolation from the costs of harvesting fish.

From this perspective, it appears that a significant portion of aggregate quota and individual quota skiffs are not capable of adequate financial performance in the absence of public sector subsidy and incentive programs. Confirmation of this observation will rest with the estimation harvest and owning costs and resultant financial profitability.

PURPOSE OF THE STUDY

This study is intended to provide a perspective of the economic viability of the "skiff" fishery in Western Canada. The study will examine the operation of this part of the harvesting sector by looking beyond the gross revenues it earns and considering the costs of fish harvesting.

The results of the study are intended to have application for public policy decisions concerning the control of fishing effort and access control for those fisheries that are capable of supporting a viable primary industry. In addition, the paper will have application in assisting allocation decisions regarding fisheries resources as well as those decisions regarding other "resource uses" which impact on the fisheries resource.

Section 2 of this study discusses a sample of the "skiff" harvesting population. Section 3 outlines the owning and operating costs incurred by the sampled "skiffs". Section 4 analyses this harvesting sector's net economic performance through the use of accounting ratios. Sections 5 and 6 examine the net performance through the use of net present values, while the final section provides a summary, conclusions and a consideration of some of the implications of the study.

It should be noted that much of the underlying data, on which the findings of this study are based, are not herein presented. Details on the data, its collection and analysis are available from the author.

Table 5. Aggregate Quota and Individual Quota Skiffs Harvests and Gross Revenues.

Skiff Group	Harvests[1] ('000 lb)	Percent Harvests	Gross Revenues ($'000)	Percent Gross Revenues
Aggregate Quota Skiffs	19,838	75.4%	$6,224	65.6%
Individual Quota Skiffs	6,465	24.6	3,271	34.4
Total Skiff Population	26,303	100.0%	9,495	100.0%

[1] Live weight equivalent

Table 6. Aggregate Quota Skiffs. Distribution of Harvest, Summer 1977.

Harvest Range ('000 lb)	No. of Enterprises	Mean Del.'s	Mean Harvest (lb)	Mean Gross Revenue
0 to 5	783	10	1,536	$627
5 to 10	416	26	7,037	2,753
10 to 15	213	35	12,291	4,502
15 to 20	133	39	17,021	5,916
20 to 25	86	46	22,179	8,301
25 to 30	29	46	27,917	9,925
30 to 35	25	47	31,920	11,407
35 to 40	18	57	37,639	13,416
40 to 45	9	53	42,805	18,974
45 to 50	7	57	47,524	16,825
Over 50	16	59	62,818	21,348
All Enterprises	1,753	24	4,791	$1,863

Table 7. Individual Quota Skiffs. Distribution of Harvest, Summer 1977.

Harvest Range ('000 lb)	No. of Enterprises	Mean Del.'s	Mean Harvest (lb)	Mean Gross Revenue
0 to 5	67	16	2,672	$1,740
5 to 10	267	31	7,155	4,607
10 to 15	188	46	12,215	7,639
15 to 20	32	54	17,057	10,359
Over 20	8	57	22,697	12,433
All Enterprises	562	36	8,127	$5,160

SAMPLE OF THE SKIFF FISHERY

DISTRIBUTION OF THE SAMPLE

A sample survey was conducted to collect data on the summer 1977 financial operations of skiff enterprises as a basis for analysing the performance of the skiff fishery. In total, some 434 skiff enterprises responded to interviews. Table 8 summarizes the geographic distribution of the sampled enterprises.

GROSS PERFORMANCE OF THE SAMPLED SKIFF ENTERPRISES

The 434 sampled skiff enterprises harvested 3042 tonnes (6.7 million lb) and earned gross revenues of $2.1 million. Harvests and revenue details are summarized in Table 9.

A comparison of the sample with the "skiff population" shows that the 434 sampled enterprises represents about 18.8 percent of the estimated 2315 enterprises. The harvests of the sample represent 25.5 percent of total skiff harvests, while gross revenues were 22.0 percent of total skiff revenues. The sample population comparison is summarized in Table 10.

The distinction made earlier between aggregate quota and individual quota skiffs is maintained for sampled skiffs. In total there were 403 aggregate quota enterprises and 31 individual quota enterprises. Table 11 summarizes their respective harvests and revenues.

In comparison to the breakdown between the aggregate quota and individual quota skiffs in the total population (Table 5), the sample of skiffs has a substantially smaller representation of individual quota skiffs (7.1 percent in the sample versus 24.3 percent in the population). This difference is reflected by the harvest and revenue percentages presented in Table 11, but is not considered to be significant because each of the sub-populations and samples are analysed separately.

As was the case with the aggregate quota and the individual quota skiff populations, the samples show a large degree of heterogeneity. Tables 12 and 13 show the variation in harvests and revenues for non-quota and individual quota skiffs respectively.

The mean sample aggregate quota skiff harvest was 3995 kg (8805 lb) delivered weight while the mean gross revenue was $3261. Approximately 85 percent of sampled aggregate quota skiffs harvested less than 9072 kg (20 000 lb) and earned less than $7800. Harvests and revenues ranged from 256 to 33 711 kg (564 to 74 305 lb) and $231 to $23 334 respectively. In comparison to the aggregate quota skiff population (Table 6) the sample's performance, while still considered poor, is improved. The range shows much the same degree of variation in both population and sample and the percentage distribution are similar in that 85 percent harvested less and earned less than 9072 kg and $7800 respectively in each case. The mean harvests and revenues of the sample appear to be greater

Table 8. Geographical Distribution of Sampled Enterprises.

Province/ Territory	Fishery	Number of Samples
Northwest Territories	Great Slave Lake	22
	Kakisa Lake	4
Alberta	Lac la Biche	12
Saskatchewan	Canoe Narrows	21
	Cole Bay/ Ile-a-la Crosse	4
	Kinoosao	9
	Lac la Loche	25
	Lac la Ronge	11
	Southend	12
	Wollaston Lake	29
Manitoba	Easterville	21
	Garden Hill	22
	Grand Rapids	33
	Koostatak	31
	Moose Lake	18
	Norway House	40
	Oxford House	18
	Red Sucker Lake	10
	Ste. Theresa Point	10
	Southern Indian Lake	12
	Wassagomack	31
Western Canada		434

Table 9. Sample Skiff Fishery Harvests, Summer 1977.

Species (grade)	Live Weight Equivalent ('000 lb)	Delivered Weight ('000 lb)	Gross Revenues ($'000)
Whitefish			
export and smoker grades	1,787	1,492	586
continental grade	484	403	80
cutter grade	834	597	77
All Whitefish	3,105	2,492	743
Walleye	1,513	1,170	954
Pike	1,033	765	120
Sauger	200	143	81
Trout	603	497	152
Others	252	204	36
Total	6,706	5,271	$2,086

Table 10. Comparison of Sample and Population Skiff Harvests and Revenues, Summer 1977.

	Sampled Enterprises as a Percentage of Population Enterprises	
	Harvests[1]	Gross Revenues
Whitefish	30.9%	29.7%
Walleye	19.7	19.0
Pike	26.4	26.9
Sauger	8.8	8.6
Trout	41.2	37.5
Others	27.2	21.8
All Enterprises	25.5%	22.0%

[1] Live weight equivalent

than those of the population. In fact, mean sample harvests are 84 percent larger than population harvests, while mean sample revenues are 75 percent larger than those of the population. The degree to which these sample means are significantly different, in a statistical sense, from population will be discussed below.

The mean harvest for sample individual quota skiffs was 4205 kg (9269 lb) delivered weight and the mean gross revenue was $5564. Again, 99 percent of the sub-sample harvested less than 9072 kg (20 000 lb). However, 50 percent harvested more than 4536 kg (10 000 lb), while the population showed only 40% with harvests above this level. Harvests ranged from 1335 to 10 325 kg (2942 to 22 758 lb). The mean gross revenue $5564, while 77 percent of this sample earned less than $7800. Revenues ranged from a low of $1651 to $11 177. The sample individual quota skiff distribution is presented in Table 13.

As was the case with the aggregate quota sample and populations, the individual quota skiffs showed the same pattern of higher sample means and large variations as indicated by the range of harvests and revenues. However, as indicated, previously, the percentage distribution of harvests and revenues are slightly divergent. In addition, the harvest and revenue means are more similar (refer to Table 7). The sample's mean harvest is only 14 percent greater than the population's, while the mean revenue is only 8 percent larger. The degree to which these means are significantly different are also discussed below.

