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A Stock Assessment for Yellowtail Flounder in
NAFO Divisions 3L, 3N, and 30

by

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Introduction

This stock has been under quota regulation since 1973. Nominal catches, by country, for 1966-82 and TAC's, 1973-83 are listed in Table 1, nominal catches by NAFO Division for 1965-82 are given in Table 2, and catch and effort data, 1968-82, are presented in Table 3.

Stock assessment

Sampling: The length measurements and otolith samples listed in Table 4 were provided by the Canadian Commercial Groundfish Sampling Section in St. John's.

Numbers at age: These were obtained in the usual way by applying quarterly age-length keys (sexes separate) to monthly length frequencies for each NAFO Division. Total catch at age for 1982 (Table 5) was obtained by combining male and female numbers from Div. 3L, 3N, and 30. Table 6 contains the catch matrix for Div. 3L, 3N, and 30 for the years 1968-82.

Weight at age: Average weights at age for 1982 (Table 5) were obtained by applying a length-weight equation to monthly average lengths (weighted by the number caught at age). Weights at age for 1968-82 are shown in Table 7.

Partial recruitment: The three versions of PR (Table 8) used in this assessment were derived and used as follows:

- a) PR 81 - Derived from a cohort run using the 1978-81 catch matrix, and the 1979-80 average F's, standardized at age 9. PR at age 4 was adjusted by catch at age in 1981 at age 4. Used to derive PR 82.
- b) PR 82 - PR at age 4 was adjusted to produce a population size at age 4 in 1982 approximately equal to the geometric mean of age 4 numbers from the cohort, 1968-81. Age 8 considered to be fully recruited.
- c) PR Ave. - Calculated from average F's (1968-76) in the cohort analysis. Used in conjunction with average weights (1968-74) to produce a value of 0.518 for $F_{0.1}$ (Brodie and Pitt; 1981, 1982) (Table 9).

Terminal fishing mortality: An estimate of F_T was obtained from calibration of the cohort analysis with these two methods:

1. Regression of age 4+ biomass from cohort on directed catch per hour (Fig. 2). The results of the regressions at values of F_T between 0.25 and 0.45 are given in Table 13. The correlation coefficient reaches a peak of 0.651 at $F_T = 0.40$ and the best predicted value for 4+ biomass in 1982 using $\text{CPUE} = 0.525$ comes from the run at $F_T = 0.45$.

2. Regression of weighted F (ages 4-10) on fishing effort (Table 14, Fig. 3). The results of regressions at values of F_T from 0.25 to 0.45 show little variation in r^2 over this range, with a maximum value of 0.851 at $F_T = 0.30$. Predicted values of weighted F in 1982 from the regressions were all higher than the observed values from cohort.

Recruitment for stock projections: The geometric mean (1977-81) of age 4 numbers from the cohort run at $F_T = 0.40$ was used to estimate recruitment at age 4 for the years 1982-84. This value was 110.6×10^6 fish, slightly higher than the 100×10^6 value used in the 1982 assessment, and quite close to the long-term (1968-81) G.M. which was 108.5×10^6 .

Discussion

Abundance indices: CPUE from Can (N) otter trawlers, TC 5, showed a steady increase over the period 1975-80, when it reached a value of 0.640 t/hr. Since then, it has declined to 0.614 t/hr in 1981 and 0.525 t/hr in 1982. Canadian research vessel surveys show a relatively stable population size since 1978, with 1981 survey coverage being somewhat inadequate (Tables 10 and 11). USSR survey data (Table 12) show that the indices of abundance for yellowtail were above the mean 1973-81 values for both 1980 and 1981 (Gorchinsky 1982).

Cohort analysis: Table 15 shows the cohort run using $F_T = 0.40$.

Catch projections: Projections were done to 1984, using the 1982 population from the cohort run at $F_T = 0.40$ (age 4 replaced by the G.M.), 1982 weights at age, and the same partial recruitment (PR 82) used in the cohort analysis. Table 16 shows that assuming the TAC of 19,000 t will be taken in 1983; the projected $F_{0.1}$ catch in 1984 would be 17,000t. Table 17 shows that assuming the catch in 1983 is at recent levels (12,000 t), the projected $F_{0.1}$ catch in 1984 would be 19,000 t.

References

- Brodie, W. B., and T. K. Pitt. 1981. An assessment of the yellowtail stock in Divisions 3LNO. NAFO SCR Doc. 81/V1/54, Ser. No. N338.
1982. Assessment update for the yellowtail stocks in Divisions 3LNO. NAFO SCR Doc. 82/V1/53, Ser. No. N546.
- Gorchinsky, K. V. 1982. Dynamics of yellowtail flounder stock on the Grand Newfoundland Bank in 1973-81. NAFO SCR Doc. 82/V1/62, Ser. No. N555.

