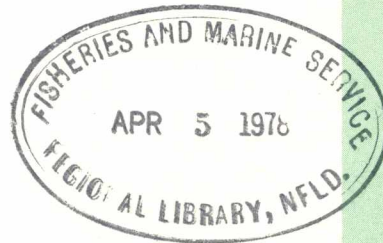


Preliminary Forecasts of the Available Roe Catch From British Columbia Herring Management Units in 1978 and Assessments of Abundance in 1977

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Fisheries & Marine Service Manuscript Report No. 1442



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Fisheries and Marine Service
Manuscript Report 1442

February 1978

PRELIMINARY FORECASTS OF THE AVAILABLE ROE CATCH FROM
BRITISH COLUMBIA HERRING MANAGEMENT UNITS IN 1978
AND ASSESSMENTS OF ABUNDANCE IN 1977

by

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Cat. no. Fs 97-4/1442

ISSN 0701-7618

ABSTRACT

Hourston, A. S., and R. D. Humphreys. 1978. Preliminary forecasts of the available roe catch from British Columbia herring management units in 1978 and assessments of abundance in 1977.

The abundance of the 1977 herring run to British Columbia waters was assessed at 345,000 tons. Runs to the 5 major districts were close to their predicted values, as were runs to most of the major individual fishing grounds. Preliminary forecasts for 1978 suggest a slightly smaller total run of 329,000 tons, with a surplus of 94,000 tons available to the roe fishery.

Key words: Pacific herring, abundance, forecasts.

RÉSUMÉ

Hourston, A. S., and R. D. Humphreys. 1978. Preliminary forecasts of the available roe catch from British Columbia herring management units in 1978 and assessments of abundance in 1977.

On a estimé l'abondance des harengs du Pacifique émigrant dans les eaux cotières de la Colombie-Britannique en 1977 à 345,000 tonnes. Les migrations aux cinq districts majeurs, aussi bien qu'à la majorité des parages de pêche individuels, approchaient leurs valeurs prédites. Des prévisions préliminaires pour 1978 ont suggérées une abondance totale de 329,000 tonnes, avec un surplus de 94,000 tonnes disponibles à la pêcherie des oeufs de hareng.

Mots d'ordres: hareng du Pacifique, abondance, prévisions.

INTRODUCTION

Each year the available catch is forecast for individual British Columbia herring roe fisheries (Hourston 1974; Hourston and Humphreys 1975a, 1975b, 1976). The available catch for each "stock" fully exploited by an individual roe fishery (management unit -- Fig. 1) is the difference between the run to that section(s) of the coast and the spawning escapement needed for the optimum production of viable young from the spawning grounds in that section (desired spawners). The available catch for the Gulf of Georgia roe fishery has been limited to 10,000 tons by other considerations. Available catches from "other" stocks which are not fully exploited by the roe fishery are estimated on the basis of recent catch patterns in these sections.

The "run" to each management unit (fish migrating to that section of the coast to spawn) is forecast in two parts. The returning adults (fish which spawned in the previous year) are estimated from the abundance of spawners in the previous year and the natural mortality rates at age for that stock. The recruits (fish maturing for the first time) are estimated on the basis of average recruitment in recent years. Separate estimates are made for poor, average and good levels of recruitment; the most appropriate level is selected for application to management strategies in that year on the basis of the age compositions for samples from research and food fishery catches prior to the roe season.

Estimates of desired spawners are presently based on spawning escapement levels which have, in the past, produced year-classes of above average strength. (Current research projects are aimed at developing a more sensitive measure based on the carrying capacity of individual spawning grounds under given conditions.)

Analyses to produce stock assessments and forecasts have been developed and programmed for computer processing from annual monitoring data and parameters developed by the research program. Because of logistic problems in the gathering, collating, and interpreting of the 1977 monitoring data for the initial processing of this analysis, forecasts for 1978 (and even final assessments for 1977) were not available in time for use in setting guidelines for the 1978 roe fishery. Consequently, it was necessary to develop forecasts for 1978 using more approximate analyses of preliminary data.

METHODS

A. ESTIMATION OF ADULTS

Information available for the 1977 run includes:

1. Catch by management unit (in final stages of revision).
2. Spawn deposition in standard square yards by statistical area.
3. Age composition (unweighted for seasonal variability) by old management units (revised in 1977).

