FISHERIES RESEARCH BOARD
OF CANADA

MANUSCRIPT REPORTS OF THE BIOLOGICAL STATIONS

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The Bonavista Long-Lining Experiment 1951

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INTRODUCTION

In 1951 the Newfoundland Fisheries Research Station continued, on behalf of the Department of Fisheries, the long-lining experiment begun in 1950 at Bonavista. In 1950 the work was experimental and as a result of the planned and methodical experimental fishing in deep water, excellent and new cod fishing grounds were found about 18 to 20 miles seaward from Cape Bonavista, in an arc with compass bearings generally between east by north and south-east of the cape, in water usually between 130 and 160 fathoms. In this area the catch of cod was consistently good from July to September 1950, averaging about a thousand pounds per tub of twelve lines of gear, and the cod caught were half a foot longer and over twice as heavy as the average trap and hand-line fish, a considerable advantage in labour of dressing and in providing fish for salting and large fillets suitable for smoking.

In 1951 the experiment was continued on a commercial basis, with the value of the fish caught, after payment of the boat's share and the ordinary running expenses, divided among the Captain and crew. An attempt was also made to compare two sizes of boats of the Cape Island type. Two long-lining boats, and their skippers, successful in fishing out of Lockeport, Nova Scotia, were selected by Dr. Needler and Dr. Martin. These were the 42-foot open type boat, the "O Johnny O", with Captain Russell Decker who had fished in the same boat at Bonavista in 1950, and the 51-foot decked "Miss Osborne" skippered by Captain

Gordon Hemeon. Each boat had two gasoline engines and a speed of about ten knots. These boats arrived in Bonavista early in June. Captain Hemeon's fishing ended on November 30 and Captain Decker's on December 15.

On August 15 the "Miss Osborne" became a total loss from a gasoline explosion near the wharf at Bonavista. From August 28 to September 18 Captain Hemeon used the "East Wind", a 47-foot decked small schooner of the Newfoundland "Jack-boat" type for long-lining. This boat had a speed of about 4 knots and while this was sufficient to haul the gear, it was considerably too low a speed for fishing the offshore grounds efficiently and with safety on all suitable days. After September Captain Hemeon used successfully for long-lining at Bonavista the 54-foot "Edward Humby" another Newfoundland schooner type boat with a speed of about 7 knots.

In 1951, in contrast to 1950, not only cod but all marketable wolffish, flounder, rosefish and halibut were accepted by the plant.

The "Miss Osborne" possessed an echo-sounder which was of considerable use in keeping the line at the most suitable depth.

ACKNOWLEDGEMENT

Most of the information given in this account of long-lining at Bonavista in 1951 has been obtained by Mr. L. N. Cluett who was assigned to follow the activities of the long-lining boats. Mr. A. M. Fleming and Mr. C. I. Barbour have also taken part in the operation. The Bonavista Cold-Storage Company and the Federal Bait-Service gave excellent co-operation to the experiment.

FISH CATCHES

Tables 1 and 2 show the catches of commercial fish by the "O Johnny O", Captain Decker, and by the boats fished by Captain Hemeon, in succession the "Miss Osborne", "East Wind" and "Edward Humby", between June 9 and December 15, 1951. The boats as a rule used 6 tubs of gear each containing twelve 50-fathom lines with hooks about a fathom apart. The catch per tub of gear increased rapidly after squid bait became available in quantity about the middle of August and decreased in November and December when the boats had more inshore than offshore trips. The best catches were made in mostly 120-140 fathom water 18 to 20 miles from Cape Bonavista. In the early part of the year inshore long-lining was not remunerative but in October, November and December catches almost half as great as those caught earlier offshore could be obtained four or five miles from the coast in water about 40 to 70 fathoms deep. In late autumn the boats became more and more confined to inshore fishing and in December all four trips by the smaller boat were inshore.

Wolffish, flounder and halibut were more plentiful in the earlier months and declined rapidly as the year advanced. September had fewest fishing trips.

It will be noted that from June 9 to December 15 the 42-foot "O Johnny O" with a crew of three caught a total of 398,000 pounds of marketable fish including 374,000 pounds of cod, the remainder being mostly wolffish and flounder (plaice), while the combination of 51-foot, 47-foot, and 54-foot decked boats used by Captain Hemeon, generally with a crew of four, produced a total of 418,000 pounds of marketable fish including

Table 1.

Fish Catches "O Johnny O", Captain Decker, Bonavista, June-December, 1951

	June 9-30	July	August	September	October	November	December 1-15	Total
Number of trips	11	13	12	7	8	11	4	66
Total Hrs. at Sea	162	210	192	102	104	123	33	926
No. Inshore Trips	1	1	2	1	2	9	4	20
No. Offshore Trips	10	12	10	6	6	2	0	46
Total Tubs Gear Used	58	73	70½	31½	34	49	15	331
Lbs. Cod per Tub Gear	824	992	1434	1531	1453	831	940	
Inshore Depths, Fath.	15- 30		22- 57	53- 54	49- 63	73	60-79	15- 79
Offshore Depths, Fath.	109-157	88-146	121-154	120-145	121-155	110-143	-	88-157
Temp. °C	-1.0 to 1.6	-1.3 to 1.4	-0.7 to 3.2	-0.5 to 0.9	-0.4 to 0.7	-	0.03 to 0.08	-1.3 to 3.2
Fish Catches, Lb.								
Cod	47,782	72,398	101,065	48,215	49,385	40,725	14,105	373,675
Wolffish	3,680	5,144	3,200	574	205	828	285	13,916
Flounder	4,607	3,085	1,512	375	113	210	50	9,952
Halibut	250	260	60	0	0	0	-	570
Rosefish	103		20		77	0	-	200
Total Marketable Fish	56,422	80,887	105,857	49,164	49,780	41,763	14,440	398,313
Values to Nearest Dollar								
Cod	$1074.	$1629.	$2274.	$1085.	$1235.	$1018.	$353.	$8668.
Wolffish	55.	77.	48.	9.	3.	12.	4.	208.
Flounder	115.	77.	38.	9.	3.	5.	1.	248.
Halibut	25.	26.	6.			0	-	57.
Rosefish	3.				2.	0	-	5.
Cod Livers	29.	111.	133.	68.	81.	53.	-	475.
Total Marketable Fish and Cod Livers	$1301.	$1920.	$2499.	$1171.	$1324.	$1088.	$358.	$9661.

N.B. Some catches of flounder and wolffish were not sold in June but the values are entered here.

Table 2.

Fish Catches, "Miss Osborne" etc, Captain Hemeon, Bonavista June-November, 1951

	Miss Osborne			East Wind and Ed. Humby	Edward Humby		
	June 11-30	July	August 1-15	September	October	November	Total
Number of Trips	10	14	6	6	9	11	56
Total Hrs. at Sea	148	230	100	111	140	127	856
No. Inshore Trips	1	0	0	1	0	7	9
No. Offshore Trips	9	14	6	5	9	4	47
Total Tubs Gear Used	57	90½	36	33½	50	55	322
Pounds Cod per Tub Gear	863	1050	1450	1595	1793	946	-
Inshore Depths, Fath.	12- 35			58- 60		40- 67	12- 67
Offshore Depths, Fath.	109-155	105-160	133-150	131-138	139-145	140-147	105-160
Temp. °C						-	
Fish Catches, Lb.							
Cod	49,167	95,018	52,205	52,775	89,630	52,020	390,815
Wolffish	5,572	7,308	2,259	425	783	517	16,864
Flounder	3,699	3,775	574	230	429	203	8,910
Halibut	300	670	95	0	0	0	1,065
Rosefish	48	10	0	0	0	25	83
Total Marketable Fish	58,786	106,781	55,133	53,430	90,842	52,765	417,737
Values to Nearest Dollar							
Cod	$1106.	$2138.	$1175.	$1187.	$2241.	$1300.	$9147.
Wolffish	84.	110.	34.	6.	12.	8.	254.
Flounder	92.	94.	14.	6.	11.	5.	222.
Halibut	30.	67.	10.	-	-	0.	107.
Rosefish	1.	-	-	-	-	1.	2.
Cod Livers	32.	124.	65.	54.	140.	68.	483.
Total Value Marketable Fish and Cod Livers	$1345.	$2533.	$1298.	$1253.	$2404.	$1382.	$10215.

