



Serial No. 3339
(D.c.3)

ICNAF Res.Doc. 74/103

ANNUAL MEETING - JUNE 1974

Some notes on the Labrador-Northeast Newfoundland cod stock
with special reference to the inshore fisheries

by

R. Wells
Environment Canada
Fisheries and Marine Service
Biological Station
St. John's, Nfld., Canada

The cod inhabiting the Hamilton Inlet Bank area are part of a stock complex which extends all the way from northern Labrador to the northern Grand Bank (ICNAF Divisions 2G, 2H, 2J, 3K, 3L). There are probably substocks within this complex but as yet these cannot be distinguished on the basis of biological data available.

Prior to 1960 the fishery in Division 2J and to a large extent 3K was traditionally a small boat inshore fishery. However, in the 1960's otter trawler landings from Division 2J quickly increased (e.g. from 39,000 tons in 1959 to 243,000 tons in 1961). Landings fluctuated between 187,000 and 227,000 tons in 1962-67 but increased to 346,000 in 1968 and 357,000 in 1969. Landings have since decreased because of severe ice conditions to 148,000 tons in 1972. Inshore landings in Division 2J fluctuated between 14,800 tons and 27,700 tons in 1959-67, but decreased rapidly to 1700 tons in 1972. Trends in total landings from the entire stock complex of 2J-3KL were similar to the trends in 2J landings. The total cod landings from Divisions 2J, 3K and 3L for the period 1959-72 are shown in Table 1.

Assessment of the level of fishing mortality was based on the removals from the stock complex in Division 2J-3KL. Fishing mortality estimates fluctuated around the level generating maximum sustainable yield from the fishery during 1961-66 but were somewhat beyond this level during 1967-70 coincident with the high catches in these years. Catches have been reduced in 1971-73 and fishing mortality has probably returned closer to the level of maximum sustainable yield.

Based on the above assessment, the sustainable yield for the complex was estimated at 550,000 tons but because of the recruitment of two good year-classes to the fishery in 1973 a TAC of 650,000 tons was agreed upon at the 1972 ICNAF Meeting. Since the catch in 1973 was expected to be well below this figure (preliminary estimates indicate it to be about 300,000 tons for Division 2J-3KL), the TAC agreed to for 1974 was also 650,000 tons.

A major effect of a fishery upon a fish stock is the reduction of the proportion of larger and older fish present. Consequently, the number of mature fish making up the spawning stock is reduced (Table 2). There is no evidence that the spawning stock of the stock complex in Divisions 2J-3KL has been reduced to a point where the number of progeny produced has been affected. In fact, the year-classes produced by the 1967 and 1968 spawning stocks are more abundant than average for this stock complex.

Monthly landings for the offshore fishery for the Divisions 2J, 3K and 3L are shown in Tables 3, 4 and 5 for the years 1967-72. In ICNAF Division 2J, about 57% of the catch was taken in the period February to April when spawning takes place on Hamilton Inlet Bank. In the same period, on the average, 47% and 23% of the catches were taken in ICNAF Divisions 3K and 3L respectively. In the inshore fishery, most of the catch is taken in the July to September period. In the February to April period, there is no inshore fishery in ICNAF Divisions 2J and 3K, but in Division 3L only about 1% of the inshore catch is taken.

Tagging in the period 1962-66, both in the inshore and offshore areas, has shown that large numbers of cod which spend the winter in the deep water offshore migrate towards the coast in the spring and are then liable to capture by the inshore fishery (Templeman, pers. comm.).

If the TAC were reduced to allow fish to escape the offshore fishery thus, in theory, increasing the inshore catch, the real question then is how many of these fish which escape will, in fact, contribute to the inshore fishermen's catch in Labrador and northeast Newfoundland. This is really a combination of two factors: (1) what proportion of fish that escape the offshore fishery will migrate inshore, and (2) of those that migrate inshore, what proportion will be caught by the inshore fishermen?

At present we have no way of determining the answer to either question. Of the fish that would escape the offshore fishery, tagging results indicate that some would in fact reach the Labrador and northeast coast inshore areas. The proportion that would migrate inshore may not even be reliably estimated from tagging data already available since this would require good estimates of fishing effort in the offshore and inshore areas respectively. Of the escaped fish that do move inshore, the proportion that would actually be caught by the inshore fishermen would, of course, depend on the amount of fishing effort expended, but it would also be affected by other factors such as environmental conditions, food availability, etc. If one could estimate the catchability-availability coefficient for the various inshore gears, an estimate of the proportion of the fish that move inshore which would be caught may be possible.