SAMPLING MECHANICS

Sampling was done during the early winter of 1978 using personal interviews with self-employed fishermen. Interviewers were fishermen or persons working in the fishing industry, who lived in the communities or regions listed in Table 8. Funding for the interviewing was provided by means of a Federal Labour Intensive Program grant.

The fisheries (communities) were chosen on the basis on their representativeness of the total

Table 11. Sample Aggregate Quota and Individual Quota Skiff Harvests and Revenues, Summer 1977.

Skiff Group	Harvests[1] ('000 lb)	Percent Harvests	Gross Revenues ($'000)	Percent Gross Revenues
Aggregate Quota	6,277	93.6	$1,895	90.8
Individual Quota	429	6.4	191	9.2
Total	6,706	100%	2,086	100%

[1] Live weight equivalent

Table 12. Sample Aggregate Quota Skiffs, Distribution of Harvest, Summer 1977.

Harvest Range ('000 lb)	No. of Enterprises	Mean Deliveries	Mean Harvest (lb)	Mean Gross Revenue
0 to 5	96	15	2,626	$980
5 to 10	114	28	7,245	2,901
10 to 15	72	36	12,355	4,382
15 to 20	55	42	17,110	5,661
20 to 25	33	52	21,196	8,351
25 to 30	9	52	27,803	10,462
30 to 35	7	55	31,540	12,341
35 to 40	8	62	37,339	12,554
40 to 45	2	50	44,086	16,367
45 to 50	2	73	47,349	21,862
Over 50	5	50	63,127	17,753
All Enterprises	403	33	8,805	3,261

Table 13. Sample Quota Skiffs, Distribution of Harvest, Summer 1977.

Harvest Range ('000 lb)	No. of Enterprises	Mean Deliveries	Mean Harvest (lb)	Mean Gross Revenue
0 to 5	3	14	3,840	$2,320
5 to 10	12	26	6,642	4,220
10 to 15	10	49	11,791	7,116
15 to 20	5	48	18,068	9,914
Over 20	1	39	22,759	10,027
All Enterprises	31	37	9,269	$5,564

fishery. In addition, however, factors such as the accessibility of the community, the number of self-employed fishermen living in the community and the ability to locate qualified fishermen-interviewers became primary considerations.

Given the above, the interviewers were instructed to attempt to enumerate all the self-employed commercial fishermen in the communities. Because of the timing of the survey, knowledge about bookkeeping practices employed by fishermen and funding constraints, the attempted enumeration was priorized from more productive fishermen to less productive fishermen. In practice a total enumeration was rarely achieved. In total the sampling was designed to collect data on approximately 700 self-employed fishermen or 20 percent of the total harvesting sector.

STATISTICAL INFERENCE

Aggregate quota skiffs

A statistical analysis of the harvest, revenue and delivery means for the population and sample skiffs found that in each case the sample means significantly over-estimated the population means. In this regard, it can be concluded that aggregate sample values are upwardly biased and are, consequently, not representative of the skiff population. An examination of Table 14 and population and sample mean harvests indicates the extent of the bias. The t-values test whether or not the sample and population means are significantly different. Generally, a large t-value indicates that a hypothesis that the means are equal should be rejected. This is clearly the case with the total harvest means whose t-value of -11.43 is very much greater than the 0.5 percent critical value of ±1.98. The same holds true for the 0 to 5000 pound harvest interval. In contrast, the other harvest intervals show t-values smaller than the 5% critical level, indicating the difference between population and sample means are not significantly different. The bias of the total sample appears to result, because of this first interval and possibly the 5000 to 10 000 pound harvest interval, whose t-value is within the critical limits, but not to the robust degree that other t-values are considered to be unrepresentative of their population counterparts.

Individual quota skiffs

The statistical analysis of the individual quota skiff population and sample harvest, revenue and delivery means did not find the sample means to be significantly different to the population means (Table 15). Consequently, the individual quota skiff sample can be regarded as representative of the individual quota population. In this regard, however, the sample should be viewed with caution. An examination of 3 of the harvest intervals, the 0 to 5000 lb, the 5000 to 10 000 lb and the 15 000 to 20 000 lb intervals shows that the t-values are not as robust as might otherwise be preferred.

Aggregate quota sample divergence

The difference between the aggregate quota sample and population means is due in part to the heterogeneous nature of the skiff fisheries involved. There are a large number of distinct fisheries geographically dispersed throughout Western Canada, at varying distances to market and harvesting a variety of different species compositions. In addition, the self-employed operators bring a variety of skills and objectives to their fishing businesses. That these differences promote sample and population divergence can be seen in comparison with the individual quota skiff sample and population, where some of the above noted differences are not as important.

It is also noted that the sample, given the constraints and objectives outlined, could not be drawn on an entirely random basis. The problem is likely responsible for the upward bias, which has been introduced into the sample results.

Despite these observations about sample bias, it is still possible to make general inferences about the aggregate quota skiff population because the bias is known and to some degree measurable. In this regard, because the sample shows a general upward bias, it can be asserted that the aggregate quota population gross performance is no better than the aggregate quota sample performance.

Table 14. Statistical Analysis of Population and Sample Means, Aggregate Quota Skiffs, Summer 1977.

Harvest Range ('000 lb)	Harvests Population (lb)	Harvests Sample (lb)	t-value	Gross Revenues Population ($)	Gross Revenues Sample ($)	t-value	Deliveries Population	Deliveries Sample	t-value
0 to 5	1536	2626	- 8.74**	$627	$980	- 6.07**	10	15	- 7.84**
5 to 10	7037	7245	- 1.34	2753	2901	- 1.21	26	28	- 1.99
10 to 15	12291	12355	- 0.34	4502	4382	0.52	35	36	- 1.54
15 to 20	17021	17110	- 0.42	5916	5661	0.88	39	42	- 1.68
20 to 25	22179	21976	0.74	8301	8351	- 0.09	46	52	- 1.91
25 to 30	27917	27803	0.25	9925	10462	- 0.34	46	52	- 0.80
30 to 35	31920	31540	0.88	11407	12341	- 0.37	47	55	- 1.25
35 to 40	37639	37339	0.45	13416	12554	0.53	57	62	- 0.84
40 to 45	42805	44086	- 1.80	18976	16367	0.41	53	50	0.04
45 to 50	47524	47349	0.27	16825	21862	- 2.08	57	73	1.92
Over 50	62818	63127	- 0.06	21348	17753	0.92	59	50	0.49
Total	4791	8805	-11.43**	$1863	$3261	-10.11**	24	33	-12.84**

* t-value is significant at 0.05% probability level
** t-value is significant at 0.01% probability level

Table 15. Statistical Analysis of Population and Sample Means, Individual Quota Skiffs, Summer 1977.

Harvest Range ('000 lb)	Harvests Population (lb)	Harvests Sample (lb)	t-value	Gross Revenues Population	Gross Revenues Sample	t-value	Deliveries Population	Deliveries Sample	t-value
0 to 5	2672	3840	-2.11	$1740	$2320	0.05	16	14	-0.90
5 to 10	7155	6642	1.93	4607	4220	1.49	31	26	1.54
10 to 15	12215	11791	0.99	7639	7116	1.55	46	49	2.12*
15 to 20	17057	18068	-2.07	10359	9914	1.05	54	48	0.96
Over 20	22697	22759	-0.07	12433	10027	3.90**	57	39	2.99**
All Enterprises	8127	9269	-1.39	$5160	5564	-0.43	36	37	-1.11

* t-value significant at 0.05% probability level
** t-value significant at 0.01% probability level

COST ANALYSIS OF THE SAMPLE SKIFF ENTERPRISES

A MODEL OF NET PERFORMANCE FOR FISHING ENTERPRISES

The analysis of performance of fishing skiffs is designed to measure the returns to both the labour and the capital invested by self-employed fishermen in their businesses. This is achieved through the use of two financial models of performance, the income (profit and loss) statement and the proforma income statement. Table 16 provides an income statement for an hypothetical skiff enterprise.

The two statements are similar in format. The basic components of the income statement are discussed in the next sub-section. The proforma statement differs from the income statement in that it is not historical, but forward looking and provides estimated information for more than just one year, usually the period of useful physical and economic life of a business' assets. The proforma statement can provide more information on economic performance than on annual "snap-shot" of performance provided by the income statement. The analysis of proforma statements allows evaluation of long-run returns to labour, capital and resources as well as a sensitivity analysis of these factor inputs through adjustments in fixed levels of two of the three inputs.