N.B. Some catches of flounder and wolffish were not sold in June but the values are entered here.

391,000 pounds of cod. Actually, owing to the destruction of the "Miss Osborne" and the delay in fitting out the other boats, Captain Hemeon lost a half month with the best fishing of the year in August and two good fishing days in September, or a total, judging from the catches of the "O Johnny O", of at least 80,000 pounds of marketable fish. We consider therefore, that Hemeon's total catch to the end of November, if the destruction of the "Miss Osborne" had not occurred, would have been about 500,000 pounds of marketable fish.

COD SIZES IN THE BONAVISTA AREA 1951

Table 3 shows the percentage of total fish at various lengths, and table 4 the percentage of the total weight of fish at various lengths, caught by different methods in different months at Bonavista in 1951. Gutted and gilled weights are used. Lengths are from the tip of the snout to the fork of the tail. It will be noted that the fish caught by the offshore long-liners were very large, with an average gutted and gilled weight of 7.6 lb. in June and July and declining gradually to an average weight of 6.1 lb. in November. The fish caught by traps and by hand-line in June and July had the smallest size, averaging only 2.7 lb. and 3.1 lb. respectively.

Only 2.5% of the weight of the offshore fish in June and July was below 3.1 lb. corresponding to a length of approximately two feet, while 62.5% of the weight of the trap and 47.6% of the weight of the hand-line fish in these months was below this size. In July a very large proportion of the inshore catch of fish in Newfoundland is caught in traps. Even in November when the offshore long-line caught fish were smallest, only 4.4% of the weight of the offshore catch was below 3.1 pounds.

The hand-line fish in August were a little larger averaging 3.8 lb. corresponding with fishing a little deeper while the inshore line-trawl fish being caught in deeper water were larger than the trap and hand-line fish, the size rising from an average of 4.3 lb. in August when fishing was in 30 to 60 fathoms to 5.6 and 5.5 lb. in November and December when fishing ranged from 40 to about 80 fathoms.

Table 3.

Percentage of Total Fish at Various Sizes. Bonavista, 1951.

Length Range In.	Long-Line Trawl Offshore				Trap Inshore	Hand-line Inshore		Trawl Inshore				Length Range Cm.
	June and July	Aug.	Oct.	Nov.	June and July	June and July	Aug.	Aug.	Oct.	Nov.	Dec.	
12.2-13.8				0.2	0.1						0.2	31-35
14.2-15.7			0.1		3.0	1.2	0.5	1.0	0.5	0.8	2.0	36-40
16.1-17.7	0.1		0.1	0.4	13.8	12.9	4.4	3.8	3.0	4.6	7.6	41-45
18.1-19.7	0.4	0.2	0.4	2.7	22.7	16.9	13.9	8.2	8.3	7.4	7.5	46-50
20.1-21.7	1.8	1.4	1.4	2.9	22.9	19.8	14.7	11.1	11.5	6.2	8.1	51-55
22.0-23.6	4.5	5.6	5.5	4.7	16.2	16.4	15.2	15.0	17.0	9.6	8.7	56-60
24.0-25.6	11.5	13.2	15.0	13.8	11.1	14.6	19.0	20.0	18.3	13.5	11.5	61-65
26.0-27.6	15.8	18.2	23.1	17.8	6.8	10.1	18.2	17.9	16.2	13.4	12.1	66-70
28.0-29.5	16.5	17.9	19.5	22.1	2.0	4.7	7.3	11.1	10.3	13.3	11.8	71-75
29.9-31.5	14.6	17.7	15.1	16.7	0.7	1.9	3.7	7.1	4.9	11.3	8.9	76-80
31.9-33.5	13.2	11.0	10.1	11.1	0.6	0.8	1.9	1.9	3.9	7.1	7.5	81-85
33.9-35.4	8.5	7.1	5.5	4.9		0.4	0.4	1.5	3.1	5.9	6.5	86-90
35.8-37.4	5.7	3.9	2.7	1.8		0.1	0.3	0.7	1.8	3.9	4.8	91-95
37.8-39.4	3.2	1.5	0.9	0.2	0.1		0.3	0.7	0.8	1.8	1.4	96-100
39.8-41.3	1.8	0.7	0.4	0.2		0.1	0.1		0.4	0.9	0.9	101-105
41.7-43.3	0.9	0.7	0.1							0.1	0.5	106-110
43.7-45.3	0.5	0.3	0.1	0.5			0.1			0.1		111-115
45.7-47.2	0.4	0.2	0.1						0.1			116-120
47.6-49.2	0.3	0.1	0.1									121-125
49.6-51.2	0.1	0.1								0.1		126-130
51.6-53.1	0.1	0.1										131-135
53.5-55.1	0.2											136-140
Total Cod Measured	2422	1617	1915	551	1711	963	749	862	1417	1057	643	
Percentages	100.1	99.9	100.2	100.0	100.0	99.9	100.0	100.0	100.1	100.0	100.0	
Av.Length Cm.	76.8	74.6	72.7	71.9	53.8	56.4	60.6	63.1	64.2	68.6	67.3	
Av.Length In.	30.2	29.4	28.6	28.3	21.2	22.2	23.9	24.8	25.3	27.0	26.5	
Av. Weight Gutted and Gilled Lb.	7.6	6.8	6.2	6.1	2.7	3.1	3.8	4.3	4.5	5.6	5.5	
Range of Depths Fished-Fathoms												
Smallest	119	131	137	130	10	3	20	30	40	40	60	
Greatest	160	150	148	143	20	20	25	60	60	50	79	

Table 4.

Percentage of Total Weight of Fish at Different Lengths. Bonavista, 1951
Gutted and Gilled Weights are Used