The inshore cod fishery off Labrador and the east coast of Newfoundland is conducted close to shore and with fixed gears. The cod trap, set close to shore in water of depths less than 20 fathoms, has been the most productive gear for many years. Handlines with a single hook baited or unbaited as well as baited line trawls with many hooks are traditional gears. The boats used in fishing with traps are usually 25-30 feet and are undecked. After the longlining experiments conducted by the Biological Station in St. John's in the 1950's, larger boats equipped with mechanical haulers, sounders and radio were able to use long lines of baited hooks over a far greater area than before. The handline and line-trawl fishery is handled with somewhat smaller boats. In the early and middle 1960's, gillnets of synthetic material were introduced into the fishery. At first these were used in small numbers in shallow water but in recent years large fleets of these gillnets have been used from the longliner-type boats and have, in fact, almost displaced the longline gear from the fishery. The two gears accounting for the bulk of the inshore catches in the last few years have been trap and gillnet. The proportion of the catch taken by gillnets has been increasing and is now almost equal to that taken by traps.

The great increase in total cod catches since about 1960 off Labrador and the east coast of Newfoundland has been coincident with a decline in cod catches by the inshore fishery. At Labrador the decline in inshore catches has been particularly severe since 1968 and has been

accompanied by a corresponding decrease in the annual catch taken per fisherman (Table 6). The catch per fisherman has decreased in the period 1966-72 to about 40-55% of what it was in the period 1959-65. The decline in catches in the inshore fishery in Divisions 3K and 3L has not been as severe as in Division 2J (Tables 7 and 8). There has been a decline, however, in the average annual catch per man in these Divisions amounting to about 11% and 15% in Divisions 3K and 3L respectively from the period 1959-65 to the period 1966-72. These declines have occurred during a period when larger boats and new types of fishing gear were being introduced to the inshore fisheries in an attempt to maintain productivity.

In the offshore fishery the changes in the annual catch per standard hour were 8% increase, 8% decrease and 11% decrease in Divisions 2J, 3K and 3L respectively from the period 1959-65 to the period 1966-71.

The effect of the increased fishery offshore has been to reduce the numbers of older and larger cod in the stock. These changes are evident in the catches taken by the trap fishery in Labrador (Table 9). The average length, average age and proportion of mature cod present in trap catches have been severely reduced. These changes are not evident in Division 3K (Table 10) but are present in Division 3L (Table 11).

The average ages of cod taken in the offshore fishery in Divisions 2J, 3K and 3L for the period 1959-71 are shown in Table 12. In each Division, a reduction in the average age from the period 1959-65 to 1966-71 is evident.

Table 1. Cod landings (metric tons round fresh) in Divisions 2J, 3K and 3L for the period 1959-72.

Year	2J			3K			3L		
	Offshore	Inshore	Total	Offshore	Inshore	Total	Offshore	Inshore	Total
1959	39405	17533	56938	83003	56264	139267	47612	85695	133307
1960	164037	15418	179455	69908	47676	117584	67568	94192	161760
1961	243145	17545	260690	60574	31159	91733	74996	70659	145655
1962	226841	23424	250265	45554	42816	88370	91846	72271	164117
1963	187926	23767	211693	75344	47486	122830	83066	73295	156361
1964	180245	14787	195032	110917	40705	151622	139293	75806	215099
1965	227206	25117	252323	46167	26467	72634	126882	58943	185825
1966	221043	22645	243688	57556	32208	89764	125484	55990	181474
1967	212355	27721	240076	77014	24905	101919	208972	49233	258205
1968	346240	12937	359177	117115	40768	157883	218814	47330	266144
1969	356580	4328	360908	74453	24923	99376	161210	67973	229183
1970	196823	1963	198786	69489	21511	91000	143446	53113	196559
1971	146903	3313	150216	58435	21111	79546	152640	38115	190755
1972	148038	1725	149763	132129	14054	146183	112371	46273	158644

Table 2. Numbers of mature cod in 2J portion of stock complex, 1959-68.

Year	2J	2J-3KL
	Numbers in stock Ages 7-15 (millions)	Numbers in stock Ages 7-15+
1959	461)	
) 465.5	
1960	470)	
1961	400	643
1962	294	571
1963	290	564
1964	365	628
1965	312	500
1966	246)	419
)	
1967	214) 231	389
)	
1968	233)	380
1969		347
1970		253
1971		209

Decline 1959-60 to 1966-68 = 50%

Decline 1961 to 1971 = 67%

Table 3 . Monthly landings (metric tons, round fresh) of cod from Division 2J, 1967-72.