Table 1. Nominal catches by country and TACs of yellowtail-NAFO Divisions 3LNO (tons).

Year	Canada	France	USSR	Other	Total	TAC
1966	4,185	0	2,834	7	7,026	
1967	2,122		6,736	20	8,878	
1968	4,180	14	9,146	0	13,340	
1969	10,494	1	5,207	6	15,708	
1970	22,814	17	3,426	169	26,426	
1971	24,206	49	13,087	0	37,342	
1972	26,939	358	11,929	33	39,259	
1973	28,492	368	3,545	410	32,815	50,000
1974	17,053	60	6,952	248	24,313	40,000
1975	18,458	15	4,076	345	22,894	35,000
1976	7,910	31	57	59	8,057	9,000
1977	11,295	245	97	1	11,638	12,000
1978	15,091	375	-	-	15,466	15,000
1979	18,116	202	-	33	18,351	18,000
1980	12,011	366	-	-	12,377	18,000
1981	14,122	458	-	-	14,580	21,000
1982 ^a	11,451	180	-	-	11,631	23,000
1983						19,000

^a: preliminary

Table 2. Breakdown of nominal catches of yellowtail by NAFO Division 3L, N and O (tons).

Year	3L	3N	3O	Total
1965	117	2,958	55	3,130
1966	62	6,442	522	7,026
1967	453	6,117	2,308	8,878
1968	2,815	8,459	2,066	13,340
1969	5,287	7,215	3,206	15,708
1970	7,419	18,668	339	26,426
1971	6,632	25,174	5,536	37,342
1972	9,292	25,788	4,179	39,259
1973	4,856	23,693	4,266	32,815
1974	1,544	19,329	3,440	24,313
1975	2,638	16,156	4,100	22,894
1976	516	5,023	2,518	8,057
1977	2,651	7,381	1,606	11,638
1978	2,547	11,079	1,840	15,466
1979	2,595	14,556	1,200	18,351
1980	1,898	9,805	674	12,377
1981	2,345	11,633	602	14,580
1982 ^a	2,306	7,614	1,711	11,631

^a: preliminary

Table 3. Nominal catch and effort data for yellowtail in NAFO Divisions 3LNO. Column 2 refers to reported "directed" catch by Canada (N) Tonnage Class 5 Otter trawlers.

Year	Directed catch (tons)	CPUE (tons/hr)	Total catch (tons)	Total calculated effort (hours)
1968	2,216	0.705	13,340	18,922
1969	3,165	0.610	15,708	25,751
1970	12,444	0.598	26,426	44,191
1971	14,094	0.600	37,342	62,237
1972	14,544	0.607	39,259	64,677
1973	21,225	0.645	32,815	50,876
1974	14,025	0.421	24,313	57,751
1975	13,345	0.402	22,894	56,950
1976	4,889	0.332	8,057	24,268
1977	5,029	0.423	11,638	27,513
1978	9,289	0.496	15,466	31,181
1979	13,273	0.517	18,351	35,495
1980	7,855	0.640	12,377	19,339
1981	10,400	0.614	14,580	23,746
1982 ^a	5,530	0.525	11,631	22,154

^a: preliminary

Table 4. List of commercial yellowtail samples from NAFO Divisions 3L, 3N, and 3O for 1982, provided by the St. John's Commercial Sampling Section.

Quarter	Measurements			Otoliths			Catch			Samples		
	3L	3N	3O	3L	3N	3O	3L	3N	3O	3L	3N	3O
2	2,440	-	1,946	141	-	425	904	761	1,336	6	-	5
3	986	10,181	-	156	435	-	961	4,400	48	2	19	-
4	426	8,567	406	65	396	70	392	2,351	139	1	14	1

Table 5. Catch and weight at age for Divisions 3LNO yellowtail in 1982.