Length Range In.	Median length In.	Average Gutted & Gilled Weight at Median Lb.	Long-Line Trawl Offshore				Trap Inshore	Hand-line Inshore		Trawl Inshore				Median Length Cm.	Length Range Cm.
			June and July	Aug.	Oct.	Nov.	June and July	June and July	Aug.	Aug.	Oct.	Nov.	Dec.		
12.2-13.8	13.0	0.5				0.01	0.01						0.01	33	31-35
14.2-15.7	15.0	0.9			0.01		1.0	0.4	0.1	0.2	0.1	0.1	0.3	38	36-40
16.1-17.7	16.9	1.3	0.02		0.02	0.1	6.7	5.4	0.8	1.2	0.9	1.1	1.8	43	41-45
18.1-19.7	18.9	1.8	0.1	0.1	0.1	0.8	15.3	9.9	6.6	3.5	3.3	2.4	2.5	48	46-50
20.1-21.7	20.9	2.4	0.6	0.5	0.5	1.1	20.6	15.4	9.4	6.3	6.1	2.7	3.5	53	51-55
22.0-23.6	22.8	3.1	1.8	2.6	2.7	2.4	18.9	16.5	12.5	10.9	11.6	5.3	4.9	58	56-60
24.0-25.6	24.8	3.9	5.9	7.5	9.4	8.8	16.2	18.5	19.7	18.3	15.7	9.4	8.2	63	61-65
26.0-27.6	26.8	4.8	10.0	12.8	17.9	14.0	12.3	15.7	23.2	20.1	17.2	11.5	10.6	68	66-70
28.0-29.5	28.7	6.0	13.1	15.7	18.8	21.8	4.5	9.1	11.7	15.7	13.6	14.2	13.0	73	71-75
29.9-31.5	30.7	7.3	14.1	18.9	17.8	20.0	1.9	4.4	7.3	12.1	8.0	14.6	11.8	78	76-80
31.9-33.5	32.7	8.7	15.2	14.0	14.2	15.8	1.9	2.3	4.3	3.8	7.5	11.0	11.9	83	81-85
33.9-35.4	34.6	10.4	11.6	10.7	9.2	8.4		1.4	1.1	3.7	7.1	10.8	12.4	88	86-90
35.8-37.4	36.6	12.2	9.1	7.0	5.2	3.6		0.4	0.9	2.0	4.7	8.4	10.8	93	91-95
37.8-39.4	38.6	14.4	6.1	3.1	2.1	0.4	0.6		1.0	2.4	2.5	4.6	3.7	98	96-100
39.8-41.3	40.6	16.7	3.9	1.8	1.0	0.5		0.6	0.6		1.3	2.8	2.8	103	101-105
41.7-43.3	42.5	19.4	2.3	1.9	0.3							0.3	1.7	108	106-110
43.7-45.3	44.5	22.5	1.6	1.0	0.4	2.0			0.8			0.4		113	111-115
45.7-47.2	46.5	26.2	1.3	0.7	0.2						0.4			118	116-120
47.6-49.2	48.4	30.2	1.2	0.3	0.3									123	121-125
49.6-51.2	50.4	35.1	0.6	0.6								0.6		128	126-130
51.6-53.1	52.4	41.4	0.5	0.7										133	131-135
53.5-55.1	54.3	47.5	1.0											138	136-140
Total Cod Measured			2422	1617	1915	551	1711	963	749	862	1417	1057	643		
Percentages			100.0	99.9	100.1	99.7	99.9	100.0	100.0	100.2	100.0	100.2	99.9		
Av. Length Cm.			76.8	74.6	72.7	71.9	53.8	56.4	60.6	63.1	64.2	68.6	67.3		
Av. Length In.			30.2	29.4	28.6	28.3	21.2	22.2	23.9	24.8	25.3	27.0	26.5		
Av. Weight Lb.			7.6	6.8	6.2	6.1	2.7	3.1	3.8	4.3	4.5	5.6	5.5		
Range of Depths Fished - Fathoms															
Smallest			119	131	137	130	10	3	20	30	40	40	60		
Greatest			160	150	148	143	20	20	25	60	60	50	79		

LOCATION AND QUALITY OF COD FISHING BY LONG-LINERS

Figure 1-7 shows the location and amount of cod caught by long-liners in the Bonavista area, 1951. From June to August 13 almost all the fishing was carried out in the deep water, generally 130 to 140 fathoms, where the fishing was good, usually averaging between 1001 and 1500 lbs. of cod per tub of 12 lines of gear. The two trials inshore gave very poor results - between 201 and 400 lbs. per tub. The bait was at first frozen herring and later herring and caplin. When squid became available in numbers for bait after August 13, fishing on the offshore grounds became very excellent, generally averaging between 1501 and 2500 pounds per tub. In 6 inshore trials in the August 14 to October period, on days when it was too windy or when the wind declined too late in the day to fish offshore, three were below 700 pounds, two below 1000 and only one between 1001 and 1500 lbs. per tub.

In November and December only 4 trials were made offshore with one fair, one moderate and two poor catches per tub, while inshore with fishing depths ranging from 40 to 79 fathoms the catches were fairly good, usually averaging between 700 and 1500 pounds per tub. With the days getting very much shorter, the weather more uncertain and boisterous and the fishing apparently at least as good inshore, the boats in November visited the offshore grounds very little and in December not at all. The offshore grounds were not fished enough in these two months for us to decide whether the rather poor results obtained offshore were due to absence of fish or to chance. Since in these months, however, the middle layer of cold water became

