

ACOUSTIC ASSESSMENT OF BAITFISH STOCKS IN PUGET SOUND,
1975-1976

by

Albert W. Drew and Richard E. Thorne

Final Report
Service Contract No. 673
Washington State Department of Fisheries
For the period November 15, 1975 - June 30, 1976

Approved

Submitted December 1, 1976


Robert L. Burgess
Director

INTRODUCTION

The cooperative program between the Washington State Department of Fisheries (WDF) and the Washington Sea Grant Marine Acoustic Program to assess acoustically baitfish stocks in Puget Sound was continued for a fourth season. As in previous seasons, the Fisheries Research Institute (FRI) contracted to aid in the collection and analysis of acoustical data. The results of this analysis are reported here in accordance with the provisions of the contract.

MATERIALS AND METHODS

Acoustic data were collected on magnetic tape with the FRI acoustic data acquisition system as described in Thorne, Nunnallee and Green (1972). Two vessels were used this season: The 38 ft RV Malka and the 67 ft RV Commando.

The areas surveyed during this season included either part, or all, or extensions of areas covered in previous seasons. As before, each series of a survey consisted of a number of zigzag transects. This season, all surveys were conducted during the evening hours in the assumption that the fish schools would be dispersed at night and could therefore be more accurately surveyed.

The acoustic data were analyzed by digital echo integration (Thorne 1973). The assumed mean target strength was -33 dB/kilogram wet weight.

RESULTS AND DISCUSSION

The results of the southern Puget Sound surveys are presented in Table 1. Two surveys were only partially completed. The survey of 2/27/76 was terminated early because of equipment problems, and the survey of 3/29/76 was abbreviated because of reduced hours of darkness.

A surprising large biomass was found in southern Puget Sound during November. Examination of echograms from the previous season indicates that large numbers of fish were also present in October and November of 1974, but were so highly concentrated during the day when the surveys were conducted that their true significance was neither appreciated nor measured.

Results of surveys on the spawning stock of herring in the Strait of Georgia are summarized in Table 2. The total biomass was partitioned by species and maturity. The components, in addition to the mature herring, were larger and more variable than had been previously expected. The peak of abundance was also surprisingly short in duration. Both of those aspects underscore the importance of frequent and complete sampling during the spawning period.

Results of acoustic surveys in other areas are given in Table 3. Densities of fish per unit area and transect durations are listed for each transect.

The accuracy of the biomass estimate for all areas in both relative and absolute terms depends on the precision of at least three elements: the system calibration, the target strength assumption and the knowledge of species and weight composition of the fish stocks surveyed. During the past two seasons the system calibration has appeared stable, although some malfunctions of the data acquisition system occurred in the field during this season. A dual beam target strength measuring system has been developed and is now being tested. This system may remove some of the uncertainty surrounding the target strength assumption. Examination of the third element, species composition, may require the use of a greater variety of fishing methods in addition to the standard mid-water herring trawl.

LITERATURE CITED

- Thorne, R. E. 1973. Digital hydroacoustic data-processing system and its application to Pacific hake stock assessment in Port Susan, Washington. NOAA Fish. Bull. 71(3):837-843.
- Thorne, R. E., E. P. Nunnallee, and J. H. Green. 1972. A portable hydroacoustic data acquisition system for fish stock assessment. Wash. Sea Grant Publ. 72-4. 14 pp.

Table 1. Summary of biomass estimates (10^6 kg), for major areas of southern Puget Sound

Area	Date					
	11/22/75	12/15/75	1/7/76	1/18/76	2/27/76	3/29/76
Dalco Pass	2.77	0.925	0.407	0.160	0.120	
Narrows	2.24	0.249	0.237	0.285	0.025	
Hale Pass	7.67	1.360	0.302	0.281	0.021	0.039
N. Carr Inlet	0.142	2.540	1.810	2.150	0.494	0.177
Central Carr Inlet	1.220	2.150	0.200	1.420	0.592	0.143
S. Carr Inlet	1.750	2.200	0.303	1.950	0.066	0.100
N. Nisqually	0.153	0.364	0.203	0.211		0.107
S. Nisqually	0.712	0.351	0.554	0.462		1.280
Drayton Pass	4.190	0.986	0.248	0.366		0.038
S. Case Inlet	0.306	0.486	1.510	0.196		0.247
N. Case Inlet	0.450	1.180	2.310	2.920		0.418
Totals	21.6	12.8	8.08	10.4		2.55