Age	Catch (numbers $\times 10^{-3}$)	Weight (kg)
4	97	0.238
5	1311	0.292
6	4580	0.346
7	7774	0.486
8	6630	0.675
9	1907	0.933
10	268	1.304

Table 6. YELLOWTAIL DIVISIONS 3LNO CATCH MATRIX(NUMBERS $\times 10^{-3}$)

AGE I	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
4 I	573	80	141	169	1943	3734	1375	955	409	1391	691	1061	1142	3245	97
5 I	6202	2993	2776	7534	10128	21280	19800	11240	2529	3211	3654	4783	5130	5077	1311
6 I	12483	15035	19839	30365	22502	23709	18100	20931	7650	6851	10979	13067	8383	8191	4580
7 I	9154	12076	20615	22117	19416	17053	11200	12737	5361	7331	11028	14284	7199	9991	7774
8 I	1421	3150	4557	5869	10553	4713	2400	2536	953	4078	3870	4940	1519	4361	6630
9 I	47	326	610	2152	4206	862	850	372	74	1433	310	773	224	356	1907
10 I	1	40	68	245	1110	300	130	23	15	289	34	109	28	29	268

Table 7. YELLOWTAIL DIVISIONS 3LNO WEIGHT MATRIX(WEIGHTS IN KG)

AGE I	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
4 I	0.247	0.247	0.247	0.247	0.247	0.247	0.200	0.184	0.200	0.214	0.249	0.178	0.271	0.228	0.238
5 I	0.305	0.305	0.305	0.305	0.305	0.305	0.300	0.298	0.322	0.324	0.315	0.278	0.274	0.308	0.292
6 I	0.456	0.456	0.456	0.456	0.456	0.456	0.452	0.450	0.486	0.409	0.430	0.378	0.493	0.349	0.346
7 I	0.610	0.610	0.610	0.610	0.610	0.610	0.600	0.569	0.615	0.532	0.557	0.504	0.635	0.496	0.486
8 I	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.743	0.814	0.648	0.740	0.668	0.750	0.661	0.675
9 I	0.842	0.842	0.842	0.842	0.842	0.842	0.842	0.953	1.029	0.809	0.981	0.787	0.927	0.909	0.933
10 I	1.030	1.030	1.030	1.030	1.030	1.030	1.030	1.111	1.201	0.905	1.235	0.756	1.221	1.186	1.304

Table 8. Partial recruitment vectors, 3LNO yellowtail. Derivation and usage of each is explained in the text.

Age	PR 81	PR 82	PR Ave.
4	.035	.003	.010
5	.068	.068	.130
6	.222	.222	.460
7	.628	.628	1.000
8	.970	1.000	1.000
9	1.000	1.000	1.000
10	1.000	1.000	1.000

Table 9. Summary of yield per recruit calculations for yellowtail
in Divisions 3LNO.

AGE	WEIGHT-AT-AGE		PARTIAL RECRUITMENT	
4		0.247		0.010
5		0.305		0.130
6		0.456		0.460
7		0.610		1.000
8		0.725		1.000
9		0.842		1.000
10		1.030		1.000
11		1.103		1.000
FISHING MORTALITY	CATCH (NUMBER)	YIELD (KG)	Avg. WEIGHT (KG)	YIELD PER UNIT EFFORT
0.1000	0.113	0.076	0.670	2.110
0.2000	0.191	0.123	0.642	1.709
0.3000	0.247	0.152	0.616	1.415
0.4000	0.285	0.171	0.593	1.194
0.5000	0.321	0.184	0.574	1.026
F0.1---	0.5176	0.325	0.571	1.000
0.6000	0.346	0.192	0.556	0.894
0.7000	0.366	0.198	0.541	0.790
0.8000	0.384	0.203	0.528	0.706
0.9000	0.398	0.206	0.516	0.637
1.0000	0.411	0.209	0.506	0.579
1.1000	0.423	0.210	0.496	0.531
1.2000	0.433	0.211	0.488	0.490
1.3000	0.442	0.212	0.480	0.455
1.4000	0.450	0.213	0.473	0.424
1.5000	0.458	0.213	0.466	0.397
FMAX---	2.6164	0.516	0.418	0.230

Table 10. Abundance of yellowtail ($\times 10^{-3}$) from Canadian research vessel surveys for selected strata in Divisions 3L and 3N.

Age	1971	1972	1973	1974	1975 ¹	1976 ¹	1977	1978	1979	1980	1981 ¹	1982
1					88			76	24	15		12
2												537
3	1,599	3,965	264	895	174	1,212	93	1,180	287	1,525	314	2,090
4	18,797	29,756	3,844	7,966	3,015	5,134	1,383	4,111	1,889	3,355	556	7,116
5	42,304	58,604	25,409	25,576	15,104	22,921	8,383	15,788	3,957	11,491	2,471	14,614
6	79,562	67,380	32,789	43,865	21,794	31,345	20,425	29,167	15,737	29,669	10,623	21,217
7	72,076	36,341	33,541	22,134	25,186	28,750	54,476	30,258	40,589	42,454	27,166	33,033
8	9,691	11,556	12,804	2,663	6,174	5,824	44,686	15,786	19,334	13,788	28,951	21,448
9	3,090	1,222	4,355	391	688	120	12,437	1,640	2,261	950	5,455	5,268
10	42	71	360		46	0	1,889	17	269	30	1,479	773
11						15	143					100
12							21					
Total	227,161	208,895	113,366	103,578	72,181	95,322	143,936	98,023	84,347	103,277	77,015	106,208
Age 7 and older	84,899	49,190	51,060	25,188	32,094	34,710	113,652	47,701	62,453	57,222	63,051	60,622

¹Survey coverage incomplete.