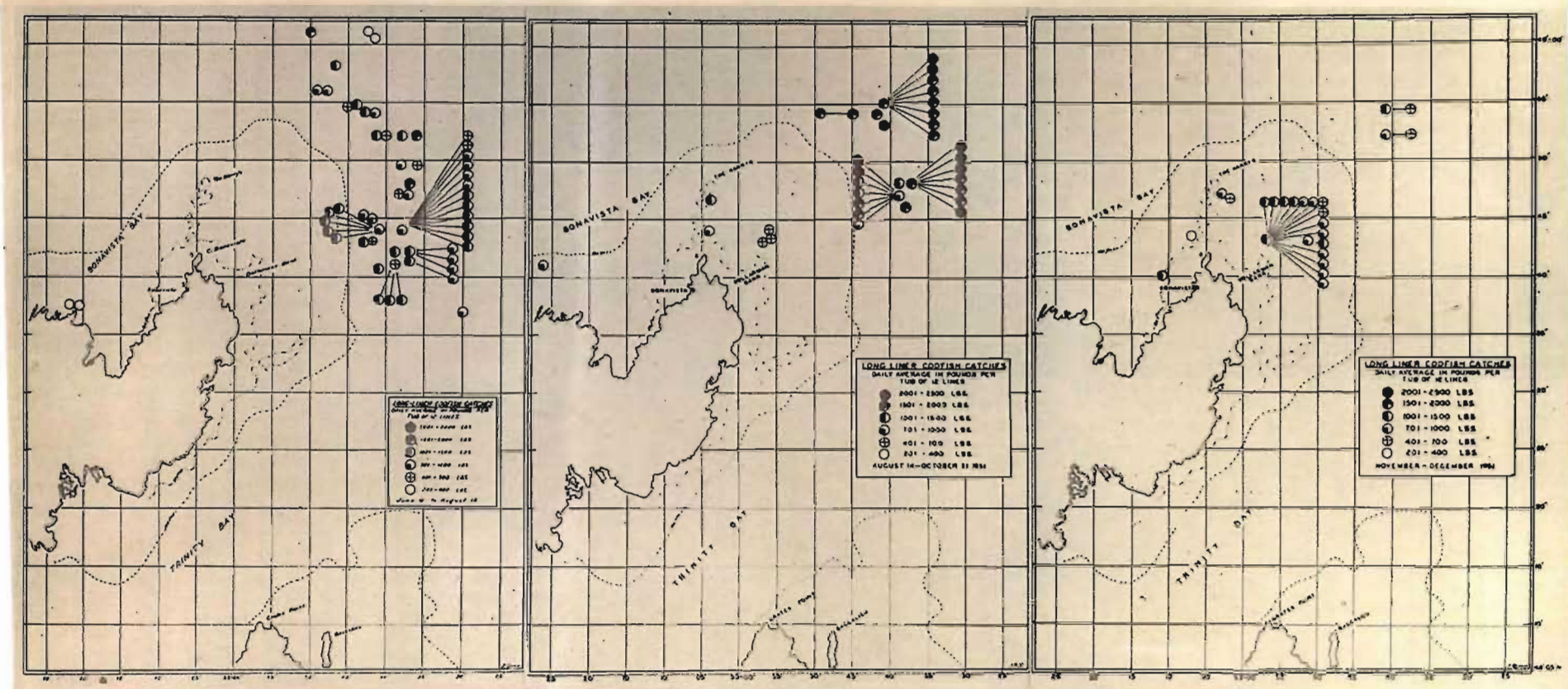
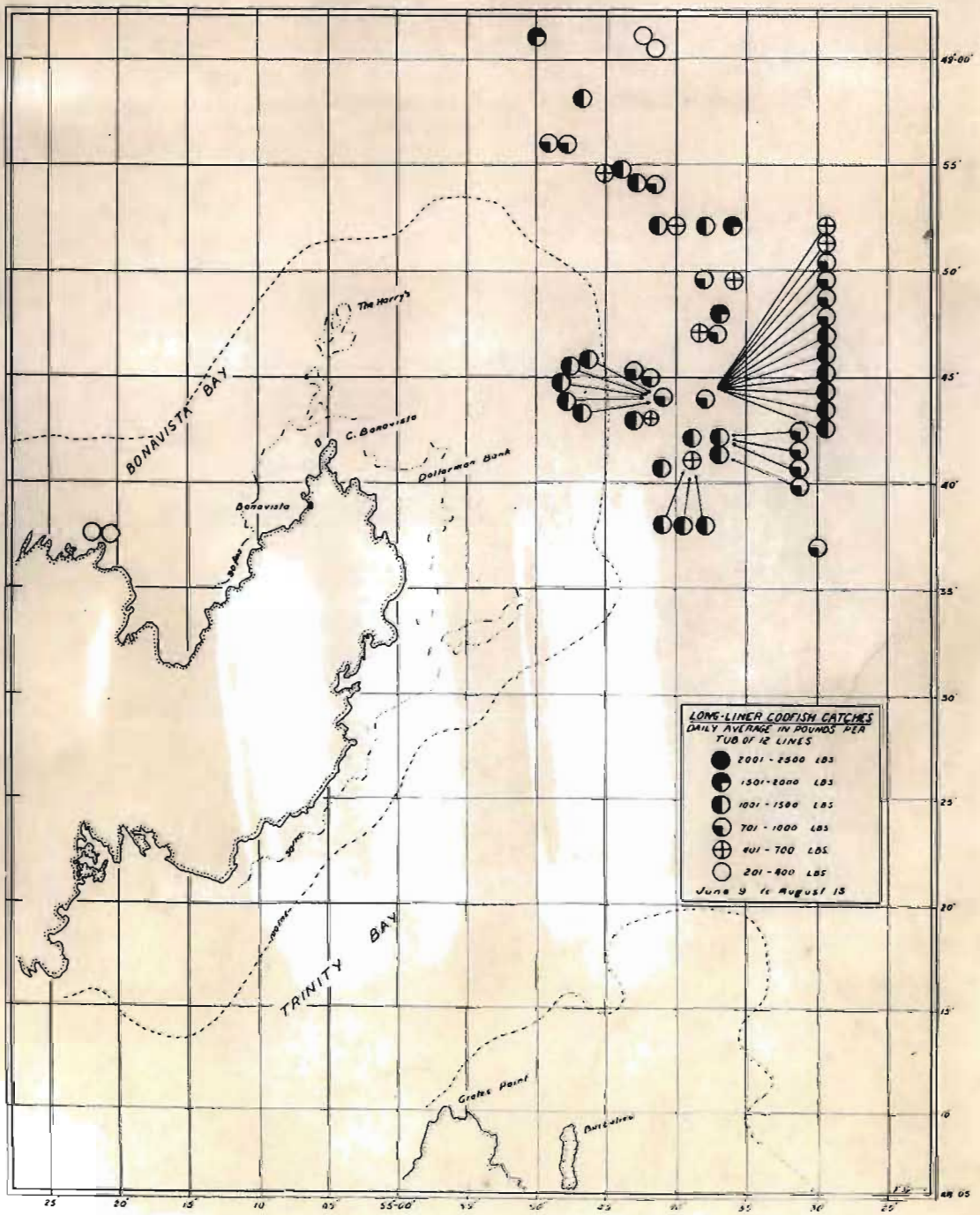
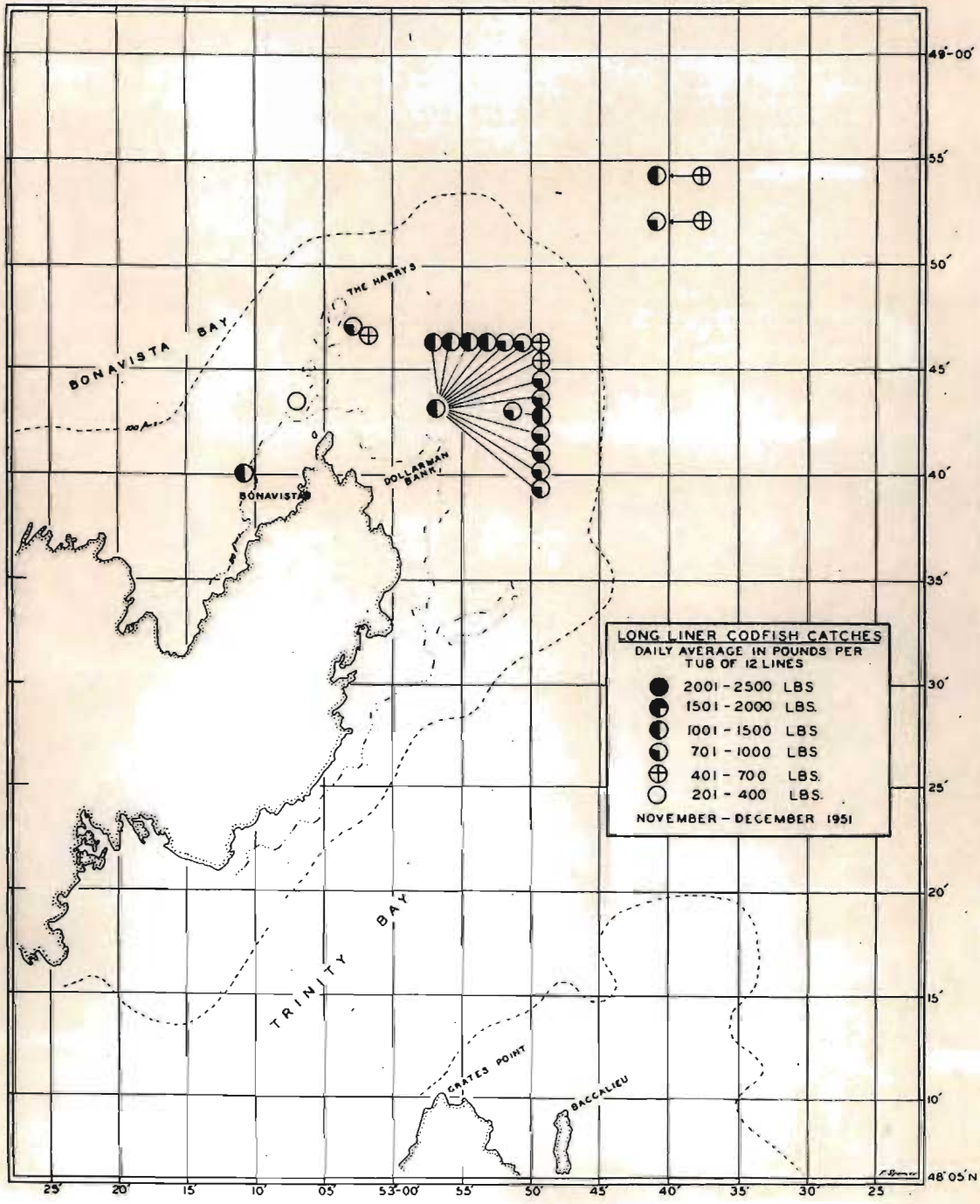


FIGURE 1. LOCATION AND QUANTITY OF COD CATCHES BY LONG-LINERS

BONAVISTA, 1951.