Only minor changes are anticipated in finalizing the catch data so they should be adequate in their present form for stock assessment (Table 1, Column 10). Spawn depositions in 1976 are available in standard square yards by statistical area and in tons of spawners by management unit. Ratios of the 1977 spawn depositions in standard square yards to those in 1976 were calculated by statistical area and these ratios were applied to the tons of spawners by management unit in 1976 to obtain estimates for 1977 (Column 9). This assumes that the ratio for a statistical area applies to major segments within that area and that the rates selected for management units involving more than one area are representative of that management unit (which is not unreasonable). It also assumes that the distribution of spawners between management units within a single statistical area was the same in 1977 as it was in 1976 (which is much less likely). Consequently, it would be more realistic to consider such combinations jointly in subsequent considerations. (These may be identified as having the same first two figures in their section number in Column 2.) The run to each management unit (Column 8) is then estimated by summing the spawners and the catch.

B. ESTIMATION OF RECRUITS

Under conditions of average recruitment, the run in any one year would be similar to that in the previous year. By comparing the relative strength of year-classes, as indicated by age composition (Table 2), it is possible to draw qualitative conclusions concerning relative abundance in two successive years and hence predict abundance in 1978 (Table 1, Column 3) from abundance in 1977 (Column 8).

C. DESIRED SPAWNERS

The spawning escapements desired (Table 1, Column 4) were estimated by subjective examination of past spawnings in relation to year-class strength (as in previous years). These were revised in 1977 on the basis of additional information (revisions will continue as further information becomes available). These estimates are considered to be liberal approximations of optimum escapements.

D. SURPLUS AND CATCH AVAILABLE TO THE ROE FISHERY

The surplus (Table 1, Column 5) represents the excess of the predicted run (Column 3) over the desired spawners (Column 4). The catch available to the roe fishery (Column 7) represents the surplus from management units minus that taken by or allocated to other fisheries (Column 6) such as food, bait and roe-on-kelp. There are two exceptions to this procedure. Firstly, an upper limit of 10,000 tons has been placed on the roe catch from the Gulf of Georgia to meet other concerns. Secondly, because of the small surplus available in the Johnstone Strait division, no roe fishing is planned for 1978. In addition to the catches from management units, some small catches would be anticipated from sections of the coast outside management units on the basis of fishing patterns in recent years.

RESULTS AND DISCUSSION

A. STOCK ASSESSMENTS FOR 1977

Although some quantitative adjustments may be anticipated after the computerized analysis is completed on the final data, some generalizations may be made on the basis of current data (Table 1).

1. The total run in 1977 (approximately 345,000 tons -- Table 1) was slightly smaller than in 1976, marking the end of a continual increase in abundance since 1972. This level of abundance is comparable to that during the peak period of the reduction fishery (1955-1965).
2. The abundance of the stocks supporting the roe fishery (management units -- 301,000 tons) was about the same as in 1976 and 1975 and may have been marginally lower.
3. The overall exploitation rate in 1977 (25%) was slightly greater than in 1976. The overall exploitation rate for management units was perforce slightly greater (27%) and is estimated to have been about one-third for the major divisions on the coast except for the Gulf of Georgia and the North Coast.
4. The North Coast, the West Coast of Vancouver Island and the Gulf of Georgia each continued to account for about one-third of the total run.
5. Older fish (ages V-VII) accounted for the bulk of the run in the North, while younger fish (ages III-IV) predominated in the Strait of Georgia (Table 7). Fish from the West Coast of Vancouver Island were intermediate in age (mainly ages IV-V).

B. ACCURACY OF FORECASTS FOR 1977

Forecasts of the abundance of runs to management units were reasonably accurate down to the division level and for most management units (Table 1, Columns 8 and 11). Comments on major discrepancies between forecasts and actual runs follow.

1. The run to Cumshewa Inlet in the Queen Charlotte Islands was overestimated. This run arrived late and some of it may have been diverted to other sections.
2. The runs to the various sections of the Gulf of Georgia were either over- or underestimated but the prediction for the overall run to this division was close. This suggests a greater mixing between runs to various management units than elsewhere on the coast.
3. The run to West Barkley on the west coast of Vancouver Island was strong as predicted and again exceeded the optimistic forecast for this area. On the other hand, the runs to West Nootka and Nuchatlitz were much weaker than predicted so that the overall forecast for the district was quite close. Unlike the situation in the Gulf of Georgia, these differences probably represent judgemental misconceptions in forecasting rather than straying between management units.

4. Forecasts of "other" stocks making minor contributions to the fishery were high for most divisions. However, differences of this order must be expected since the data base for both stock assessments and forecasts is weak.