Table 11. Average number per set at age and average numbers and weights for totals for yellowtail from Canadian research vessel surveys in NAFO Divisions 3L and 3N (see Fig. 1). A key stratum, number 361, was not fished in 1981, and in 1975 and 1976 strata 373 and 375 respectively were missed.

Age	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
3	1.44	3.57	0.24	0.81	0.19	1.09	0.08	1.06	0.26	1.37	0.32	1.88
4	16.92	26.79	3.46	7.17	3.27	4.62	1.24	3.70	1.70	3.02	0.57	6.41
5	38.09	52.76	22.88	23.02	16.39	20.64	7.55	14.21	3.56	10.35	2.54	13.16
6	71.63	60.66	29.52	39.49	23.65	28.22	18.39	26.26	14.17	26.71	10.93	19.10
7	64.89	32.72	30.20	19.93	27.33	25.88	49.05	27.24	36.54	38.22	27.96	29.74
8	8.73	10.40	11.53	2.40	6.70	5.24	40.23	14.21	17.41	12.41	29.43	19.31
9	2.78	1.10	3.92	0.35	0.75	0.11	1.20	1.48	2.04	0.86	5.64	4.74
10	0.04	0.06	0.32	-	0.05	-	1.70	0.02	0.24	0.03	1.52	0.70
11						0.04	0.13					0.09
Average number per set	204.52	188.06	102.07	93.27	78.33	85.84	119.57	88.18	75.92	92.97	78.91	95.13
Average weight per set (kg)	90.01	75.10	41.20	41.15	34.80	37.33	56.96	36.54	36.18	48.65	43.16	40.57

Table 12. Abundance and biomass estimates of yellowtail in Divisions 3LNO from USSR bottom trawl surveys, 1973-81.

	Number of fish per hour trawling	Catch per hour trawling (kg)	Absolute abundance (numbers x 10 ⁻⁶)	Biomass (t x 10 ⁻³)
1973	272	104.6	962.6	370.0
1974	234	93.9	828.1	331.2
1975	147	58.9	539.1	215.4
1976	195	77.7	701.2	279.8
1977	175	76.2	636.7	277.7
1978	204	88.8	728.7	319.4
1979	151	69.3	526.6	241.7
1980	283	134.4	993.7	472.4
1981	229	104.3	795.0	360.3
Mean 1973-81	210	89.8	745.7	318.7

Table 13. Regression of age 4+ biomass from cohort analysis on commercial directed CPUE. Cohort runs are at the indicated levels of F_T.

Year	CPUE (t/hr)	Terminal F				
		.25	.30	.35	.40	.45
1968	.705	87.2				
1969	.610	101.8				
1970	.598	104.0				
1971	.600	94.6				
1972	.607	79.6				
1973	.645	67.8				
1974	.421	51.9				
1975	.402	42.0				
1976	.332	48.2	48.0	47.8	47.7	47.6
1977	.423	57.6	56.1	55.0	54.2	53.6
1978	.496	82.2	76.9	73.2	70.4	68.3
1979	.517	81.5	73.4	67.7	63.3	60.0
1980	.640	128.6	112.0	100.2	91.3	84.4
1981	.614	120.2	102.4	89.6	80.0	72.6
1982	.525	132.3	110.3	94.5	82.7	73.5
1968-82 r ²	0.425	0.549	0.629	0.651	0.633	
intercept	-8.75	-7.37	-6.39	-5.65	-5.06	
slope	173.43	162.10	154.01	147.94	143.20	
predicted 1982	82.3	77.7	74.5	72.0	70.1	

Table 14. Regression of fishing mortality from cohort analysis, ages 4-10, weighted by population numbers, on fishing effort. Cohort runs are at the indicated levels of F_T .