LONG LINER CODFISH CATCHES
DAILY AVERAGE IN POUNDS PER TUB OF 12 LINES
2001 - 2500 LBS
1501 - 2000 LBS.
1001 - 1500 LBS
701 - 1000 LBS
401 - 700 LBS.
201 - 400 LBS.
NOVEMBER – DECEMBER 1951
BONAVISTA BAY
THE HARRYS
DOLLARMAN BANK
BONAVISTA
TRINITY BAY
CRATES POINT
BACCALIEU
49°-00'
55'
50'
45'
40'
35'
30'
25'
20'
15'
10'
48°05'N
25'
20'
15'
10'
05'
53°-00'
55'
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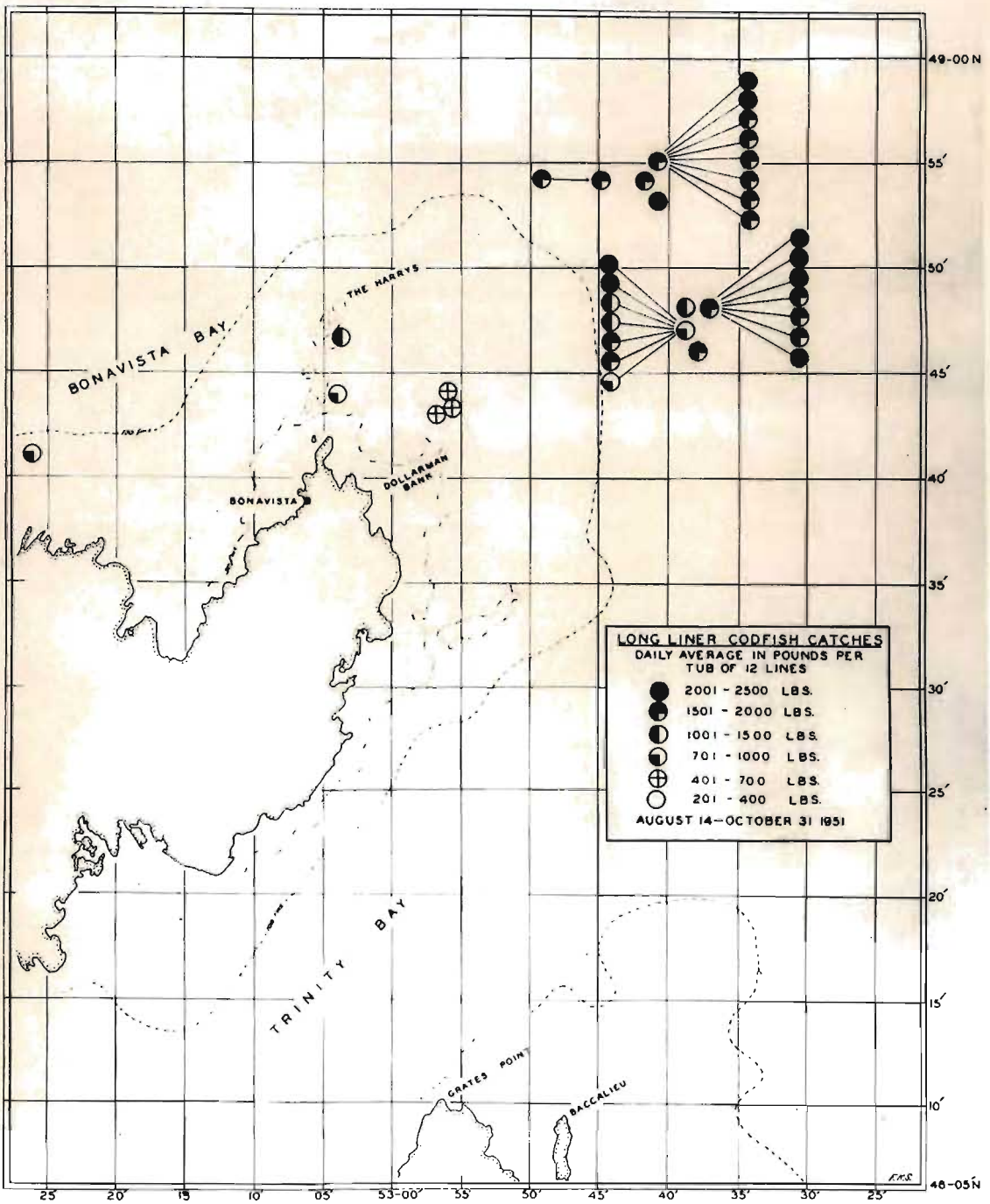
LONG LINER CODFISH CATCHES
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AUGUST 14—OCTOBER 31 1951
BONAVISTA BAY
THE HARRYS
DOLLARMAN BANK
BONAVISTA
TRINITY BAY
GRATES POINT
BACCALIEU
49-00 N
55'
50'
45'
40'
35'
30'
25'
20'
15'
10'
48-05 N
25'
20'
15'
10'
05'
53-00
55'
50'
45'
40'
35'
30'
25'

much thinner and the size of fish caught in inshore waters showed a considerable increase while the offshore cod were decreasing somewhat in size, it is very likely that a movement of cod from deep water towards the outer part of the inshore grounds occurs at this time.

ECONOMICS OF THE BOATS' OPERATIONS

As shown in Table 5 the "O Johnny O", apart from several fishing days lost while undergoing repairs, continued fishing for the whole period from June 9 to December 15. During these months this boat had a gross stock from sale of fish of $9599 and after paying a twenty per cent boat's share of $1920 and operating expenses of $2156, the remainder provided a share of $1842 for each of the crew of 3 men.

The combination of somewhat larger boats used by Captain Hemeon from June to November produced a gross stock of $10,129, which after providing a boat's share (25% for the "Miss Osborne" and 20% for the "East Wind" and the "Humby") of $2279 and operating expenses of $2016, gave a share to each of usually 4 men, of $1522. Through the destruction of the "Miss Osborne" at least $1800 worth of fish was not caught, which being divided on the same basis as that used by the "Miss Osborne" in early August just before the explosion, would have brought the gross to $11,929, the boat's share to $2729, the expenses to $2465 and the share per man to $1822.

Table 5. Economics of the Long-Lining Boats, 1951

Month	Gross Stock $	Boat's Share $	Expenses $	Net Stock $	Share per Man $	
Boats with Nova Scotian Skippers "O Johnny O"						
June 9-30	1228	246	406	577	192	3 men
July	1934	387	437	1110	370	"
August	2501	500	499	1502	501	"
September	1166	233	261	672	224	"
October	1324	265	273	786	262	"
November	1088	217	215	656	219	"
December 1-15	358	72	65	221	74	"
"Miss Osborne", "East Wind" and "Edward Humby"						
June 11-30 "Miss Osborne"	2195	549	508	1138	285	4 men
July "Miss Osborne"	1582	395	477	709	177	"
August 1-15 "Miss Osborne"	1297	324	211	761	254	3 men
August 29-Sept. 18 "East Wind") Sept. 22-30 "Humby")	1269	254	213	802	200	4 men
October - "Edward Humby"	2404	481	340	1583	396	"
November "Edward Humby"	1382	276	266	840	210	"
Totals						
"O Johnny O" June-December 15	9599	1920	2156	5524	1842	3 men
"Miss Osborne", "East Wind" and "Edward Humby" June - November	10129	2279	2016	5833	1522)	
Total allowing for $1800 worth fish lost through "Miss Osborne" explosion	11929	2729	2465	6733	1822)	generally 4 men

Note: To save space, all figures have been reduced to the nearest dollar, causing some apparent small disagreements in totals.