FISHING COSTS

The basic format of income and proforma income statements segregates costs into two groups and subtracts these cost groups from gross revenues to derive a net revenue. The first group of costs are variable costs. These tend to vary in proportion with the amount of fishing effort expended by the enterprise. For example, a skiff's fuel expenses are considered variable, because fuel consumption tends to increase with the number of days fished and the number of gillnet sets fished. The second cost group, fixed or semi-variable costs, do not tend to change with the level of fishing effort. The cost of a fishing licence is an example of an independent cost.

Table 16. Income Statement for an Hypothetical Skiff Enterprise.

	1977-1978	
Gross Revenues (from fish sales)		$22,000
Variable Costs		
Fuel	1,725	
Repairs	25	
Provisions	1,600	
Hired Labour	2,350	
Own Labour	2,350	
Transportation	5,425	
Fishing Supplies	500	
Miscellaneous	600	
Gross Profit		7,425
Semi-Variable Costs		
Licences	50	
Taxes	75	
Rent	150	
Overhaul	525	
Gross Operating Profit		6,625
Fixed Costs		
Interest on Debt	100	
Depreciation	950	
Net Operating Profit		5,575
Income Taxes	1,394	
Net Revenue		4,181

Variable costs

Seven categories of variable costs are examined:

1. Fuel costs include gasoline, oil and lubrication purchases. It should be noted that these costs do not include federal and provincial excise and sales taxes, where commercial fishermen are exempt from liability for such taxes.
2. Maintenance and repair expenses include engine tune-up costs and minor replacement parts such as propellors. These costs are of an ongoing nature and represent the relatively minor expenses incurred in maintaining boats and engines in a operating condition.
3. The costs of provisions may be deducted as a business expense where such expenses are incurred for the purpose of gaining on producing income from the business (C.C.H. Canadian Ltd. 1975). Consequently, the cost of providing food etc. are pertinent when a self-employed fisherman and his crew are required to be absent from their residences at a meal time. Fishermen who must travel to and stay at a fishing ground, located some distance from their residences, clearly incur living expenses, which are required in order to conduct their businesses. Similarly, fishermen who travel daily to and from fishing grounds may also incur provisions expenses.
4. Labour costs include wages paid to crew hands and also actual or inputed wages to the (owner) operator. Hired labour costs are the actual costs reported by the sampled skiffs. Self-employed fishermen, however, rarely pay themselves a direct wage. Their general practice is to take a residual payment, after all cash costs have been accounted for. Because this analysis is designed to examine returns to both capital and labour (implicit wages for owner-operators), it was necessary to impute operator's wages in the majority of cases. The imputed wage was calculated using the provincial minimum wage rates in order to estimate a minimum evaluation of the value of self-employed fishermen's labour.
5. Fishing supplies entail expenditures on a wide range of items necessary for operating a fishing skiff, including rope, knives, net repair supplies, etc.
6. Transportation costs cover the expenditures many skiff enterprises incur in transporting their harvest production to one of the approximately 95 assembly points in Western Canada. Fish are purchased from fishermen by the Freshwater Fish Marketing Corporation F.O.B. at these assembly points.

   In some instances assembly points are located at lakeside and fishermen can deliver their harvests direct to the "packing" plant from their vessels. In other instances, this is not possible and fishermen must ship their fish by other means because the assembly point is not located convenient to lakeside. In such cases, the cost charged by commercial carriers and/or the costs incurred in the operation of private vehicles were recorded.
7. Miscellaneous costs include expenditures made for ice or weighing services. These costs were incurred by a small number of enterprises.

Table 17 summarizes the mean variable fishing costs for aggregate quota and individual quota skiffs by harvest interval. As was the case for harvests and revenues the means are geometric means.

Semi-variable and fixed costs

Four categories of fixed and semi-variable costs are examined:

1. Depreciation is an accounting practice that imputes an annual cost for attribution to capital costs. The Income Tax Act capital cost allowance schedule pertaining to farmer's and fishermen's capital assets (CCH Canadian Ltd. 1974) were used to calculate depreciation expenses. Table 18 summarizes the ownership of capital assets.

Table 17a. Mean Variable Fishing Costs, Aggregate Quota Skiff Sample, Summer 1977.

Harvest Range ('000 lb)	Fuel	Repairs	Provisions	Labour	Fishing Supplies	Transportation	Miscellaneous
0 to 5	$ 173	$31	$ 217	$ 762	$194	$ 125	$106
5 to 10	363	26	361	1215	202	371	184
10 to 15	501	26	499	1725	238	427	283
15 to 20	619	36	600	2034	245	590	369
20 to 25	764	33	831	2920	271	1147	472
25 to 30	896	37	739	3129	271	444	361
30 to 35	835	67	819	2755	280	1873	390
35 to 40	1173	28	1413	3601	408	1422	757
40 to 45	1083	80	1732	4432	974	2500	---
45 to 50	1725	24	1597	4668	489	5426	587
Over 50	1830	73	1783	4067	513	1816	835
All Enterprises	$ 403	$30	$ 427	$1453	$225	$ 423	$261
Percent with expense	100%	90%	100%	100%	100%	38%	21%

Table 17b. Mean Variable Fishing Costs, Individual Quota Skiff Sample, Summer 1977.

Harvest Range ('000 lb)	Fuel	Repairs	Provisions	Labour	Fishing Supplies	Transportation	Miscellaneous
0 to 5	$129	$10	$288	$ 882	$118	---	---
5 to 10	197	13	345	1163	182	---	---
10 to 15	246	17	644	2168	231	---	---
15 to 20	452	25	754	2348	264	---	---
Over 20	871	49	640	4717	740	---	---
All Enterprises	$243	$16	$485	$1622	$210	---	---
Percent with expense	$100%	$94%	$100%	$100%	$100%	0%	0%

2. Interest expenses related to financing costs for purchases of equipment and borrowed working capital were reported by respondents.
3. Overhaul costs include such expenses as rebuilding outboard engines and the fiberglassing of boats. These expenses differ from the variable repair costs because they are considered to be of a major and non-recurring nature. They are generally independent of fishing effort on annual basis.
4. Miscellaneous fixed costs include items such as annual fishing licence fees and payroll tax liability, for example. In addition, where an enterprise does not own all of its equipment, but instead rents equipment, this category includes any rental cost incurred.

Table 19 summarizes these cost categories for both sampled non-quota and individual quota skiffs.

Total variable and fixed costs

Table 20 consolidates the variable and fixed costs for aggregate quota and individual quota skiffs. Variable costs were approximately $1000 more for aggregate quota skiffs than for individual quota skiffs. This is likely a consequence of more remote locations of some aggregate quota fisheries and corresponding higher fuel and transportation costs. Conversely, average fixed costs were over $350 greater for individual quota skiffs. This differential is explained by the higher depreciation expenses resulting from the greater investments in fishing assets.

SUBSIDIES: FREIGHT EQUALIZATION AND ASSISTANCE PROGRAMS

The transportation costs reported by the respondent enterprises represent gross expenditures incurred for freighting fish harvests. Many fishermen operating in the summer 1977 fishery received government subsidies to compensate them for a portion of their freight costs. The provinces of Manitoba, Ontario and Saskatchewan operated subsidy programs for fishing enterprises in their jurisdictions. Under these programs, fishermen, who harvest fish in selected high cost areas, were compensated on a per pound basis. Subsidies were species dependent and area specific. Table 21 details mean subsidies paid to aggregate quota enterprises. No subsidies were paid to individual quota skiffs.

Given the analysis of costs and revenue, the next section takes the final step in assessing the performance of fishing enterprises through an analysis of profitability.

Table 18. Average Replacement Costs of Fishing Assets, Aggregate Quota and Individual Quota Skiff Samples, Summer 1977.

Harvest Range ('000 lb)	Aggregate Quota					Individual Quota				
	Vessels	Engines	Gillnets	Other	Total	Vessels	Engines	Gillnets	Other	Total
0 to 5	$ 673	$1397	$ 647	$ 233	$2950	$ 950	$1846	$1863	$ 965	$5574
5 to 10	923	1494	701	281	3386	940	2229	1265	625	5059
10 to 15	1014	1557	935	320	3793	1010	2219	1853	755	5838
15 to 20	1344	1705	1107	433	4331	1000	2299	2493	696	6489
20 to 25	1270	1690	1185	498	4562	1075	2809	3437	1849	9170
25 to 30	2392	1911	1659	1332	5675	----	----	----	----	----
30 to 35	2271	1842	1839	652	6605	----	----	----	----	----
35 to 40	990	2187	1444	482	5102	----	----	----	----	----
40 to 45	1670	2385	3327	1095	8414	----	----	----	----	----
45 to 50	1036	2121	1122	713	4991	----	----	----	----	----
Over 50	1896	2202	3314	1496	8908	----	----	----	----	----
All Enterprises	$1041	$1570	$ 929	$ 367	$3810	$ 977	$2219	$1776	$ 751	$5723

Table 19. Average Semi-variable and Fixed Costs, Aggregate Quota and Individual Quota Skiff Samples, Summer 1977.