FORECASTS FOR 1978

In most sections of the coast, the phasing out of the strong 1970 and 1971 year-classes (ages VIII and VII in 1978) should be more than compensated by the strong 1974 year-class (age IV in 1978). Consequently, the abundance of runs in the North, which have traditionally contained large portions of age IV fish, should be slightly higher in 1978 than in 1977. In the South, limited sampling from research and food catches in the fall of 1977 suggests that the incoming 1975 year-class is less abundant than its predecessor. Gulf of Georgia stocks, which have been traditionally composed mainly of age III and age IV fish should therefore contain appreciably less age III fish in 1978 than in 1977 but appreciably more age IV fish (as the strong 1974 year-class replaces the weak 1973 year-class). The net result is expected to be a slight drop in abundance from 1977 levels. On the west coast of Vancouver Island, where recruitment has traditionally taken place at age III, the 1973 year-class, which was weak elsewhere on the coast, was recruited in appreciable numbers as age IV fish in 1977 (Table 2). Conversely, the 1974 year-class, which was strong elsewhere on the coast, was not prominent as age IV fish in samples from research catches in the fall of 1977. On the other hand, age III fish were prominent (but not consistently so) in these catches, suggesting that the 1975 year-class will be recruited in 1978. The net result is expected to be a slight reduction in abundance from 1977 levels (but somewhat greater than that for the Strait of Georgia run).

This reduction should be most prominent in the West Barkley management unit. Because of the many inconsistencies in both the data and the population dynamics of these stocks, this assessment must be considered most tenuous. (Test fishing prior to the 1978 season should do much to clarify the situation.)

The 1978 runs to individual management units were predicted (Table 1, Column 3) by applying the above considerations to the observed abundance in 1977. The total run forecasted (329,000 tons) is about 5% smaller than that in 1977 with virtually all of the reduction attributed to southern stocks. A catch of 94,000 tons was forecast to be available to the 1978 roe fishery (Column 7) using procedures outlined in the previous section. This represents an increase in the roe catch of 14% over that in 1977 but about 10% less than the catch considered to have been available from the 1977 run. The roe catch in the Gulf of Georgia will be held to about 11% of the total in 1978 (down from 21% in 1977) because of the major food fishery on these stocks. Because of the slightly reduced abundance anticipated for west coast of Vancouver Island stocks in 1978, their contribution to the roe catch is expected to remain at 39%. Northern stocks, which should be more abundant in 1978, will then supply a larger portion of the roe catch (50%) than in 1977 (39%). The Queen Charlotte Islands and Central Divisions are each expected to contribute 19% of the 1978 roe catch (up from 17% and 15%, respectively in 1977), and the North Coast Division 12% (up from 8% in 1977).

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Table 1. Preliminary herring forecasts for 1978 (tons).

Division and management unit	Section	1978				1977				
		Predicted run	Desired spawners	Surplus	Other fisheries	Available roe catch	Run	Spawners	Catch	Predicted run
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Q.C.I.										
Louscoone	006	7,000	3,000	4,000		4,000	6,983	3,542	3,441	8,000
Cumshewa	023	4,000	3,000	1,000		1,000	2,689	2,689	-	6,000
Skincuttle	025	20,000	5,000	15,000		15,000	17,341	6,603	10,738	16,000
M.U.		31,000	11,000	20,000		20,000	27,013	12,834	14,179	30,000
Other		14,000	4,700	9,300		100	13,231	13,082	149	15,000
Total		45,000	15,700	29,300	2,000	18,100	40,244	25,916	14,328	45,000
North Coast										
Tsimpsean	033,042	18,000	15,000	3,000		3,000	18,029	13,779	4,250	19,000
Porcher Is.	043,044, 052	20,000	7,100	12,900		12,900	22,427	20,234	2,193	9,000 ^b
M.U.		38,000	22,100	15,900		15,900	40,456	34,013	6,443	28,000
Other		2,000	650	1,350		300	1,863	1,548	315	5,000
Total		40,000	22,750	17,250	5,000	11,200	42,319	35,561	6,758	33,000
Central										
Kitasu Bay	067	5,000	3,000	2,000		2,000	3,336	2,110	1,226	6,000
Milbanke Sound	072-074	22,000	10,000	12,000		12,000	22,325	12,177	10,148)	30,000
Queens Sound	075,076	6,000	3,000	3,000		3,000	6,086	5,079	1,007)	
Burke Channel	084	3,000	2,000	1,000		-	2,805	2,805	- *	
Kwakshua	085	2,500	1,500	1,000		1,000	2,488	2,488	- *	
Rivers Inlet	091-093	2,000	2,000	-		-	1,900	1,859	41*	
Smith Inlet	101-103	200	350	(-150)		-	145	141	4*	
M.U.		40,700	21,850	19,000		18,000	39,085	26,659	426	36,000
Other		2,000	950	1,050		50	1,777	1,742	35	35,000
Total		42,700	22,800	20,050		18,050	40,862	28,401	12,461	71,000
Johnstone St.										
Upper Johnstone	123-126	5,000	4,000	1,000		-	4,449	4,364	85	7,000 ^b
Knight Inlet	127	5,000	4,000	1,000		-	4,565	4,565	+	
M.U.		10,000	8,000	2,000		-	9,014	8,929	85	7,000
Other		1,600	1,300	300		-	1,564	1,005	559	28,000
Total		11,600	9,300	2,300		-	10,578	9,934	644	35,000