DETAILED EXPENSES LONG-LINING BOATS

As will be seen from Table 6 there are considerable expenses involved in the operation of a long-lining boat. These boats, however, were on charter and the owners could afford to operate them on a somewhat more lavish scale than would the Bonavista fishermen. Specifically the bills for food and water would not be part of the boat expenses and all or most of the expenses for baiting trawl and bait truckage, some of the expenses for bait, almost all the expenses for stove fuel and lamps and almost certainly some of the expenses for trawls and cotton gloves would be reduced if these boats were operated by Bonavista fishermen. Each of these two expense accounts would probably be reduced by local fishermen $800 or more but the wisdom of reducing payments for trawl baiting on shore would be doubtful. In fact the long-liners in 1951 would have benefited in June to August if the harbour conditions had been such that they could have paid for more baiting on shore, left earlier in the morning and used more gear. When the fishing became very good about the middle of August the smaller long-liner was often bringing in full loads of fish and could not have benefited by using more gear but up to August 14 the smaller long-liner also could have benefited by the use of more gear.

Table 6.

Detailed Expenses Long-Lining Boats Bonavista, 1951

	"O Johnny O" June 9 - Dec. 15	"Miss Osborne" June 11-Aug. 1 "East Wind" and "Edward Humby Aug. 29 - Nov. 30
Bait	$ 333.40	$ 334.11
Labour Baiting Trawl and Bait Truckage	166.75	204.00
Trawls and Cotton Gloves	405.40	351.22
Gasoline	634.95	422.05
Diesel Oil		194.58
Lubricating Oil	11.43	49.81
Fuel for Stove and Lamps	114.22	66.00
Food	473.36	379.25
Water	13.50	10.61
Sundries	2.60	4.25
Total	2155.61	2015.88

ECONOMICS OF SOME OF THE LOCAL BOATS' OPERATIONS

Table 7 gives a breakdown of the earnings and expenses of some of the most successful fishermen in Bonavista in 1951 as compared with those of the long-lining boats. The average fisherman earned considerably less than the amounts shown, but since the long-lining fishermen were chosen as being among the most successful in Lockeport, N. S., the most suitable comparison of the working of these boats is with the earnings of the best local fishermen.

Table 7. Economics of Fishing Boat Operations, Bonavista 1951

Boat	Overall Length Feet	Tonnage Gross	Tonnage Registered	Engines	Approx. Replacement Value Boat $	Boat's Share of Gross %	No. Men	Total Catch Gutted Head-on Fish, lb.
I	42	17	16	Chrysler Marine gas. 115 H.P. Chev. 95 H.P. gas.	7000	20	3	398,313
II (with loss of fishing time allowed for)	51	32	31	"Miss Osborne" Truck 138 H.P. gas. Chrysler Marine gas. 115 H.P.	11000	25 (generally)	4 (generally)	500,000
Local Boats								
A	31	open boat		Acadia 12 H.P.	1000	5	6	223,000
B	28	open boat		Atlantic 10 H.P.	950	5	4	128,000
C	26	open boat		7 H.P.	800	5	4	111,110
D	26	open boat		Atlantic 8 H.P.	900	5	4	174,000
E	27	open boat		Atlantic 8 H.P.	900	5	3	145,767
F	22	open boat		Atlantic 5 H.P.	700	5	3	160,000

Boat	Gross Stock from Sale of Fish and Liver $	Boat's Share $	Operating Expenses not including food $	Net Stock $	Shares per Man including food supplied by Boat $	Method of Fishing	Period of Fishing
I	9599	1920	1683	5996	1999	Long-lining mostly offshore	June 9-Dec. 15
II (with loss of fishing time allowed for)	11929	2729	2026	7174	1932	Long-lining mostly offshore Catch partly calculated	June 11-Nov. 30
Local Boats							
A	6077	304	651	5122	854	Traps (2) and line-trawl inshore	June 5-Dec. 5
B	3290	165	377	2748	687	Trap (1) and line-trawl inshore	June 20-Nov. 15
C	2860	143	326	2391	598	Trap (1) and line-trawl inshore	Latter part June - Aug.31
D	4481	208	271	4002	1001	Line-trawl and hand-line	June 1 - Nov.
E	3793	190	244	3359	1120	Line-trawl and hand-line	June - Nov.
F	4175	209	301	3665	1222	Line-trawl and hand-line	June - Nov.

I. "O Johnny O"

II. "Miss Osborne" "East Wind" and "Edward Humby"

It will be noted that the long-lining earnings per man average about twice as high as those of the other successful fishermen. Each of these crews of inshore fishermen shown in table 7 owns its boat and gear in common and the crew members pay expenses and share equally. There is thus no boat's share deducted, but to obtain a comparison with the long-lining boats, a boat's share of 5% has been deducted as compared with the 20 or 25% for the long-lining boats.

The value of the inshore boats is only about one-seventh to one-tenth that of the smaller long-liner and one-eleventh to one-sixteenth the value of the larger long-lining boats and the local boats will last at least as long as the long-lining boats. Relative to the cost of the boat the long-line trawl gear of both long-liners and inshore boats will be relatively inexpensive. Thus while the total capital value of trawls and hand-lines used by an inshore fisherman would usually be $150 or less, a cod trap with a box 60 fathoms on the round, 12 fathoms deep, and with a fifty-five fathom leader has been estimated separately by two Bonavista trap fishermen to cost $1100 for actual materials including second hand anchors and unknitted twine. Since this price does not include the labour of the fisherman in knitting the twine and preparing the trap, anchor buoys etc. the value of a new trap at Bonavista including even a small figure for the labour involved must be at least $1500.

Crew A, therefore, with two traps would have gear which in the new condition would cost $3000 including labour and Crew B and C have one trap with a replacement cost of $1500 each.

We have allowed $150 upkeep for each trap as part of the operating expenses and this should keep the trap going indefinitely apart from complete loss by storms or ice. The cost of carrying the extra capital charge and risk of loss of at least $1100 per trap represents an additional charge against the trap crew's gross stock of possibly $100 a year per trap as compared with the inshore line-trawl and hand-line crews. This has not been allowed for in table 7. In the case of the long-liners the cost of the original fishing gear has been included with the boat cost and the charge is carried by the boat's share.

To handle a large trap usually requires a crew of four or five and often, as apparently occurred at Bonavista in 1951, if the fish are not extremely plentiful close to shore, the small line-trawl fisherman with a crew of 3 or 4 with lower expenses may receive a greater net share. In some Newfoundland localities, however, in 1951, fish were much more available to the traps than at Bonavista and much higher trap catches were obtained than at Bonavista. Trap fishing, being in shallow water close inshore, although often very profitable, is very much at the mercy of chance runs of fish inshore and thus in any one locality fluctuates greatly from year to year.

The expenses of the local boats contain no amount for food, this being supplied by the members of the crew as individuals. Included in table 5 but not in table 7 for the operating expenses of the long-liner "O Johnny O" is an amount of $473 for food; and for the "Miss Osborne" of $439 (including a calculated amount for the inoperative period). Considering this amount as crew earnings, the earnings per man of the

"O Johnny O" on the same basis as the local boats become $1999 and those per man of the "Miss Osborne" (also adjusted for los of fishing time) become $1932. By Bonavista standards, the long-lining boats were run in a rather expensive fashion and there was always a man living on board. Also there were many expenses for fuel, water and other items which would not appear in the expenses of a Bonavista operated boat. Thus the expenses of the long-liners shown in tables 5, 6 and 7, even with the cost of food removed, are still considerably higher than if the long-liners were operated by Bonavista fishermen.

OPINIONS OF THE LONG-LINING SKIPPERS FROM LOCKEPORT, N. S.

Captain Hemeon

Captain Gordon Hemeon of the "Miss Osborne" was of the opinion that long-lining would prove to be a very successful method of fishing for Bonavista. He claimed that the grounds that he fished, both inshore and offshore, proved to be good commercial fishing grounds. He was under the impression that if there were more long-liners fishing in this area they would probably find more fishing grounds to the north and south of the area that he fished during the past season. He thought that by fishing in the deeper water the fishing season could be extended somewhat by starting the first of May and fishing until December or January.