Harvest Range ('000 lb)	Aggregate Quota				Individual Quota			
	Overhaul	Semi-variable	Interest	Depreciation	Overhaul	Semi-variable	Interest	Depreciation
0 to 5	$ 260	$ 16	$ 67	$ 447	---	$ 40	$117	$ 799
5 to 10	418	30	90	571	$107	34	39	894
10 to 15	316	45	48	634	495	70	49	1020
15 to 20	305	59	62	767	140	84	58	1190
20 to 25	579	175	149	893	450	315	104	1859
25 to 30	686	117	158	1103	---	---	---	----
30 to 35	---	204	37	1075	---	---	---	----
35 to 40	1112	24	61	889	---	---	---	----
40 to 45	525	120	145	1938	---	---	---	----
45 to 50	---	54	108	908	---	---	---	----
Over 50	547	153	169	1724	---	---	---	----
All Enterprises	$ 410	$ 52	$ 85	$ 656	$298	$ 63	$ 52	$1005
% with expense	15%	100%	31%	99%	13%	100%	71%	100%

Table 20. Total Variable and Fixed Costs, Aggregate quota and Individual Quota Skiffs, Summer 1977.

Harvest Range ('000 lb)	Aggregate Quota Skiffs		Individual Quota Skiffs	
	Variable Costs	Fixed Costs	Variable Costs	Fixed Costs
0 to 5	$ 1622	$ 489	$1472	$ 878
5 to 10	2628	667	1000	963
10 to 15	3476	749	3415	1179
15 to 20	4096	919	3949	1349
20 to 25	5509	1240	6990	2728
25 to 30	6123	1443	--	--
30 to 35	5446	1290	--	--
35 to 40	8314	1206	--	--
40 to 45	9632	2464	--	--
45 to 50	14870	1016	--	--
Over 50	11227	2416	--	--
All Enterprises	$ 3049	$ 792	$2050	$1144

Table 21. Aggregate Quota Skiff Freight Subsidies.

Harvest Range ('000 lb)	Mean Subsidy Payment
0 to 5	$55
5 to 10	286
10 to 15	449
15 to 20	660
20 to 25	723
25 to 30	644
30 to 35	996
35 to 40	2003
40 to 45	1115
45 to 50	1493
Over 50	2110
All Enterprises	267

ECONOMIC VIABILITY: ANNUAL PERFORMANCE

PERFORMANCE MEASUREMENTS

The economic performance of a business is commonly measured in two ways. First, the annual analysis utilizes financial (accounting) measures of profitability such as net revenues and financial ratios, generated from income (profit and loss) statements and balance sheets. The "sales margin" and the "productivity of assets ratio" (Weston and Brigham 1966) are two such ratios. The second method of measuring performance examines earnings and costs over the expected lifetime of a firm's assets by analysing the present value of cash flows. This section looks at the first set of performance measurements.

NET REVENUE

Net revenue provides an annual assessment or a "snapshot" of the performance of a business operation. In this study net revenue is defined as the difference between gross revenues earned from fish sales minus variable, semi-variable and fixed costs. A positive net revenue may be indicative of good performance, while a negative net revenue may be indicative of an unstable financial position.

It should be noted that subsidy payments for freight assistance are ignored. This has been done because of an interest in assessing the performance of the business on its own merits, in the absence of subsidies. Generally, a "private" benefit-cost calculus of a private investment would include subsidies in an evaluation. On the other hand a "social" benefit-cost calculus of a private investment would exclude subsidies in an evaluation. While the subsidies may clearly enhance the "welfare" of recipients, the inclusion of subsidies at this stage of analysis would not allow an unambiguous assessment of individual firms' and the fishing industry's economic viability and the consequent ability of the industry to compete on the international markets in which it must sell the vast proportion of its products.

Table 22 summarizes the gross and net revenues by harvest interval for aggregate quota and individual quota skiffs. The aggregate performance of the two skiff groups is markedly different. The better performance of individual quota skiffs is again related to proximity to markets and financially favourable species compositions.

Examining the sample aggregate quota skiffs net revenues, the average net revenue was $283. Fifty-five percent of the sample had negative net revenues, the median net revenue $-376, while only 28 percent had a net revenue in excess of $1000. The individual quota skiff sample had an average net revenue of $2064 while the median net revenue was $1943. Only 15 percent of the sample had negative net revenues and 70 percent had net revenues in excess of $1000.

SALES MARGIN

The sales margin is calculated as the ratio of net profits[2] to sales. A sales margin of eight (8) indicates that 92 percent of sales dollars were consumed by costs and the residual or profit amounted to 8 percent of the sales dollars. Larger sales margins are considered indicative of good financial performance, however, no hard and fast rule can be set as to a "good sales margin", because sales margins tend to be peculiar to the type of business under study. Large volume, multi-product businesses will have relatively low margins, often less than 2 percent (Dun and Bradstreet 1977), while small volume, single product firms might be expected to have relatively higher margins. A sales margin of 10 percent, although arbitrary, is felt to be acceptable for fishing skiffs. Margins below this level, indicate that the firm's sales prices are relatively low or that its costs are high. Conversely, margins above the level are indicative of lower costs or higher sales prices. In general, a narrow profit margin can be interpreted as poor, because a small downward percentage change in sales earnings will lead to a firm incurring losses, while a large margin will protect a firm from losses due to falling prices (Weston and Brigham 1966).

Table 23 provides a summary of sales margins for the sampled skiffs. The calculation of the sales margins can be followed from Table 22. Essentially the margin is calculated by dividing the net revenue of each enterprise by that enterprise's gross revenue. The value presented for each interval of Table 23 is the average margin of the enterprises in that interval.

Again individual quota skiff performance is considered better than that of the aggregate quota skiffs. The average sales margin was -45.6 percent, while the median margin was -10.3 percent for the aggregate quota skiffs. As was the case in the analysis of net revenues,

[2] Profits can be before or after taxes. In this study net revenues or profits are before tax.

Table 22. Gross and Net Revenues of Aggregate Quota and Individual Quota Skiff Samples, Summer 1977.

Harvest Range ('000 lb)	Aggregate Quota Skiffs Number of Enterprises	Gross Revenue	Net Revenue	Individual Quota Skiffs Number of Enterprises	Gross Revenue	Net Revenue
0 to 5	96	$ 980	$-1089	3	$ 2320	- 48
5 to 10	114	2901	342	12	4220	1348
10 to 15	72	4382	258	10	7116	2450
15 to 20	55	5661	661	5	9914	4487
20 to 25	33	8351	1572	1	10027	309
25 to 30	9	10462	3452	0	--	--
30 to 35	7	12341	6605	0	--	--
35 to 40	8	12554	3186	0	--	--
40 to 45	2	16367	4839	0	--	--
45 to 50	2	21862	5283	0	--	--
Over 50	5	17753	4417	0	--	--
All Enterprises	403	$ 3261	$ 283	31	$ 5564	$2064

Table 23. Sales Margins, Aggregate Quota and Individual Quota Skiff Samples, Summer 1977.

Harvest Range ('000 lb)	Sales Margin Number of Enterprises	Aggregate quota (Percent)	Number of Enterprises	Individual Quota (Percent)
0 to 5	96	-166.3	3	0.7
5 to 10	114	- 31.9	12	28.9
10 to 15	72	- 9.7	10	34.4
15 to 20	55	4.8	5	45.9
20 to 25	33	11.0	1	3.1
25 to 30	9	24.7	0	---
30 to 35	7	40.3	0	---
35 to 40	8	21.4	0	---
40 to 45	2	26.6	0	---
45 to 50	2	23.3	0	---
Over 50	5	21.8	0	---
All Enterprises	403	- 45.6	31	29.9

55 percent of these skiff enterprises had negative values. However, 37 percent of the enterprises also had margins in excess of 10 percent. This appears to indicate that the individual firms in the industry show either good or poor performance. Very few firms appear to show marginal performance.

The average and median individual quota skiff margin was 29.9 percent. Only 15 percent of the sample had negative margins and 77 percent had sales margins in excess of 10 percent.