Gears	Month	1967	1968	1969	1970	1971	1972	Average	%
Offshore	Jan	26361	22697	25991	26853	46441	69751	36349	15
	Feb	36949	92192	124094	89588	53819	16840	68914	29
	Mar	13677	74323	96945	39668	5952	3855	39070	17
	Apr	22088	27021	42660	16287	18516	27885	25743	11
	May	47653	46816	27650	4372	3434	959	21814	9
	June	10474	30981	18433	276	4259	368	10799	5
	July	266	1695	664	311	704	231	645	-
	Aug	318	1280	4304	5511	830	1233	2246	1
	Sept	4887	18708	4887	5781	1030	949	6040	3
	Oct	28122	22570	7190	3418	403	5094	11133	5
	Nov	11158	4789	2281	1078	1253	1705	3711	2
	Dec	10397	3168	1474	3680	2540	18673	6655	3
NK	-	-	7	-	7722	495	1371	1	
Annual		212350	346240	356580	196823	146903	148038	234489	101
Inshore	Annual	27726	12937	4328	1963	3313	1725	8665	
Total	Annual	240076	359177	360908	198786	150216	149763	243154	

Table 4. Monthly landings (metric tons, round fresh) of cod from Division 3K, 1967-72.

Gears	Month	1967	1968	1969	1970	1971	1972	Average	%
Offshore	Jan	873	5621	1334	1030	946	3388	2199	2
	Feb	4708	5913	893	14913	18917	100106	24242	28
	Mar	2075	3052	3270	22351	12957	1377	7514	9
	Apr	2153	6535	19733	10684	11599	8361	9844	11
	May	1400	2730	17855	6119	2504	5832	6073	7
	June	2467	33025	3757	1612	919	3733	7586	9
	July	2074	10783	4961	2792	1485	1898	3999	5
	Aug	4127	6482	2202	3852	1506	2551	3453	4
	Sept	13044	4487	7189	1804	1172	779	4746	5
	Oct	11186	12440	4926	1871	722	628	5296	6
	Nov	21832	19693	5894	1052	533	1756	8460	10
	Dec	11056	6354	2425	1409	217	1128	3765	4
	NK	-	-	14	-	4958	592	927	1
	Annual	76995	117115	74453	69489	58435	132129	88103	101
Inshore	Annual	24924	40768	24923	21511	21111	14054	24549	
Total	Annual	101919	157883	99376	91000	79546	146183	112651	

Table 5. Monthly landings (metric tons, round fresh) of cod from Division 3L, 1967-72.

Gears	Month	1967	1968	1969	1970	1971	1972	Average	%
Offshore	Jan	299	761	1628	711	576	3605	1263	1
	Feb	850	4475	1121	576	1916	6289	2538	2
	Mar	10571	19823	5363	4484	26611	13258	13352	8
	Apr	30597	30678	14726	25088	10684	17107	21480	13
	May	22426	18348	9730	18472	15336	16724	16839	10
	June	35396	19697	36181	24822	15205	12146	23908	14
	July	39781	37458	36760	19314	22232	6379	26987	16
	Aug	19173	39580	25166	15480	16604	8658	20777	12
	Sept	24704	30426	16484	17862	18967	11350	19966	12
	Oct	9942	9178	5816	7344	14141	8460	9147	5
	Nov	10893	6168	6661	7511	7156	5070	7243	4
	Dec	4136	2222	1566	1770	1886	1827	2235	1
	NK	198	-	8	12	1326	843	398	-
	Annual	208966	218814	161210	143446	152640	111716	166132	98
Inshore	Annual	49239	47330	67973	53113	38115	46928	50450	
Total	Annual	258205	266144	229183	196559	190755	158644	216582	

Table 6. Number of men, catch and catch per man in the Labrador inshore fishery, 1937-72.

Year	Number of men (adjusted)	Annual catch (metric tons round fresh)	Annual catch/man
1937	6600	86771	13.1
38	6568	101063	15.4
39	6878	86317	12.5
1940	6111	66178	10.8
41	4985	43886	8.8
42	4368	52016	11.9
43	5323	68360	12.8
44	5889	69915	11.9
45	6049	46134	7.6
46	5849	50114	8.6
47	5596	41417	7.4
48	4730	46113	9.7
49	4713	48344	10.3
1950	2600	32903	12.7
51	2089	22976	11.0
52	1536	21819	14.2
53	1430	16741	11.7
54	619	11693	18.9
55	470	10501	22.3
56	346	8646	25.0
57	500	11692	23.4
58	732	11089	15.1
59	791	18854	23.8
1960	1041	16692	16.0
61	1473	18595	12.6
62	1823	24623	13.5
63	2396	24697	10.3
64	2487	15616	6.3
65	2412	26334	10.9
66	2485	(23956)	9.6
67	2467	27725	11.2
68	2349	13460	5.7
69	1733	4648	2.7
1970	1419	2038	1.4
71	832	3320	4.0
72*	743	1728	2.3
1959-65	1775	20773	11.7 (13.3)
1966-72	1718	10982	6.4 (5.3)

*provisional

Table 7. Number of men, catch and catch per man in the inshore fishery off northeast Newfoundland (ICNAF Division 3K), 1959-72.