Year	Effort (hr x 10^{-3})	Terminal F				
		.25	.30	.35	.40	.45
1968	18.9	.129				
1969	25.8	.132				
1970	44.2	.200				
1971	62.2	.317				
1972	64.7	.424				
1973	50.9	.442				
1974	57.8	.392				
1975	57.0	.448	.448	.449	.449	.449
1976	24.3	.127	.128	.129	.129	.129
1977	27.5	.182	.188	.193	.196	.199
1978	31.2	.150	.162	.171	.178	.185
1979	35.5	.181	.204	.225	.243	.259
1980	19.3	.067	.078	.089	.098	.107
1981	23.7	.090	.107	.123	.139	.154
1982	22.2	.063	.077	.090	.104	.118
1968-82 r^2		0.850	0.851	0.849	0.844	0.836
intercept		-0.071	-0.058	-0.045	-0.034	-0.023
slope		0.008	0.008	0.007	0.007	0.007
predicted 1982		0.102	0.111	0.119	0.126	0.133

Table 15. Cohort run for yellowtail in Div. 3LNO. $F_t = 0.40$

POPULATION NUMBERS

AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
4	156799	147013	119893	110608	121788	113159	75826	71914	82921	102114	131122	125633	122718	80055	93617
5	109297	115666	108841	88697	81795	88550	80617	54990	52453	61078	74451	96543	92158	89929	56513
6	53827	75631	83112	78242	59224	51878	47284	42680	31063	36681	42484	52009	67404	63857	62251
7	18231	29132	43088	44495	31828	24507	18026	19450	13603	16428	21278	22023	27283	42719	40256
8	2460	5627	11187	14177	13926	6867	3477	3714	3446	5463	5860	6271	4021	14015	23048
9	149	599	1457	4366	5451	1234	1031	510	569	1733	537	1010	394	1671	6629
10	2	70	163	555	1382	418	172	32	58	357	50	131	83	99	932
4+	340763	373738	367742	341140	315394	286613	226432	193290	184113	223854	275782	303621	314060	292345	283246
5+	183965	226725	247849	230532	193606	173454	150606	121376	101191	121740	144659	177988	191342	212290	189629
6+	74668	111058	139008	141834	111811	84904	69990	66386	48738	60662	70209	81445	99184	122361	133116
7+	20841	35427	55896	63592	52587	33026	22706	23706	17675	23981	27725	29435	31780	58504	70865
8+	2610	6296	12808	19097	20759	8519	4680	4256	4072	7553	6447	7412	4498	15785	30608

POPULATION BIOMASS (MID-YEAR)

AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
4	33392	31362	25568	23583	25759	23705	12970	11348	14289	18737	28125	19230	28584	15413	19238
5	27887	30041	28274	22256	20040	20061	17895	12484	14200	16595	19707	22547	21137	23175	14074
6	18342	26376	28183	23531	17941	14603	14162	11443	11165	11568	13391	14487	26684	17852	17845
7	6540	11437	15865	16053	9928	6569	5436	5262	5487	5454	6842	5335	12648	15812	15040
8	955	2238	5256	6619	3797	2231	1121	1245	2028	1376	2042	1418	2007	6521	11188
9	88	282	787	2184	1650	454	242	198	468	384	282	292	198	1150	4448
10	1	39	109	361	529	192	74	16	51	119	29	34	70	84	874
4+	87205	101775	104041	94587	79645	67815	51901	41996	47688	54233	70417	63343	91329	80008	82708
5+	53813	70413	78473	71004	53886	44111	38931	30648	33400	35496	42292	44113	62745	64594	63470
6+	25926	40372	50199	48747	33846	24050	21035	18164	19200	18901	22586	21567	41608	41419	49396
7+	7584	13997	22016	25217	15904	9447	6873	6721	8035	7333	9195	7080	14923	23567	31550
8+	1044	2559	6151	9164	5976	2877	1437	1459	2547	1879	2353	1744	2275	7756	16510

FISHING MORTALITY

AGE	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
4	0.004	0.001	0.001	0.002	0.019	0.039	0.021	0.016	0.006	0.016	0.006	0.010	0.011	0.048	0.001
5	0.068	0.031	0.030	0.104	0.155	0.327	0.336	0.271	0.058	0.063	0.059	0.059	0.067	0.068	0.027
6	0.314	0.263	0.325	0.599	0.582	0.757	0.588	0.843	0.337	0.245	0.357	0.345	0.156	0.161	0.089
7	0.876	0.657	0.812	0.862	1.234	1.653	1.280	1.431	0.612	0.731	0.922	1.401	0.366	0.317	0.251
8	1.112	1.051	0.641	0.656	2.124	1.596	1.619	1.577	0.388	2.020	1.458	2.468	0.578	0.449	0.400
9	0.458	1.000	0.666	0.850	2.268	1.669	3.171	1.876	0.164	3.243	1.110	2.198	1.082	0.284	0.400
10	1.061	1.046	0.644	0.698	2.162	1.607	1.818	1.609	0.353	2.206	1.424	2.426	0.487	0.409	0.400

Table 16. Stock projections to 1984, assuming catch in 1983 equal to the TAC of 19,000 t.