* Included in "other"

^b Part only.^c Special adjustment applied.

Table 1. (cont'd)

Division and management unit	Section	1978					1977			
		Predicted run	Desired spawners	Surplus	Other fisheries	Available roe catch	Run	Spawners	Catch	Predicted run
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Gulf										
Comox-Qualicum	142	10,000	5,000	5,000		-	9,850	7,635 ^g	2,215)	20,000
French Creek	143	25,000	10,000	15,000		5,000	27,158	17,765	9,393)	
Lund	152	20,000	5,000	15,000		-	22,620	22,620 ^e	-	
Nanoose	172	20,000	10,000	10,000		5,000	18,767	18,433	334	30,000
Yellow Point	173	5,000	5,000	-		-	5,819	5,819	-	
Ganges	182	3,500	3,000	500		-	3,541	1,308	2,233	7,000
M.U.		83,500	38,000	45,500		10,000	87,755	73,580	14,175	57,000
Other		7,000	5,800	1,200		-	7,219	3,140	4,079	30,000
Total		90,500	43,800	46,700	15,000	10,000	94,974	76,720	18,254	87,000
West Coast										
W. Barkley	232,233	35,000	15,000	20,000		20,000	45,071	29,744	15,327	27,000
Hesquiat Hbr.	242	1,000	1,000	-		-	139		139	4,000
Sydney Inlet	243	3,000	1,000	2,000		2,000	4,043	677	3,366)	35,000
S. Clayoquot	244,245	30,000	16,000	14,000		14,000	34,700	23,508	11,192)	
W. Nootka	252	3,000	5,000	(-2,000)		-	2,352	372	1,980	16,000
Nuchatlitz	253	8,000	7,000	1,000		1,000	8,217	6,241	1,976	18,000
Bajo Reef	254	3,000	1,000	2,000		2,000	3,141	3,141	- ^b	
M.U.		83,000	46,000	39,000		39,000	97,663	63,683	33,980	100,000
Other		16,000	10,000	6,000		600	18,625	18,020	605	20,000
Total		99,000	56,000	45,000	3,000	36,600	116,288	81,703	34,585	120,000
SUMMARY										
North										
M.U.		109,700	54,950	54,900		46,900	106,554	73,506	33,048	94,000
Others		18,000	6,300	11,700		450	16,871	16,372	499	55,000
Totals		127,700	61,250	66,600	7,000	47,350	123,425	89,878	33,547	149,000
South										
M.U.		176,500	92,000	86,500		46,000	194,432	146,192	48,240	164,000
Others		24,600	17,100	7,500		600	27,408	22,165	5,243	78,000
Total		201,100	109,100	94,000	18,000	46,600	221,840	168,357	53,483	242,000
All										
M.U.		286,200	146,950	141,400		92,900	300,986	219,698	81,288	258,000
Others		42,600	23,400	19,200		1,050	44,279	38,537	5,742	133,000
Total		328,800	170,350	160,600	25,000	93,950	345,265	258,235	87,030	391,000

Table 2. Preliminary age composition (unweighted) for herring, 1976-77. Type: R = Roe fishery; F = Food fishery; T = Test fishery.