For himself Captain Hemeon preferred the 55-foot boat rather than the 42-foot boat for the following reasons:

(1) You would be able to fish a greater distance from land.

(2) With a larger boat you would be able to take ice and fuel enough to fish two or three days.

(3) You would have space enough to take the fish after a couple good days' fishing.

(4) By stopping overnight you would have a longer time to fish your trawls.

(5) Your fuel bill would be much lower with a diesel engine and two day trips.

Later he expressed the opinion that the right boat for fishermen starting long-lining at Bonavista would be somewhere in the forty-foot class because these boats would be much more easily adapted to fishing inshore on bad days than the larger boats.

Captain Hemeon, who fished in a Newfoundland Jack-boat after the month of August, was under the impression that this type of boat could be converted into a long-liner and operated successfully. But he stated that if any fisherman was having a new boat built for long-lining it should be built like the Cape Island boat for convenience of operation by a minimum crew.

He was of the opinion that the following suggestions are required to make long-lining at Bonavista a commercial success.

Navigational Aids. A Groaner buoy placed between Gull Is. and Stone Is. so that during foggy weather, boats fishing outside could steer for this buoy instead of having to steer for the Cape and taking the chance of going to leeward into the shoal water that lies to the south of the Cape. A Bell buoy placed a good distance off Squarry Head so that a straight course can be steered from the Groaner buoy to this Bell buoy. This would make it possible to keep clear of the nets when going out or returning in the darkness. From late May to early August there are at first salmon nets and later cod traps in the inshore area between Green Island near the Cape to Squarry Head. From the harbour light on the breakwater to the Bell buoy and from the Bell buoy to the Groaner buoy should be made a fairway channel and salmon nets and traps should not be allowed to be set in this channel. The idea of having a fairway channel even without the buoys is a good idea and very important to the use of long-liners especially the larger boats, for if they are going to be a commercial success, they must be able to leave and return during the hours of darkness and with

nets and traps being placed anywhere and everywhere in the entrance to the harbour the possibility of striking a buoy or fouling the propellor in a net is very great. Since at present there is no way of docking a boat at Bonavista for underwater repairs a fisherman owning such a boat cannot afford the risk of being delayed for repairs. Therefore he cannot leave as early as he would like or if he is fishing he must regulate the amount of trawl he can use so as to be in before dark.

Small Slip for Underwater Repairs. With the introduction of long-liners to Bonavista, for the larger type similar to the "Miss Osborne" it will be necessary to have some method of docking the boat for underwater repairs. At present in Bonavista all the repairs are made by hauling the boats out by hand. With the larger type boats this is impossible. The rise and fall of the tides is not great enough to permit drying the boats by the side of the pier. If the boats are equipped with an echo-sounder as was the "Miss Osborne" they must be docked in an upright position to prevent injury to the sounding gear. To dock boats in an upright position a cradle is required, such a cradle to be equipped with some sort of rollers or laid on a track. In this way it would be possible to haul the boats out with a truck or to have a stationary engine attached to the cradle for this purpose.

Captain Decker

Captain Russell Decker of the "O Johnny O" thought that long-lining would prove very successful at Bonavista. He claimed that most of the grounds which he fished during the season proved to be good commercial fishing grounds. He was of

the same opinion as Captain Hemeon that if there were more long-liners fishing out of Bonavista they would probably find more fishing grounds to the north and south of the grounds he fished during the past season. He thought that if the boats fished in deeper water the season could be extended somewhat, from at least the first of May to the last of December or January, depending on ice conditions.

Captain Decker thought that a 42-foot boat would be more suitable for Bonavista than a 55-foot boat ~~for~~ at the present time for the following reasons:

(1) Cost of boat much lower thus giving the fishermen a better chance to own their boats.

(2) Cost of operating would be lower.

(3) Fishing grounds near enough to return to port every night.

(4) Much easier to keep up on gear while fishing than a larger boat.

Navigational Aids. For long-lining at Bonavista it is certainly necessary to have a fairway channel in which nets are prohibited as Hemeon has suggested. He agrees with all the Buoys that Hemeon has suggested except that he would also recommend that the buoy between Stone Is. and Gull Is. need not necessarily be a Groaner buoy, but he thinks that a Groaner buoy should be placed in a position somewhere south and east from the Offer Rock of the Old Harry Shoals, so that a course can be taken from this buoy to the buoy between Stone Is. and Gull Is. This buoy is of major importance should boats be fishing any farther north than the long-lining boats were in 1951 because the Harry's Rocks then lie in a direct course from

the fishing grounds and they are very dangerous shoals in rough and foggy weather.

He also agrees with Hemeon on the advisability of some method of docking long-liners at Bonavista because the range of tides is so small in Bonavista harbour and so uncertain that a great deal of delay can be caused in trying to get the right tide to dock or float a boat.

CHANCES OF PROFITABLE BOAT OPERATION

The calculations used here have been made by the writer on information supplied by Captain Decker.

"O Johnny O"

On a 42 to 46 foot open type long-liner similar to the "O Johnny O" and with gasoline engines the cost of the boat including trawls ready for fishing is estimated to be $7000. With a boat of this type fishing at Bonavista the boat's share at 20% would be about $1500 to $2000 per year depending on the availability of fish and the price. It has been Captain Decker's experience that with a new boat there are very little repairs for the first five years except painting the hull. The engines for the first five years should not give a great deal of trouble and should easily be kept up for $350 a year. Insurance on these boats up to now has been 4% and this would give the expenses for each year approximately:

Upkeep on boat	$ 50.00
Upkeep on engines	350.00
Insurance	280.00
Depreciation on trawl gear for which boat would be responsible	100.00
Total each year for first 5 years approx.	$780.00

Captain Decker estimates that for the second five years the upkeep of the boat and engines would probably increase by an average of $150 a year which would mean that during the last five years to keep the boat fishing would cost about $4600. Thus in ten years which is the estimated life of the boat it would cost about $6500 to keep the boat in operation. If the

full $7000 cost of the boat were obtained by commercial borrowing at 6%, with the above expenses and boat earnings at the higher amount of $2000 per year and with no mishaps not covered by insurance, it would take 8 years to pay off the boat, leaving several thousand dollars and the value of the boat at the end of ten years to go toward a new boat. With boat earnings as low as $1500 a year the boat would not be paid for at the end of ten years. There would be a gradual reduction in insurance as the boat became older and more depreciated in value but the earnings of the boat might be less also from more frequent need for servicing the engines.

"Miss Osborne"

The 51-foot decked "Miss Osborne", also provided with two gasoline engines, was valued at $11,000 and the life of boats of this type is estimated to be ten years. Estimating the catch of fish at Bonavista by a boat of the "Miss Osborne" type to be approximately 450,000 lbs. per year this would give the boat's share at 25% about $2500. Over a ten year period the boat's expenses, including insurance at 4%, would be about one thousand dollars per year.

If the whole $11,000 cost were borrowed at a commercial rate of 6% and with the above yearly earnings and expenses it would take ten years to pay off the cost of the boat, leaving only the value of the boat at the end of ten years to go toward a new boat. There is also a good possibility of fishing years much worse than 1951, injuries to the boat not covered by insurance, breakdowns which would not allow the boat to operate for longer or shorter periods, sickness of the captain or crew

and other factors which might cause earnings to be less and expenses higher than those calculated above. Thus it is fairly certain that on a full commercial basis the "Miss Osborne" would not be paid off at the end of 10 years when her usefulness for offshore fishing was approximately at an end.

SUMMARY AND CONCLUSIONS

In 1950 deep water grounds suitable for long-lining were discovered off Bonavista and the hydrographic and depth relations of the offshore cod studied. It was indicated that the deepwater cod were most numerous in the mixed water near the border of the cold below zero centigrade (32°F) Labrador Current water and the underlying salter warmer Atlantic water. The shallow inshore grounds produced poor catches until September, after which it was worth while doing inshore fishing whenever offshore long-lining was not possible.