CATCH NUMBERS			POPULATION NUMBERS					
	1982	1983	1984		1982	1983	1984	
4	97	160	148	4	110600	110600	110600	
5	1311	2637	2448	5	56513	81851	81797	
6	4580	4117	5494	6	62251	40742	58378	
7	7774	10878	6449	7	40256	42198	26664	
8	6630	8695	7788	8	23048	23198	22014	
9	1907	4290	3478	9	6629	11445	9832	
10	268	1234	1716	10	932	3292	4851	
4+1	22567	32011	27523	4+1	300229	313327	314135	
5+1	22470	31851	27374	5+1	189629	202727	203535	
6+1	21159	29214	24926	6+1	133116	120876	121738	
7+1	16579	25097	19432	7+1	70865	80133	63360	
CATCH BIOMASS			POPULATION BIOMASS (AVERAGE)					
	1982	1983	1984		1982	1983	1984	
4	23	38	35	4	22730.33	22723.31	22724.52	
5	383	770	715	5	14073.96	20280.73	20293.67	
6	1585	1424	1901	6	17845.45	11489.65	16531.74	
7	3778	5287	3134	7	15040.39	15075.32	9634.38	
8	4475	5869	5257	8	11188.36	10509.88	10148.85	
9	1779	4003	3245	9	4447.89	7167.36	6265.12	
10	349	1609	2238	10	874.09	2881.11	4320.25	
4+1	12373	19000	16526	4+1	86200.48	90127.25	89918.54	
5+1	12350	18962	16490	5+1	63470.14	67404.04	67194.02	
6+1	11967	18192	15776	6+1	49396.19	47123.31	46900.35	
7+1	10382	16767	13874	7+1	31550.74	35633.67	30368.61	
FISHING MORTALITY								
	1982	1983	1984		1982	1983	1984	
4	0.001	0.002	0.002	4	0.001	0.002	0.002	
5	0.027	0.038	0.035	5	0.027	0.038	0.035	
6	0.089	0.124	0.115	6	0.089	0.124	0.115	
7	0.251	0.351	0.325	7	0.251	0.351	0.325	
8	0.400	0.558	0.518	8	0.400	0.558	0.518	
9	0.400	0.558	0.518	9	0.400	0.558	0.518	
10	0.400	0.558	0.518	10	0.400	0.558	0.518	
4+1	0.098	0.141	0.119					

SUMMARY OF PROJECTIONS

YEAR	1982	1983	1984
POPULATION NUMBERS	300229.00	313326.86	314135.01
POPULATION BIOMASS	86200.48	90127.25	89918.54
CATCH	12372.69	19000.00	16525.66
F DR QUOTA	12372.69	19000.00	0.52

AGE GROUPS CONSIDERED: 4+

Table 17. Stock projections to 1984, assuming catch in 1983 equal to 12,000 t.

CATCH NUMBERS				POPULATION NUMBERS			
	1982	1983	1984		1982	1983	1984
4	97	93	148	4	110600	110600	110600
5	1311	1545	2450	5	56513	81851	81855
6	4580	2452	5583	6	62251	40742	59313
7	7774	6757	6792	7	40256	42198	28084
8	6630	5600	9020	8	23048	23198	25496
9	1907	2763	4395	9	6629	11445	12422
10	268	795	2168	10	932	3292	6129
4+	22567	20005	30556	4+	300229	313327	323899
5+	22470	19912	30408	5+	189629	202727	213299
6+	21159	18367	27958	6+	133116	120876	131444
7+	16579	15916	22376	7+	70865	80133	72131
CATCH BIOMASS				POPULATION BIOMASS (AVERAGE)			
	1982	1983	1984		1982	1983	1984
4	23	22	35	4	22730.33	22730.78	22724.52
5	383	451	715	5	14073.96	20433.68	20307.92
6	1585	848	1932	6	17845.45	11771.53	16796.70
7	3778	3284	3301	7	15040.39	16110.27	10147.71
8	4475	3780	6089	8	11188.36	11645.44	11754.14
9	1779	2578	4100	9	4447.89	7941.78	7915.54
10	349	1036	2827	10	874.09	3192.40	5458.33
4+	12373	12000	19000	4+	86200.48	93825.89	95104.85
5+	12350	11978	18964	5+	63470.14	71095.11	72380.33
6+	11967	11527	18249	6+	49396.19	50661.42	52072.42
7+	10382	10679	16317	7+	31550.74	38889.89	35275.72
FISHING MORTALITY							
	1982	1983	1984		1982	1983	1984
4	0.001	0.001	0.002	4	0.001	0.001	0.002
5	0.027	0.022	0.035	5	0.027	0.022	0.035
6	0.089	0.072	0.115	6	0.089	0.072	0.115
7	0.251	0.204	0.325	7	0.251	0.204	0.325
8	0.400	0.325	0.518	8	0.400	0.325	0.518
9	0.400	0.325	0.518	9	0.400	0.325	0.518
10	0.400	0.325	0.518	10	0.400	0.325	0.518
4+	0.098	0.082	0.129	4+	0.098	0.082	0.129