Sec.	Name	Type	Date	Age									No. of fish	% female
				I	II	III	IV	V	VI	VII	VIII	IX+		
012	Louscoone	R	Mar.16 - 20	-	0.2	22.6	5.0	11.5	23.4	27.6	9.0	0.6	1,396	54
023	Skincuttle	R	Mar.20 - 24	-	-	17.3	10.3	43.1	22.6	5.5	1.0	0.2	1,825	56
032	Area 3 inside	F	Jan.28	-	1.5	20.3	15.9	26.1	20.3	5.8	7.3	2.9	69	50
033	Port Simpson	R	Mar.29	-	.2	24.3	3.3	19.4	33.4	14.5	3.0	2.0	664	50
041	Other Area 40 Out	F	Jan. 6 - 23	-	.4	30.8	17.2	20.1	14.3	8.6	5.7	2.9	279	52
045	North Porcher	F	Dec.17- Jan.17	-	-	4.6	7.3	27.3	23.6	20.0	13.6	3.6	110	52
053	Kitkatla	F	Jan.23	-	-	26.9	25.0	25.0	9.6	9.6	3.9	-	52	59
	Kitkatla	R	Mar.24 - 29	-	-	7.6	4.2	25.9	42.3	15.7	3.6	.8	645	46
064	Laredo	F	Jan.18 - 19	-	1.0	32.8	18.7	29.8	8.1	6.6	3.0	-	198	56
	Laredo	R	Mar.22	-	-	11.4	9.4	43.6	14.1	13.6	6.0	2.0	149	48
073	Thompson Bay	R	Mar.20 - 23	-	0.8	15.5	18.4	29.4	21.5	11.0	2.8	0.6	831	54
074	Kildidt	R	Mar.21 - 29	-	0.6	17.1	26.3	32.7	14.9	7.1	1.1	.2	1,420	50
083	Kwakshua	R	Mar.23	-	1.1	49.5	27.5	19.8	1.1	1.1	-	-	91	40
135	Kanish Bay	F	Jan.11	-	3.2	19.8	24.8	36.9	14.7	0.6	-	-	157	35
140	Comox-Qualicum	T	Feb.28- Mar. 7	0.4	3.5	54.7	20.6	16.4	2.8	1.1	.5	-	567	44
	Comox-Qualicum	R	Mar.10 - 13	-	2.8	57.1	21.4	15.4	3.2	0.2	-	-	1,374	46

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Table 2 (cont'd)

Sec.	Name	Type	Date	Age									No. of fish	% female
				I	II	III	IV	V	VI	VII	VIII	IX+		
172	Area 17B	F	Nov.12- Jan.10	-	1.7	60.6	20.6	12.4	3.2	0.7	0.5	0.4	846	50
	Area 17B	T	Nov. 5- Feb.11	1.4	12.9	49.1	13.4	8.6	4.8	4.8	3.2	2.0	442	48
173	Nanoose	T	Feb.24 Mar. 8	-	4.3	62.3	19.3	11.0	2.4	0.5	0.3	-	374	48
181	Other Gulf Is.	F	Dec.14- Jan.26	-	1.9	47.1	25.0	19.9	4.6	1.2	0.3	-	1,194	47
	Other Gulf Is.	T	Feb.11	-	10.5	26.3	10.5	15.8	19.3	8.8	7.0	1.8	57	63
182	Ganges	T	Dec.14	10.8	9.7	35.5	17.2	10.8	5.4	6.5	2.1	2.1	93	41
231	Other Barkley	T	Mar. 3	-	1.1	16.3	60.9	15.2	6.5	-	-	-	92	56
232	West Barkley	T	Feb.22- Mar. 6	-	0.5	9.4	36.4	35.2	13.3	3.9	1.2	0.1	1,477	52
	West Barkley	R	Mar. 8 - 14	-	0.3	11.0	32.8	40.1	11.3	3.5	1.0	0.0	2,507	53
241	Other Clayoquot	T	Mar. 3	-	1.1	22.6	33.3	17.2	15.1	6.5	3.2	1.1	93	52
	Other Clayoquot	R	Mar.11 - 13	-	2.8	16.5	30.8	34.0	10.6	4.1	1.3	-	321	51
242	Sydney Inlet	T	Feb.25- Mar. 4	-	0.3	12.3	29.9	32.0	17.1	5.9	2.1	0.5	375	56
	Sydney Inlet	R	Mar. 8 - 11	-	0.4	15.4	24.8	39.8	12.6	4.0	2.4	0.6	1,029	48
243	Hesquiat Harbour	T	Feb.28	-	-	10.0	20.0	31.7	16.7	15.0	6.7	-	60	66
244	Hecate Bay	R	Mar.11 - 14	-	-	6.0	24.8	45.9	14.7	6.0	2.3	0.5	218	44
251	Other Nootka	R	Mar.15 - 16	-	0.5	18.9	20.0	30.0	13.1	11.6	4.3	2.0	397	60
252	Esperanza	T	Mar. 1	-	1.7	21.2	21.8	42.5	7.3	2.8	2.2	0.6	179	53