Table 2. Results of acoustic surveys in the Strait of Georgia

Survey	Date	Biomass (10^6 kg)					
		Total	Herring		Pollock (Juvenile)	Smelt (Mature)	Misc.
			(Mature)	(Immature or sport)			
1	10-12 Mar 76	6.07	--	--	--	--	--
2-3	5-8 Apr 76	1.74	1.34	0.40	--	--	--
4	15-16 Apr 76	6.37	3.75	1.84	0.58	0.09	0.12
5	21-22 Apr 76	19.14	11.29	5.54	--	1.73	0.58
6	27-28 Apr 76	9.92	7.58	1.28	--	0.56	0.50
7	5-7 May 76	6.40	2.94	2.04	0.06	--	1.36
8	19-20 May 76	4.11	1.36	1.64	0.30	--	0.81
9	3-4 June 76	1.93	0.04	0.91	0.24	--	0.74

Table 3. Results of acoustic surveys in areas other than southern Puget Sound and Strait of Georgia

Location	Date	Transit	Duration (sec)	Density (kg/m ²)
Bellingham Bay	23 Dec 75	1	577	0.028
		2	539	0.017
		3	373	0.005
		4	228	0.007
		5	487	0.013
		6	364	0.016
		7	872	0.012
		8	962	0.006
		9	262	0.008
		10	440	0.032
Samish Bay		1	956	0.011
		2	1,057	0.085
Padilla Bay		1	289	0.094
		2	319	0.105
		3	281	0.143
		4	275	0.161
		5	342	0.089
		6	287	0.057
Protection Island	14-15 Jan 76	1	536	0.021
		2	432	0.007
		3	564	0.010
		4	713	0.044
		5	780	0.133
		6	617	0.250
		7	441	0.186
		8	369	0.097
Discovery Bay		1	591	0.249
		2	941	0.011
		3	824	0.033
		4	610	0.019
North Hood Canal	14-15 Jan 76	1	628	0.021
		2	622	0.021
		3	826	0.019
		4	814	0.143
		5	723	0.128
		6	378	0.204
		7	382	0.145
		8	580	0.077
		9	645	0.010

Table 3. Results of acoustic surveys in areas other than southern Puget Sound and Strait of Georgia - Continued

Location	Date	Transit	Duration (sec)	Density (kg/m ²)
Protection Island	9 Feb 76	1	456	0.021
		2	431	0.085
		3	473	0.204
		4	363	0.153
		5	549	0.278
		6	432	0.297
		7	383	0.085
		8	363	0.040
Discovery Bay		1	383	0.263
		2	682	0.231
		3	721	0.180
		4	338	0.108
		Tow 1	602	0.126
		Tow 2	324	0.376
Protection Island		Tow 3	623	0.395
		Tow 4	622	0.255
		Tow 5	941	0.184
		Tow 6	935	0.361
Port Town- send Harbor	10 Feb 76	1	720	0.030
		2	546	0.044
		3	375	0.098
		4	780	0.122
		5	921	0.123
		6	407	0.137
		7	702	0.111
		Tow 7	606	0.126
		Tow 8	610	0.100
		Tow 9	610	0.059
Hood Canal N. of Bridge	10-11 Feb 76	1	547	0.018
		2	455	0.017
		3	533	0.013
		4	514	0.047
		5	640	0.039
		6	263	0.054
		7	353	0.231
		8	419	0.198
		9	250	1.138
		Tow 10	1,418	0.329
		Tow 11	304	1.759

Table 3. Results of acoustic surveys in areas other than
southern Puget Sound and Strait of Georgia - Continued

Location	Date	Transit	Duration (sec)	Density (kg/m ²)
Hood Canal	11 Feb 76	1	708	0.010
S. of Bridge		2 & 3	1,672	0.0106
		4 & 5	2,186	0.0048
		6	728	0.048
		7	2,104	0.010
S.-Central		1	236	0.012
Hood Canal--		2	588	0.027
Hoodsport to		3	362	0.028
Lynch Cove		4	182	0.043
		5	217	0.617
		6	242	0.207
		7	269	0.647
		8	391	0.033
		9	241	0.022
		10	152	0.018
		11	705	0.060
		12	287	0.020
		13	300	0.024
		Tow 12	609	0.011
		Tow 13	900	0.013
		Tow 14	1,192	0.228
		Tow 15	941	0.034
Hoodsport	11-12 Feb 76	1	462	0.007
to Quatsap Pt.		2	689	0.012
		3	811	0.008
		4	789	0.005
		5	429	0.018
		6	484	0.003
		7	566	0.004
		8	469	0.014
		9	663	0.011
		10	488	0.003
Dabob Bay	12 Feb 76	1	726	0.008
		2	824	0.012
		3	884	0.008
		4	577	0.007
		5	696	0.014
		6	432	0.017