SUMMARY OF PROJECTIONS

YEAR		1982	1983	1984
POPULATION NUMBERS		300229.00	313326.86	323898.59
POPULATION BIOMASS		86200.48	93825.89	95104.85
CATCH		12372.69	12000.01	18999.59
F OR QUOTA		12372.69	12000.00	0.52

AGE GROUPS CONSIDERED: 4+

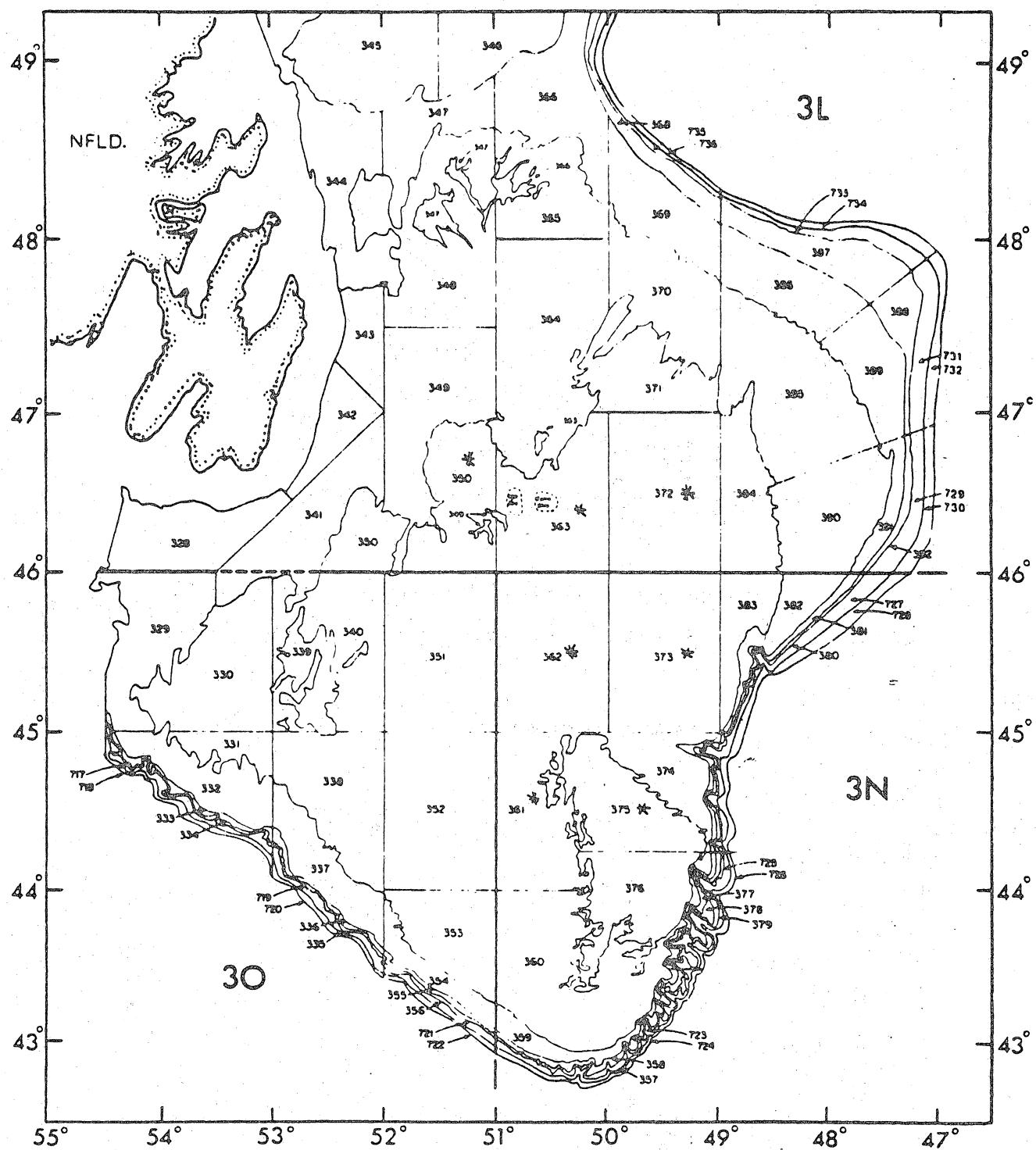


Fig. 1. Stratum map for NAFO Divisions 3LNO. Asterisks denote strata of prime importance in determining yellowtail abundance.