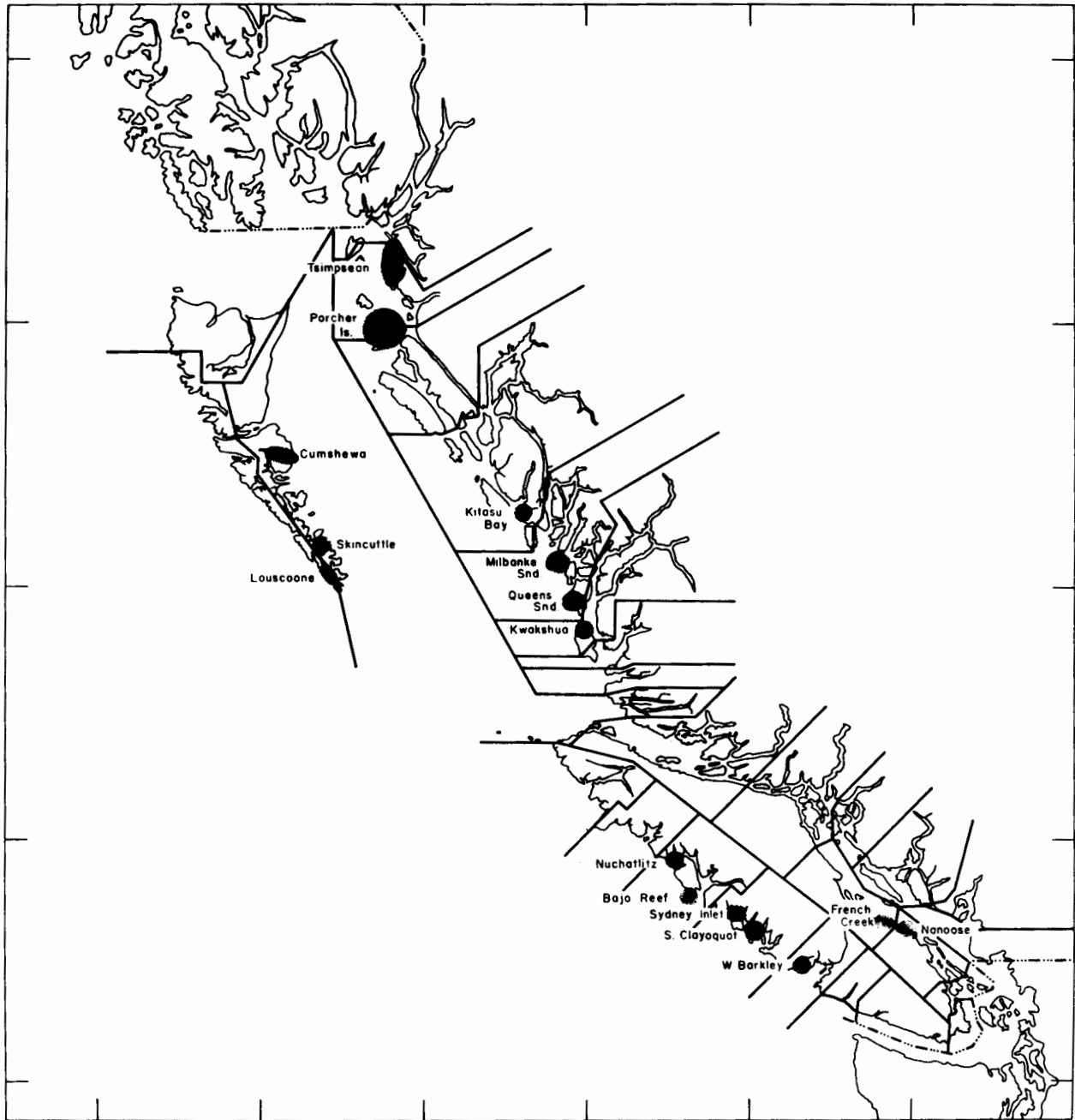


Fig. 1. Management units expected to support appreciable roe herring fisheries in 1978.