PRODUCTIVITY OF ASSETS

The productivity of assets or profitability ratio is computed by dividing net profits (usually after taxes) by total assets (Dun and Bradstreet 1977). The ratio is designed to measure the annual return on the firm's resources. A ratio of 10 percent is regarded as adequate (Dun and Bradstreet 1977). An enterprise with ratios lower than 10 percent are considered to be performing poorly.

Table 24 summarizes the profitability ratios for the sampled enterprises. The average ratio for aggregate quota skiffs was 2.7 percent, but the median ratio was -10.9 percent. Again 55 percent of aggregate quota enterprises had negative ratios, while only 38 percent had ratios in excess of 10 percent.

Individual quota skiffs had an average profitability ratio of 38.4 percent and a median ratio of 34.4 percent. Only 13 percent had negative ratios and 73 percent had ratios in excess of 10 percent.

Table 24. Productivity of Assets, Aggregate Quota and Individual Quota Skiffs, Summer 1977.

Harvest Range ('000 lb)	Productivity Ratio Aggregate Quota (Percent)	Individual Quota (Percent)
0 to 5	- 38.4	0.7
5 to 10	- 10.6	28.7
10 to 15	9.6	43.7
15 to 20	21.1	78.7
20 to 25	48.5	3.4
25 to 30	64.4	---
30 to 35	91.5	---
35 to 40	70.2	---
40 to 45	55.5	---
45 to 50	104.5	---
Over 50	63.2	---
All Enterprises	2.7	38.4

ECONOMIC VIABILITY: CAPITAL BUDGETING

PRESENT VALUES OF CASH FLOWS

The foregoing performance measures provided a one year's analysis of the financial status of an enterprise. Typically, a firm is in business for a much longer period and usually plans and makes business decisions based on the expected physical and economic life of its assets. A firm's performance then needs to be related to this planning period. This is why the annual measures of performance are regarded as an intermediate judgement of financial performance.

An evaluation of a firm's cash flow provides the means to assess performance over the planning period. The cash flow is defined as the firm's net revenue, plus interest payments, plus depreciation costs. By discounting the net cash flow, it is possible to relate the resultant present values to the investment requirements in assets and determine whether or not it is possible for the firm to meet all its costs, including labour and obtain a return on investment.

Cash flow analysis requires three basic steps. First, cash flows are computed and projected over an investment period equivalent to the firm's planning horizon. Second, the projected cash flow is equated to a single reference point through the discount process (Grant et al. 1976). Finally, the discounted present value of projected cash flows is equated with the firm's investment requirements. The net present value is the present value less the cost of investment. A positive net present value is regarded as being indicative of a viable business.

In analysing performance, it is important to differentiate between "long" and "short-run" assessments of viability. In the long-run, enterprises must cover all costs to be capable of re-investing and remaining viable. In the short-run, a firm need cover only its variable costs and some of its fixed costs of operation to stay in business. A firm operating in the short-run will go out of business at the end of its planning horizon, because it is incapable of re-investing in new assets.

This type of analysis is most commonly used for capital budgeting - whether or not to undertake investments. It is also relevant to assessing existing investments. This is done by computing the net present value on the basis of the present replacement cost of existing assets. It has been pointed out that the use of replacement costs may overstate the long-run economic break-even point for existing investments, because replacement costs are generally greater than that which was initially invested. This, consequently, is said to lead to the capture of "super" profits, if fishing enterprises can operate at those break-even levels. This idea can not be supported for two reasons. First, the purchase of vessels and equipment must be justified on the future earning potential of the firm, not the past. Clearly, a firm that doesn't have the future earning potential to meet present investment requirements cannot be regarded as viable in the long-run. Second, the comparison of historical cost and replacement cost of assets in terms of constant dollars is likely to yield no significant difference in the two values. Any difference that might occur can be ascribed as a legitimate "economic rent" accruing to owners of assets that have appreciated in value in "real" terms over time.

LONG-RUN ASSESSMENT OF CASH FLOWS

Because fishermen purchase vessels and equipment that have in some cases an economic life of 10 or more years, they must make commitments for the future, the final result of which can not be determined until a long period of time has elapsed. The cash flow analysis provides an estimation process for measuring future performance and can be an important aid to fishermen in making investment decisions.

Table 25 summarizes the observed annual cash flows of the sampled skiffs. These cash flows are projected for an investment period of 10 years. The average cash flow for aggregate quota skiffs was $966. while the median cash flow was only $316. Forty-two percent of this sample had negative cash flows suggesting that a large portion of industry is performing poorly. In this regard, a negative cash flow indicates that not only is there no return available for the enterprise's investments, but also the return to labour must also be less than minimum wage rate, which was set as the standard.

The average cash flow for individual quota skiffs was $3097 while the median was $2905. All sampled individual quota skiffs had positive cash flows.

The second and third steps of the analysis involve the calculations of the present values and net present values respectively. These are presented in Tables 26 and 27. Two discount rates, 10 percent and 15 percent have been used to provide for sensitivity to the effect of the discount rate (Treasury Board 1976).

Table 25. Projected Cash Flows per Year, Aggregate Quota and Individual Quota Skiff Samples.

Harvest Range ('000 lb)	Aggregate Quota Number of Enterprises	Aggregate Quota Projected Cash Flow	Individual Quota Number of Enterprises	Individual Quota Projected Cash Flow
0 to 5	96	$- 624	3	$ 790
5 to 10	114	261	12	2232
10 to 15	72	906	10	3510
15 to 20	55	1439	5	5723
20 to 25	33	2519	1	2272
25 to 30	9	4626	0	--
30 to 35	7	7691	0	--
35 to 40	8	4090	0	--
40 to 45	2	6922	0	--
45 to 50	2	6245	0	--
Over 50	5	6242	0	--
All Enterprises	403	$ 966	31	$3097

Table 26. Present Values and Net Present Values, Aggregate Quota and Individual Quota Skiff, 10 Percent Discount Rate.

Harvest Range ('000 lb)	Aggregate Quota Skiffs: Number of Enterprises	Investment Cost	Present Values 10%	Net Present Values 10%	Individual Quota Skiffs: Number of Enterprises	Investment Cost	Present Values 10%	Net Present Values 10%
0 to 5	96	$2950	$- 3835	$- 6720	3	$5574	$ 4853	$- 721
5 to 10	114	3386	1604	- 2624	12	5059	13714	8812
10 to 15	72	3793	5567	940	10	5838	21566	15729
15 to 20	53	4331	8838	3804	5	6489	35164	28675
20 to 25	33	4562	15478	12375	1	9170	13958	4788
25 to 30	9	5675	28421	14359	0	--	---	---
30 to 35	7	6605	47252	40648	0	--	---	---
35 to 40	8	5102	25130	20028	0	--	---	---
40 to 45	2	8414	42528	34115	0	--	---	---
45 to 50	2	4991	38372	33381	0	--	---	---
Over 50	5	8908	38354	29445	0	--	---	---
All Enterprises	403	$3810	$ 5935	$ 1457	31	$5723	$19023	$ 13340

Table 27. Present Values and Net Present Values, Aggregate Quota and Individual Quota Skiffs, 15 Percent Discount Rate.

Harvest Range ('000 lb)	Aggregate Quota Skiffs: Number of Enterprises	Investment Cost	Present Values 15%	Net Present Values 15%	Individual Quota Skiffs: Number of Enterprises	Investment Cost	Present Values 15%	Net Present Values 15%
0 to 5	96	$2950	$- 3133	$-6027	3	$5574	$ 3964	$- 1610
5 to 10	114	3386	1310	-2764	12	5059	11203	6301
10 to 15	72	3793	4548	73	10	5838	17617	11780
15 to 20	55	4331	7220	2312	5	6489	28725	22236
20 to 25	33	4562	12644	9272	2	9170	11420	2232
25 to 30	9	5675	23217	10691	0	--	---	---
30 to 35	7	6606	38600	31996	0	--	---	---
35 to 40	8	5102	20528	15426	0	--	---	---
40 to 45	2	8414	34741	26328	0	--	---	---
45 to 50	2	4991	31346	26355	0	--	---	---
Over 50	5	8908	31331	22422	0	--	---	---
All Enterprises	403	$3810	$ 4848	$ 492	31	$5723	$15544	$ 9856

For a fishing vessel to be regarded as profitable in the long-run, the estimated present values must be equal to, or greater than the cost of investment. The net present value is the difference between the present value and cost of investment. A negative net present value is indicative of sub-marginal economic performance.