4+ POPULATION BIOMASS (MID-YR) VS CPUE

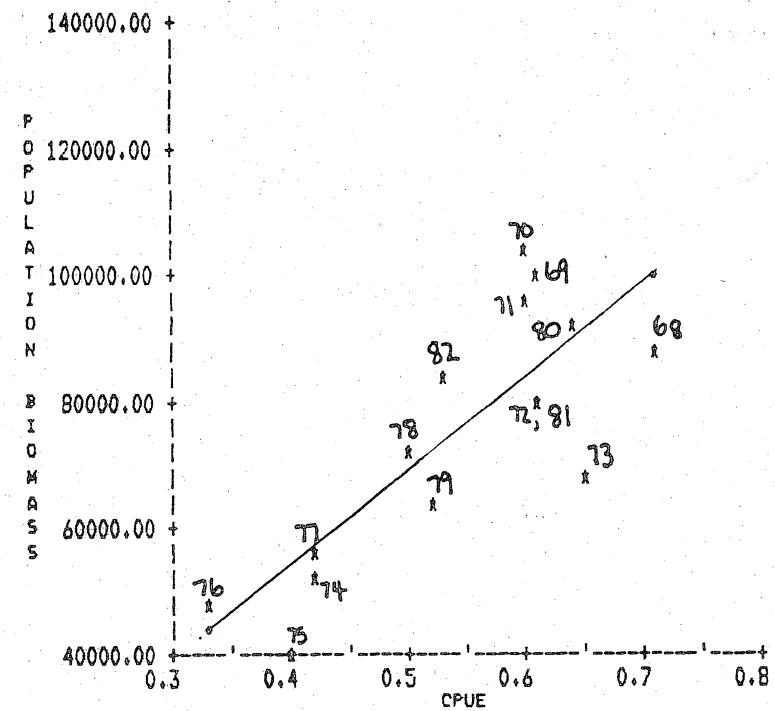


Fig. 2. Regression of 4+ Biomass (t) from cohort at $F_t = 0.40$ on directed CPUE (t/hr) for yellowtail in Divisions 3LNO.

WEIGHTED FISHING MORTALITY VS EFFORT

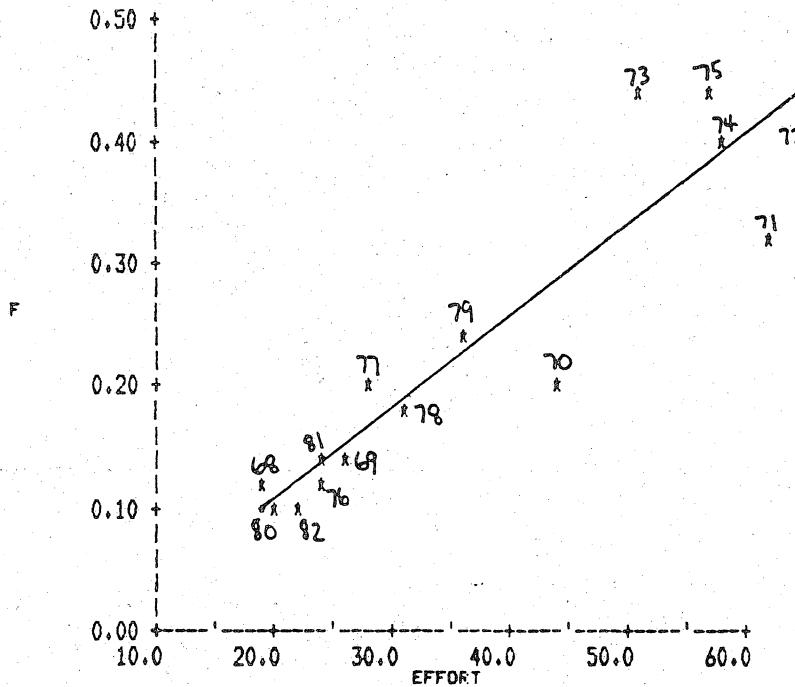


Fig. 3. Regression of weighted fishing mortality (ages 4-10) from cohort at $F_t = 0.40$ on commercial fishing effort (hrs. $\times 10^{-3}$) for yellowtail in Divisions 3LNO.