In 1951 the experiment was purely commercial, consequently the more detailed hydrographic information, available from the operation of the boats in 1950, is to some degree lacking. From our general hydrographic work by the Investigator II, it was found that there was less below zero centigrade (32°F) water in the Newfoundland area generally than in 1950, and at Bonavista the below zero centigrade water was not as cold and did not extend as deeply as in 1950. Most of the deep water fishing consequently, in 1951, was in 130 to 140 fathoms and about eighteen miles from Cape Bonavista, as compared with 130 to 160 fathoms and eighteen to twenty miles as in 1950.

The fisherman's share for the June-December fishing, $1999 in the case of the boat fishing for the whole period, was much above the shares of the local inshore fishermen in the area and was highly satisfactory. The amounts received for the boats' shares were also apparently enough for profitable operation, at least of the smaller boat, or of boats up to 50 feet built under a bounty system.

For the period of fishing the larger boats produced more fish but with a crew of four did not produce a significantly higher share per fisherman. The "Miss Osborne", however, could have been operated by a crew of three and judging by the short period in August when Captain Hemeon operated with a crew of three and still caught considerably more fish than the smaller boat, the share of a crew of three for the "Miss Osborne" if she had fished the whole period would have been considerably higher. Possibly, however, the total catch and the boat's share would not have been so high.

Up to September the larger boat fished offshore only on the same days as the smaller boat, and the greater catch per day's fishing of the larger boat was due to fishing a larger amount of gear, probably according to our observer ten to fifteen per cent more lines than are reported in the table of catches and fishing effort already presented. With a suitable amount of gear baited on shore by a hired hand the smaller boat can set as much gear as the larger. At the time of the best catches during the latter half of August, however, the smaller boat was catching a full load so that it could not have used extra gear.

The larger boat caught considerably more in October. In August and September, 1951, after squid were available as bait, cod were caught in much greater amounts per tub of gear than during the earlier part of the year or at any time during 1950. We believe, however, that in spite of the good results in 1951, on-shore baiting facilities were not used to best advantage, and owing to the lack of a buoyed channel extending from the harbour and the interference of salmon nets and cod-traps set across the channel outside the harbour, the boats left port much later in the morning during the early best fishing months of the year than should be possible in a properly organized port. We would think it likely, therefore, that in the longer daylight period of the months of June, July and August, if Bonavista were a properly organized fishing port, more gear could be fished than the 72 lines commonly used in 1951. In October and November with less daylight, less gear can be used.

The offshore cod on the average were almost three times as heavy as the trap fish and over twice as heavy as the hand-line fish caught in the same months. Offshore long-line catches were excellent to good and the inshore long-lining catches poor from June to October, while in November and December the long-liners were able to fish profitably within 5 miles of the shore in 40-79 fathoms while the few offshore trips were generally unprofitable.

Our opinion at present is that a sea-worthy decked boat of about 38 to 45 and probably not over 50 to 55 feet, with a carrying capacity of at least fifteen thousand pounds, and a speed of eight to ten knots, will be suitable for long-

lining in the offshore Bonavista area. The boat should be capable of being operated by a crew of two or three, but it is possible that during the good weather fishing period of June to August when there is little rest between trips, especially from the point of view of the boat's share, the larger boats of 50 feet or over will profitably employ a crew of four.

Our calculations have shown that with the full capital value borrowed at 6%, with the fishing at Bonavista and allowing for something less than perfect operation and good catches the 42-foot "O Johnny O" with a cost of $7000 would barely be paid for from the boat's share of 20% and the $11,000 "Miss Osborne" would not be paid for completely from a boat's share of 25% at the end of 10 years. Thus for profitable operation of long-lining boats at Bonavista there would be the following possibilities and alternatives.

1. A boat's share higher than 20% of the gross for smaller boats and higher than 25% of the gross for larger boats.
2. Fishing on the south coast during the winter season.
3. Boats provided at cost without interest by the industry which would make its profits from plant operation. The skipper eventually becomes the owner of the boat by allowing the boat's share to go to the Company until the cost is paid. According to Captain Decker this has been the practice for small long-lining boats below bounty size in some Nova Scotia areas.
4. Government tonnage subsidies and low interest costs on money borrowed so as to reduce the capital costs and the carrying charges. With present building subsidies and in-

terest costs on loans and with a 20 or 25% boat's share according to the size and cost of the boats there should be no difficulty whatever in paying off the capital cost of boats up to the 50 foot class long before the useful life of the boat is over. In fact for gasoline engined boats of 50 feet or less the present total federal and provincial tonnage bounties are probably higher than are necessary. The present bounty and loan facilities should allow the purchase of diesel boats which would have lower operating costs and less chances of loss by explosion. The possibility of an explosion is great in gasoline engined decked boats with the engine and gas tanks forward near the living quarters. It is thus probable that the bounties should be adjusted definitely to encourage diesel engines in decked boats. Too easy repayment of capital cost will encourage inefficient operation of these boats on a half year basis. The whole policy should at least be re-examined after several years operation of the boats now being built. During this time statistics of the catch, gross value of the catch, boat's share, operating costs and fishing effort of local long-liners should be obtained.

While the 1950 experimental work in the area provoked only academic interest, the obvious commercial success, relative to local inshore fishing, of the long-lining boats in 1951 induced two local crews at Bonavista to begin long-lining with fair success, although the boats used, through lack of power, were not perfectly adapted to this method of fishing in the Bonavista offshore area. It is very probable that the long-lining method will become established at Bonavista and at the

present time there is considerable interest in the method among the more enterprising Bonavista fishermen.

It is apparent, however, that Bonavista is not at present a fishing port suitable for boats of forty feet and over and that a number of port improvements are necessary for the real progress of long-lining in the Bonavista area. Some of these are -

(1) The definite and committed interest and co-operation of a shore plant which will take all the long-liners' fish in a head-on gutted condition and cater to the needs of the long-liners.

(2) The provision of the necessary buoys for purposes of navigation in fog or darkness.

(3) The definition and buoying of a channel to the offshore grounds. This channel must be kept clear of nets.

(4) The provision of a small marine slipway for boats up to 55 or 60 feet.

(5) The assurance of a supply of frozen bait set aside specifically for the long-liners. This would probably be easier for a Company to do than for the Government bait freezer. The assumption would have to be made that the squid would not arrive in numbers and enough frozen bait for the year put down before the disappearance of the caplin. If the squid appeared the surplus caplin bait could be discarded later. A season's supply of bait for a long-lining boat costs less than the gross value of the fish from two good days' fishing. The operations of these costly boats should never be held up for lack of bait.

(6) Provision of cold storage space for baited gear.

(7) If possible the crowding of the present harbour by small boats should be reduced.

The provision of these and other plant and port facilities will be found to be necessary not only for Bonavista but also for other fishing ports as interest develops in the use of larger boats for long-line fishing.

It is evident that cod were very plentiful in the offshore Bonavista area in 1951, certainly more plentiful than in 1950. Cod were also relatively plentiful inshore in this area in both 1950 and 1951. Although good results are to be expected in the offshore deep water it is quite likely that the catches per tub of gear will not always be as high as in 1951. There are many years when the inshore fishing at Bonavista is moderate or poor. It is to be hoped that in these years a catch as good as usual could still be obtained offshore by the long-liners. The result of offshore fishing in such years will be awaited with considerable interest. Although the presence of fish within range of the long-lining boats has not yet been proven earlier than June, in many years it should be possible to catch fish in the offshore area at Bonavista as early as May. Fishing within four to six miles of the shore may be successful in warm winters from Bonavista or neighbouring ports until January.