Referring to the 10 percent present and net present values for aggregate quota skiffs (Table 26), the average present value was $5935, while the median was only $1943. Again, 42 percent of this sample had negative present values. These enterprises can be regarded as incapable of generating sufficient returns to either labour or capital. Considering the investment costs ($3810), the average net present value was $2106. However, the median net present value was $-1702. More than 55 percent of sampled aggregate quota skiffs had negative net present values. These enterprises were incapable of earning sufficient cash flows to provide a return on invested capital and may also not earn enough to provide for minimum returns to labour.

As has been the case in most performance measurements the individual quota skiff enterprises performance has been better than the aggregate quota skiffs. The average present values were $19 028 while the median value was $17 848. The average and median net present values were $13 340 and $12 705 respectively. Only 10 percent of the sample had negative net present values.

Referring to Table 27, the effect of the higher discount rate is to lower the average present and net present values. Using the 15 percent discount rate 57 percent and 13 percent of the aggregate quota and individual quota skiff samples respectively, do not meet long-run viability criterion. As can be seen, the choice of discount rate may be critical to the estimate of viability.

SHORT-RUN ASSESSMENT OF CASH FLOWS

Given this estimate of poor performance for a significant segment of the skiff fishery, the question is raised, "Why do fishermen continue to fish?". Apart from arguments which involve the absence of alternative means of earning income, a "way of life" and the availability of unemployment insurance benefits and other government subsidies, the answer may be found in the difference between the long and short-runs.

In the long-run, enterprises must generate sufficient earnings to cover all costs and provide for a return to labour and capital. In the short-run, they need only to generate sufficient earnings to meet variable expenses. Usually, investment costs in vessels and equipment are ignored. The return on capital is less than required to reinvest and the investments are, therefore, treated as "sunk" costs. Fishermen will continue to fish as long as earnings cover variable expenses. However, when capital equipment becomes exhausted and new investment is required, the enterprise is faced with the requirement of covering total costs or going out of business.

The existence of government subsidies has a significant impact in mitigating against this adjustment process. Capital equipment (i.e. vessel) subsidies, for example, reduce the requirement for returns to capital. Operating subsidies (i.e. freight) reduce variable costs thereby increasing cash flow available for a return on capital. Individually and in combination, they permit enterprises to continue to operate in the short-run. In addition the existence of Unemployment Insurance benefits may subsidize the annual or seasonal return to labour for the enterprise. This too allows the enterprise to continue its operations in the short run.

Table 28 presents a partial perspective of the effect of the various subsidies that allow short-run operation. It is only partial because only freight assistance subsidies are considered. No account has been taken for the effect of capital subsidies or unemployment benefits related to fishing. The former can provide subsidies of either 35 percent or 100 percent on the purchase of assets (Canada Department of Fisheries and Oceans 1980; Canada Department of Regional Economic Expansion n.d.). As for the latter, it is known that approximately 900 fishermen in Western Canada received average benefits of $772 during 1977 (Department of Fisheries and Oceans 1980). This is only a partial count of beneficiaries because of reporting difficulties.

The addition of the subsidy to the cash flow (no freight assistance subsidies were received by individual quota skiffs) has an impact on the performance of enterprises. Comparison of Table 28 with Tables 25 and 26 shows that both average cash flow and resultant present values are increased from $966 to $1207 and $5935 to $7421 respectively. The subsidized medians were $633 and $3890 respectively. Less than 38 percent of enterprises had negative cash flows when this subsidy was considered. When capital investments are ignored, the remainder (62 percent) can be considered viable in the short-run. This number of course would increase, if we were able to consider the other types of subsidies. This would likely also be the case could considerations such as "way of life" be included in the calculus.

Table 28. Subsidized Projected Cash Flows and Present Values, Aggregate Quota Skiffs.

Harvest Range ('000 lb)	Number Enterprises	Projected Cash Flows	Present Value 10%
0 to 5	96	$- 578	$-3557
5 to 10	114	390	2397
10 to 15	72	1127	6925
15 to 20	55	1862	11438
20 to 25	33	2944	18091
25 to 30	9	4939	30347
30 to 35	7	7975	49001
35 to 40	8	5140	31578
40 to 45	2	8198	50371
45 to 50	2	6992	42958
Over 50	5	7722	47444
All Enterprises	403	$1207	$ 7421

THE MARGINS OF ECONOMIC VIABILITY

The analysis of viability presented in the last two sections were based on gross revenue, harvest and cost data that had been aggregated across all skiff fisheries. The individual quota skiff fishery of Lake Winnipeg was the exception. While these analyses served to examine the general performance of this part of primary fishing industry, they disguised variations between fisheries, variations due to different species compositions, fish stocks available for harvests, costs, enterpeneurial skill, etc. This section is designed to provide some sensitivity to this variation.

ECONOMIC VIABILITY OF INDIVIDUAL ENTERPRISES

As has been discussed, economic viability is a long-run and a short-run phenomenon. Businesses with sufficient earnings to cover all costs including labour and capital are viable in the long-run. Businesses with earnings sufficient to meet their operating costs are viable only in the short-run and will go out of business at the time they are forced to make reinvestment decisions. The fishing industry has a third type of enterprise, one that continues to operate, but one that is not viable. In the absence of many public sector assistance programs, such enterprises would be unable to generate sufficient earnings to meet capital requirements and minumum labour requirements and possibly some operating costs. These enterprises could not and would not fish, were it not for the subsidy programs.

ECONOMIC VIABILITY OF LAKES

Table 29 examines the relative viability (not viable, short-run or long-run) for some of the lakes fished by sample enterprises by harvest intervals. The table estimates for any given lake, economic viability at eleven different harvest levels.

The estimation involved the use of simple linear regressions for each lake (or groups of similar lakes) with the net present value (10 percent discount rate) as the dependent variable and fish harvests as the independent variable (see Appendix 2 for model specification). Regression estimates for net present values were used rather than observed values in order to reduce the variation caused by entrepeneurial skill, which may be extremely evident in small samples. This may allow the analysis to have better sensitivity to the degree to which economic viability is determined by other factors that are more or less invariant on any given lake.

It should be recognized, however, that these regression estimates have limited usefulness because they do not provide a definitive classification of economic viability on a lake by lake basis. This is because the regression model may ignore many of the factors thought to be determinants of economic viability. Many of the coefficients of determination (r^2) and or their statistical significance are poor, and consequently the regression model does not explain a significant amount of observed variation. The poor r^2 are perhaps indicative of not including important variables in the model. Nevertheless, the regression estimates do provide some initial sensitivity to the relative viability of different fisheries.

The estimated net present values for each lake at the different harvest levels have been summarized. Three ranges of economic viability are defined as follows:

1. L.R. - economically viable in the long-run
   a) The present value (PV) is greater than zero (0) and is greater than the average replacement cost of assets.
   or b) the net present value (NPV) is greater than zero (0)
2. S.R. - economically accessible in the short-run
   a) PV>0, but PV $\leq$ average replacement cost
   or b) NPV$\leq$0, but -NPV $\leq$ average replacement cost
3. N.V. - economically not viable
   a) PV<0,
   or b) -NPV > average replacement cost.

From Table 29 it is possible to define three broad categories of commercial fisheries based on the likelihood of enterprises obtaining market returns to their labour and capital (Gordon 1953; Cauvin 1979). Starting at the bottom of the table, six (6) lakes; Winnipeg (quota and non-quota), Playgreen, Deschambault, Canoe, Kakisa and Moose can be classed as economically accessible because long-run viability can generally be achieved by harvesting more than 2270 kg (5000 lb) of fish. This assumes that the level of harvest is achievable on an ongoing basis over time. Recalling Table 6, 55 percent of all skiff enterprises harvest more than this amount.

Six lakes, Cedar, Sharpe, Red Sucker, Knee, Great Slave and Stevenson may be classed as marginal. Long-run economic viability

Table 29. Estimated Economic Viability of Selected Skiff Fisheries.