Year	Number of men	Annual catch (metric tons round fresh)	Annual catch/man
1959	4410	56264	12.76
1960	4201	47676	11.35
1961	4222	31159	7.38
1962	4175	42816	10.26
1963	4312	47486	11.01
1964	4510	40705	9.03
1965	3988	26467	6.64
1966	3507	32208	9.18
1967	3241	24905	7.68
1968	3259	40768	12.51
1969	2677	24923	9.31
1970	2528	21511	8.51
1971	2566	21111	8.23
1972	2686	14054	5.23
1959-65	4260	41796	9.81 (9.78)
1966-72	2923	25640	8.77 (8.66)

Table 8. Number of men, catch and catch per man in the inshore fishery off eastern Newfoundland (ICNAF Division 3L), 1959-72.

Year	Number of men	Annual catch (metric tons round fresh)	Annual catch/man
1959	4942	85695	17.34
1960	5095	94192	18.49
1961	4777	70659	14.79
1962	5476	72271	13.20
1963	5681	73295	12.90
1964	6424	75651	11.78
1965	6289	58943	9.37
1966	5444	55988	10.28
1967	5184	49233	9.50
1968	4993	47330	9.48
1969	4150	67973	16.38
1970	4113	53113	12.91
1971	3711	38116	10.27
1972	3163	46273	14.63
1959-65	5526	75815	13.72 (13.98)
1966-72	4394	51147	11.64 (11.92)

Table 9. Changes in the proportions of immature and mature cod, average length and average age in the southern Labrador trap fishery, 1959-72.

Year	% immature	% mature	Average length	Average age
1959	1	99	57.19	9.0
1960	4	96	58.63	10.1
1962	8	92	61.80	10.1
1963	19	81	57.74	8.7
1964	32	68	54.69	7.7
1965	19	81	56.00	7.6
1966	30	70	53.93	6.4
1967	24	76	56.93	6.1
1968	15	85	57.85	7.1
1969	44	56	54.80	6.5
1971	57	43	48.98	5.7
1972	74	26	44.60	5.3

Table 10. Changes in the proportions of immature and mature cod, average length and average age in the trap fishery off northeast Newfoundland (ICNAF Division 3K), 1961-72.

Year	% immature	% mature	Average length	Average age
1961	58	42	53.40	5.9
1962	64	36	51.16	5.2
1963	41	59	56.69	6.7
1964	43	57	51.92	6.0
1965	50	50	51.83	5.6
1966	73	27	51.22	5.5
1967	70	30	48.60	5.1
1968	78	22	48.25	5.1
1969	67	33	52.28	5.8
1970	66	34	48.68	5.0
1971	45	55	51.16	5.6
1972	-	-	44.80	5.5

Table 11. Changes in the proportions of immature and mature cod, average length and average age in the trap fishery off eastern Newfoundland (ICNAF Division 3L), 1959-72.

Year	% immature	% mature	Average length	Average age
1959	46	54	54.72	6.0
1960	60	40	53.30	5.8
1961	48	52	55.42	5.8
1962	50	50	56.29	5.9
1963	36	64	53.66	5.9
1964	51	49	54.25	5.8
1965	70	30	50.37	5.4
1966	81	19	47.04	4.7
1967	68	32	48.49	5.0
1968	-	-	49.77	4.8
1969	80	20	51.84	5.0
1970	76	24	50.49	5.0
1971	90	10	46.20	4.4
1972	-	-	49.17	5.0

Table 12. Average ages of cod in the offshore fisheries in Divisions 2J, 3K and 3L for the period 1959-71.

Division	2J	3K	3L
Year	Average Age	Average Age	Average Age
1959	7.76		6.47
1960	8.67		7.88
1961	8.09	8.30	6.38
1962	8.43	6.50	6.08
1963	7.12	6.17	6.46
1964	7.21	6.17	7.75
1965	7.81	6.48	6.46
1966	6.32	6.09	5.63
1967	5.91	5.64	6.54
1968	6.21	6.94	5.22
1969	6.83	7.24	5.69
1970	-	5.97	5.20
1971	5.78	6.56	5.68
1959-65	7.87	6.72	6.78
1966-71	6.21	6.45	5.66