Lake	Harvest Intervals 0 to 5	5 to 10	10 to 15	15 to 20	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	Over 50	r^2	Significance Level
Descharme Lake	nv	nv	nv	nv	nv	nv	nv	nv	nv	nv	nv	.45	.25
Lac la Ronge	nv	nv	nv	nv	nv	nv	nv	nv	nv	nv	nv	.89	>.25
Lac la Loche	nv	nv	nv	nv	nv	nv	nv	nv	nv	nv	**SR**	.04	>.25
Lac la Biche	nv	nv	nv	nv	nv	nv	nv	nv	nv	**SR**	**SR**	.19	.25
Island Lake	nv	nv	nv	nv	nv	nv	**SR**	LR	LR	LR	LR	.19	.05
Bigstone Lake	nv	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	.59	.01
Reindeer Lake	nv	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	.74	.01
Wapawekka Lake	nv	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	.80	.01
Rat Lake	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	.37	.01
Beaverhill Lake	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	.54	.10
Wollaston Lake	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	.14	.05
Bennet Lake	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	.37	.01
Utik Lake	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	.37	.01
Southern Indian Lake	nv	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	.61	.01
Stevenson Lake	nv	nv	**SR**	**SR**	LR	LR	LR	LR	LR	LR	LR	.46	.01
Great Slave Lake	nv	nv	**SR**	**SR**	LR	LR	LR	LR	LR	LR	LR	.47	.01
Knee Lake	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	LR	.32	.01
Red Sucker Lake	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	LR	.32	.01
Sharpe Lake	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	LR	.32	.01
Cedar Lake	nv	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	LR	.80	.01
Moose Lake	nv	**SR**	LR	LR	LR	LR	LR	LR	LR	LR	LR	.94	.01
Kakisa Lake	nv	LR	LR	LR	LR	LR	LR	LR	LR	LR	LR	.99	.01
Canoe Lake	nv	LR	LR	LR	LR	LR	LR	LR	LR	LR	LR	.38	.01
Deschambault Lake	nv	LR	LR	LR	LR	LR	LR	LR	LR	LR	LR	.62	.01
Playgreen Lake	nv	LR	LR	LR	LR	LR	LR	LR	LR	LR	LR	.82	.01
Lake Winnipeg (non-quota)	**SR**	LR	LR	LR	LR	LR	LR	LR	LR	LR	LR	.95	.01
Lake Winnipeg (quota)	**SR**	LR	LR	LR	LR	LR	LR	LR	LR	LR	LR	.42	.01

nv not economically viable
SR economically viable in the short-run
LR economically viable in the long-run

requires the harvesting of more than 6800 kg (15 000 lb), a harvest level achieved only by slightly more than 18 percent of the skiff fishery. While it is possible that individuals might perform at or about this level, given observed performance it is felt that this level of production is not possible on an ongoing basis for the large majority of enterprises. Consequently, in these fisheries it will not be possible for enterprises to earn an adequate return on capital.

The remaining fourteen (14) lakes must be classed as economically inaccessible. Short- and long-run viability can only be achieved by harvesting fish at a level greater than those of the marginal fisheries. In examining levels of harvests over time from these lakes, the required harvest levels do not appear to be achievable on a sustainable basis. For example, fewer than 2 percent of Island Lake's enterprises achieved required harvest levels in 1977. In subsequent years, no enterprises achieved this level. Wollaston Lake, which is somewhat higher up on the viability scale, at best had only 5 percent of its enterprises catch the required amount of fish. Consequently, earnings will be insufficient to provide market returns to labour as well as capital.

The classification of lakes appears to be primarily related to the interaction between species composition available at a lake and the geographic location of the lake. Lakes which have been classed as economically accessible have species compositions comprised mainly of walleye and other highly valued species. These enterprises earn relatively high average revenues per pound of fish harvested. The location of these lakes also tends to be favourable. Most are located relatively close to major fish distribution channels. Average costs per pound are consequently relatively low. In some cases, (i.e. Kakisa Lake) the relatively large average revenues provide a substantial cushion for enterprises to absorb higher average costs. Relatively small to moderate quantities of fish need to be harvested for enterprises to achieve long-run viability.

The marginal fisheries have mostly different species compositions than the accessible lakes, and are generally more distant from distribution channels. The compositions range from a mixture of walleye, northern pike and lower grade whitefish to export whitefish. Consequently, average revenues are lower than the long-run lakes, while average costs are at best only equivalent. For these lakes the harvest required to have a positive net present value is not considered sustainable.

Finally, the inaccessible lakes exhibit the poorest combination of species composition and geographic location, so much so, that in some

cases average cost may actually exceed average revenues. Consequently, net present values achievable by enterprises in these fisheries tend to be so low that in the absence of subsidies, fishing would not occur.

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

GROSS PERFORMANCE

The commercial skiff fishery operating in Western Canada is comprised of approximately 2300 fishing enterprises. During the summer fishery of 1977, these enterprises harvested 12 100 tonnes (26.5 million pounds) of freshwater fish. Gross revenues earned by the enterprises amounted to nearly $9.5 million. Mean enterprise harvests were only 2200 kg (4800 lb), while mean gross revenues were less than $1900. The variability of harvests and gross revenues among the enterprises was very large. This is perhaps indicative of the heterogenous nature of the fishery. Harvests ranged from a low of only 11 kg (24 lb) to 33 700 kg (74 305 lb). Similarly gross revenues ranged from $20 to more than $36 000. Twenty percent of these enterprises earned more than 53 percent of total gross revenues and harvested more than 56 percent of total amount of fish harvested.

The sample of skiff enterprises contained 434 respondent enterprises or about 19 percent of the skiffs. These enterprises employed approximately 286 crew members, who worked nearly 390 person-months. In addition, another 111 persons provided nearly 230 person-months of non-remunerated labour to the enterprises. Enterprise operators worked approximately 1100 person-months.

Sample enterprises harvested about 6.7 million pounds of fish, earning gross revenues of more than $2.0 million. This represents 25 percent of the total skiff harvests and 21 percent of the gross revenues. Here to, there is a large degree of variability although not as great. Harvests ranged from 256 kg (564 lb) to 33 700 kg (74 305 lb), while gross revenues ranged from $231 to $23 344. Mean harvests and gross revenues were greater than those for the aggregate skiff population at 4010 kg (8837 lb) and $3388 respectively.

The sample enterprises are not representative of the skiff fishery population. That is, the sample is biased towards those enterprises that harvest more fish and earn greater gross heterogenous nature of the fishery and the logistical difficulties encountered in sampling.

NET PERFORMANCE

While gross performance measurements of the activity of the primary fishing industry, including skiffs, are readily available, such measures are generally not suitable, in isolation, for determining the adequacy of returns to fishermen's labour and capital (or to the fishery resource itself). Gross revenues earned by the industry represent the total amount of money available to the industry to pay for the costs of fishing and remunerate fishermen for their labour and their invested capital.

Total variable fishing costs for the sample amounted to approximately $1 553 900. Percentage breakdowns by item of variable cost is fuel 14 percent, repairs 1 percent, provisions 20 percent, fishing supplies 8 percent, transportation 4 percent, miscellaneous 2 percent, and labour 51 percent.

Variable costs are more than 74 percent of gross revenues earned from fish sales. Semi-variable and interest costs amounted to more than $61 000 or 4 percent of total costs.

The cash flow for the sample skiff fishery is estimated to be $479 800. This amount may be compared to the estimated total investment (at replacement costs) in vessels, gear and equipment for the sample of $1.72 million. The discounted net present value of the cash flow over 10 years at 10 percent and 15 percent discount rates is $1.23 million and $0.69 million respectively. It is noted, however, that the surplus is not distributed uniformly among the sample enterprises and that it assumes minimum returns to labour.

Examining the distribution of sample returns to capital, less than 45 percent of enterprises harvested at levels which lead to estimated net present values of greater than zero. The average net present value (10 percent discount rate) was $2903. However, the median was approximately $-1600 and 64 percent had net present values less than the average of $2903.

CONCLUSIONS

This study has provided an aggregate profile of Western Canada's skiff fishery. Based on the capital budgeting analysis of cash flows of the sample skiff it appears that economic performance of the skiff fishery is very poor. The situation is even more desperate to the extent that the analysis assumption of minimum returns to labour may underestimate the real opportunity costs of the labour employed in the fishery. Moreover the analysis has not included any payment for the resource (or the owners of the resource). Most renewable and non-renewable resources in Canada are owned by the public. In this regard, private users of these public resources normally make payments (royalties) to the Crown for the use of the resources. This is not the case in the great majority of fisheries in Canada.

It is noted that, while the aggregate performance is poor, there is a large degree of variation in economic viability among enterprises. This diversity results in mainly species composition, geographical location and entrepeneurial skill. Of 24 lakes reported on, 6 were classed as economically accessible, 6 as economically marginal and 12 as economically inaccessible.

Returns to capital

The majority of invested capital in the skiff fishery can not be economically justified based on the potential earnings. Fishing occurs in lakes, which at best can be termed economically marginal. Returns to capital from fishing operations in these fisheries will not be sufficient to allow enterprises, on their own, to be able to reinvest in vessels, gear and equipment. In those areas where fishing is classed as economically accessible, the observed long-run economic viability would decrease with the inclusion of a cost to cover a return to resource owners.

Returns to labour

As mentioned in the section on costs, the supply price of the majority of labour resources employed by the skiff fishery were unavailable. In such cases from an economic perspective, the shadow pricing of labour returns should be equated to the opportunity cost of that labour, otherwise the discussion of the return to labour involves a more subjective appraisal of what is "adequate". The evaluation of the opportunity costs of the labour of skiff fishermen is however, beyond the scope of this study. Alternatively, labour returns were equated to the provincial minimum wage. The minimum wage may be viewed as a benchmark labour return, one that presumably represents a minimum valuation of the labour in the skiff fishery. To the extent that the real opportunity cost of labour is greater than that estimated by the minimum wage, there is a direct trade-off between labour returns and the estimated return to capital. In the economically accessible fisheries, where the opportunity cost is most likely to be greater than the labour benchmark, the returns to capital in this study may be overstated. Consequently, the economic performance of the industry may also be overstated.

In inaccessible and marginal fisheries, the direction of error of the benchmark labour return is less clear. These fisheries tend to be geographically remote and, consequently, there may tend to be fewer employment alternatives for participants. In addition, participants may also have a lower level of employment skills. Nevertheless, it is not felt that a strong case for the opportunity cost being less than the minimum wage rate is warranted. In a long-run analysis, to do so, would be to project unemployment and continued poor employment skills far into the forseeable future (Treasury Board 1976).

POLICY IMPLICATIONS: FISHERIES MANAGEMENT

Economic analysis, which examines the net performance of the fishery, defining the necessary harvest levels for long-run economic viability, given varying species compositions, geographical locations and other factors, is regarded as an important fisheries management tool. Traditionally, fisheries have been managed by regulations that impose closed season or areas, gear restrictions, aggregate quotas, fixed non-transferable individual quotas, etc. that attempt to deal with problems of overfishing and common property resource exploitation. While such methods may be effective in preserving fish stocks, these methods by themselves have not counteracted the other problems. Rather, it is probable that such regulations have contributed to the economic problems of individual fishing enterprises and the industry as a whole. Alternatively, management programs, such as entry control, have been suggested (Cauvin 1979). These programs have been designed in attempt to control overfishing and correct the common property problems by limiting the amount of fishing effort (number of fishing vessels) to a level that is consistent with the size of the fishing resource and long-run economic returns to labour, capital and the resource. The economic analysis is integral to entry control programs in ensuring that economic viability objectives are achieved. It provides a basis to estimate optimal fleet size.

Further to providing an input to the management of commercial fisheries, this type of economic analysis is also important to resource allocation decisions and decisions regarding resource degradation or enhancement. For example, the economic analysis of the commercial fisheries help to provide an evaluation of net private and social benefits of resource exploitation, which is required in deciding how much commercial exploitation is desirable relative to recreational or domestic exploitation of given fish stocks.

POLICY IMPLICATIONS: GOVERNMENT INCENTIVES

The categorization of Western Canada's commercial fisheries (economically inaccessible, economically accessible and marginal) has some important implications to the operations of public sector programs and subsidies. These deal with the achievability of stated objectives, and with the "universal" application of programs and subsidies. While it is a generalization, the most often stated objectives of public sector initiatives deal with the fostering of economic development. It is clear that given the different economic potential of our fisheries the realization of economic development in those different fisheries will vary.

As has been seen, a large proportion of the skiff fishery appears to be of the economically inaccessible variety. These fisheries have little or no potential for economic viability either in the short-run or the long-run. Their continued existence is entirely dependent on the myriad of public subsidies, the withdrawal of which would see the cessation of fishing activities. Conversely, the continuance of fishing will require perpetual public support. The subsidies can not be justified on economic development grounds because the fisheries have no potential to be self-sufficient in the foreseeable future. Moreover, given present demand and supply trends, it appears that some of these fisheries may be actually becoming less self-sufficient. The continuance of subsidies to support the fishing industry, then, must be justified on social grounds.

At issue then is not whether or not there should be a subsidized fishing industry but what

is the most economically and socially efficient method delivering social assistance to economically disadvantaged peoples and regions. A subsidized fishery is an indirect means of delivering social assistance. It must be evaluated in light of alternative indirect methods as well as more direct delivery systems. The social benefits of public assistance by indirect methods (i.e. subsidized fishing industry) may be of dubious quality. First, the cost of providing subsidies (actual payments, administrative costs, resource management costs, recreational disbenefits, etc.) may actually exceed the sum of the amounts that are actually captured by the recipients given the costs they must incur in fishing. Second, if the business activity is nonviable and individuals and communities may be bouyed with "false hope". The social benefit from unproductive work may be offset by a resignation to continual failure. Finally, subsidization of the fishery provides little long-term improvement of human capital or the physical capital stock that people and communities can build upon to change their economically disadvantaged status.

Public subsidies in accessible fisheries also require comment. First by definition, accessible fisheries are economically viable. Consequently, economic development of such fisheries would occur even in the absence of public sector assistance. The principal effect of subsidies in these fisheries is to transfer income. Since the subsidies have no allocative consequences, they may be redundant in terms of their contribution to economic development and efficiency.

Often accessible fisheries do exhibit depressed returns to enterprises. These depressed returns, however, result because of the common property problem of "too many fishermen and boats chasing too few fish". Subsidies such as capital subsidies, freight subsidies and unemployment insurance only compound the problem by attracting more labour and capital to these fisheries than would normally fish. Subsidies may also retard the natural adjustment that would see enterprises, which can only operate in the short-run because of excess competition for fish leaving the industry to invest their labour and capital in more productive alternatives.

Economic development programs and subsidies would appear to have the greatest application in marginal fisheries. It is these fisheries that have some potential to achieve long-run economic viability.

In conclusion, while the universal application of government programs, incentives and subsidies may be regarded as acceptable for reasons of equity, the broad categorization of commercial fisheries leaves the economic and social efficiency of such application open to question.

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APPENDIX 1

Geometric means rather than averages have been used in most of this analysis because of the highly skewed distributions of much of the data. The skewed nature of the population and sample data (high proportion of low values and a smaller proportion of high values, often to the extreme) renders the distributions non-normal.

The significance of statistical analyses of non-normal, right-skewed populations is that arithmetic statistics (i.e. the average) are inefficient statistics for describing the populations and the average or arithmetic mean, ceases to be a summary measure of central tendency because it is highly distorted by the extreme values of the population. The theoretically correct mean for describing these types of skewed populations (log-normal) is the geometric mean. While the geometric mean is more difficult mean to compute than is the average, it has the same properties and attributes of the average, but is less affected by extreme values in a population. It, generally, has a smaller value in skewed populations than the average (Croxton and Cowden 1955).

The differences between the two averages can be illustrated by reference to the geometric mean (2174 kg) for aggregate quota skiff harvests from Table 6 and the median harvest of 2596 kg (5721 lb). The average for this variable is 4086 kg (9007 lb). It is 57 percent larger than the median and an examination of the distribution shows that 65 percent of the enterprises did not harvest as much fish as is indicated by the average. On the other hand, geometric mean of 2174 kg (4791 lb) is 16 percent smaller than the median and 43 percent of the enterprises did not harvest as much fish. In this regard, the average can not be regarded as the best measure of central tendency.

The geometric mean is calculated as follows:

$$G = \sqrt[n]{Y_1 \times Y_2 \times Y_3 \times \ldots . Y_n}$$

or

$$\ln G = \ln Y_1 + \ln Y_2 + \ln Y_3 + \ldots \ln Y_n$$

APPENDIX 2

The regression model used in section on the margins of economic viability may be specified as follows:

$$NPV = a + bH$$

where NPV is the net present value (10% discount rate)

and H is the total catch of an enterprise.

This regression model was estimated for each lake listed in Table 29. For example, the following is the regression for Cedar Lake, Manitoba:

$$NPV = -21\,729.2 + 1.681\,H$$

Standard error of regression coefficient = 0.1901
Coefficient of determination (r^2) = 0.8045
F = 78.177 with 1 and 19 degrees of freedom
number of observations = 20

In compiling Table 29, the net present value, as calculated by the regression, was determined for the mid-point of each of the harvest intervals and the level of viability was determined as explained in the text.