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ACOUSTIC ASSESSMENT OF BAITFISH STOCKS IN PUGET SOUND

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Richard E. Thorne and Albert W. Drew

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ACOUSTIC ASSESSMENT OF BAITFISH STOCKS IN PUGET SOUND

INTRODUCTION

The cooperative program between the Washington Department of Fisheries (WDF) and the Washington Sea Grant Marine Acoustics Program to assess acoustically baitfish stocks in Puget Sound was continued for a third season. As in previous seasons, the Fisheries Research Institute (FRI) contracted to aid in the collection and analysis of acoustical data. A total of 232 hours of acoustic data was collected during the past year. The results of analysis of 164 hours, including the most important surveys, 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). Several vessels were utilized this season: A WDF 17-ft Glasspar, the 20-ft WDF Research I, the 67-ft RV Commando, the 38-ft RV Malka, the 30-ft WDF Patrol Boat No. 1, and the commercial purse seiners Blue Pacific and Panther. The U.S. Department of Fish and Wildlife provided the charter of the Panther and several charters of the Malka for surveys in the Gulf of Georgia. The results of these surveys are also included in this report.

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.

Analysis was conducted with the aid of a Digital Data Acquisition and Processing System (DDAPS) as described by Thorne (1973). The system

provides an estimate of abundance, the accuracy of which depends on the accuracy of the system calibration and the target strength assumption. Results from previous years have been based on a target strength value indirectly derived by comparison with net catches. Calibration studies early this year indicated that the value of this target strength was -32.8 dB/kilogram wet weight. However, further examination recently has revealed inaccuracies in the echo sounders' Time-Varied-Gain, so that the effective target strength assumption used in past data was -32.8 dB/kg during day and about -34.5 dB/kg for night surveys. For standardization, the values reported this year are referenced to a target strength value of -33 dB/kg. Night surveys from past years must be reduced by 1.5 for direct comparison. The correction for day series is negligible.

RESULTS AND DISCUSSION

A list of all surveys conducted during the past season is presented in Table 1. Fifteen surveys were conducted in the Gulf of Georgia. Results of analysis of all these surveys are given in Table 2. The population increased from a level of 2 to 3 million lb to a peak estimate of 24 million lb on May 8. A technical problem involving the position of the transducer during the previous survey on April 30 aboard the Blue Pacific is believed to have caused an anomalously low biomass estimate for this survey. The population level was still 11.8 million lb on the final survey on May 26.

The number and extent of surveys in the Gulf of Georgia were much greater than the previous year, when the initial and peak estimate was 20 million lb when referenced to -33 dB on April 16. The estimates in 1974 decreased to a value of only 1.2 million lb on May 17. The

survey area and effort were also smaller. Direct comparison between the two years is difficult because the peak abundance was not delineated in 1974.

Results of analysis of surveys in other areas are presented in Table 3. Herring populations in these areas were generally lower than previous years even after accounting for the adjustment to the -33 dB/kg standard. An exception was Nisqually Reach where significant fish concentrations were noted for the first time. The most striking reduction was in lower Hood Canal, 0.33 million lb, compared with last year's 10 million lb. This change may be due to modification of the migration time of the herring as was observed in the Gulf of Georgia herring, which appeared two to three weeks later than expected this year. This potential for changing migration times means that increased effort in terms of a number of surveys over an extended time period will be required to obtain maximum biomass estimations of the stock size of the Protection Island and Hood Canal herring in the future.

The -33 dB/kg reference was selected both to minimize adjustment of previous data, which is based on a series of net catch comparisons in 1973, and because the value is in reasonable agreement with the limited information on clupeid target strengths. For example, Nakken and Olsen (1973) suggest -33 dB/kg for herring, Johannesson and Losse (1973) report -33 dB/kg for pelagic species off West Africa, and a value of -34.5 dB/kg is used for FAO surveys of anchovy off Peru (Edwards, personal communication). It is obvious from these examples that while a value of -33 dB/kg is a reasonable interim standard, caution must be exercised when treating the results as

absolute population values. Future refinements of the value are not unexpected as additional information becomes available.

LITERATURE CITED

- Johannesson, K., and G. Losse. 1973. Some results of observed abundance estimations obtained in several UNDP/FAO resource survey projects. Paper No. 3, ICES/FAO/ICNAF. Symposium on acoustic methods in fisheries research, Bergen, Norway. 50 pp.
- Nakken, O., and K. Olsen. 1973. Target strength measurements of fish. Paper No. 24, ICES/FAO/ICNAF. Symposium on acoustic methods in fisheries research, Bergen, Norway. 13 pp.
- 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.

Table 1. Summary of herring surveys, September 1974 - May 1975

Survey number	Area	Boat	Date
1	Carr Inlet (day)	WDF (17-ft Glasspar)	8-7-74
2	South Sound Carr Inlet (day)	<u>Research I</u>	9-25-74 9-26-75
3	South Sound Carr Inlet (day)	<u>Research I</u>	10-21-74 10-22-74
4	South Sound Carr Inlet (day and night)	<u>Malka</u>	11-12-74 11-13-74
5	South Sound	<u>Commando</u>	11-18-74 11-19-74
6	South Sound Carr Inlet (day)	<u>Research I</u>	12-18-74 to 12-20-74
7	South Sound excluding Carr Inlet	<u>Malka</u>	1-13-75 1-14-75
8	South Sound	<u>Commando</u>	1-18-75 1-19-75
9	Carr Inlet (day and night)	<u>Malka</u>	1-22-75 1-23-75
10	Hood Canal, Discovery Bay, and Protection Island	<u>Commando</u>	2-3-75 to 2-6-75
11	South Sound Carr Inlet (day)	<u>Research I</u>	2-10-75 2-11-75
12	Gulf of Georgia Bellingham Bay Padilla Bay	<u>Commando</u>	2-17-75 2-18-75 2-19-75
13	South Sound Carr Inlet (day and night)	<u>Malka</u> <u>Commando</u>	3-17-75 to 3-19-75 3-20-75 3-21-75
14	Gulf of Georgia	<u>Malka</u>	3-27-75 3-29-75

Table 1. Summary of herring surveys, September 1974 - May 1975 -
Continued

Survey number	Area	Boat	Date
15	Gulf of Georgia	<u>Malka</u>	4-7-75 to 4-10-75
16	" "	<u>Patrol I</u> <u>Malka</u>	4-16-75 4-18-75
17	" "	<u>Malka</u>	4-24-75 4-25-75
18	" "	<u>Blue Pacific</u>	4-30-75
19	" "	<u>Panther</u>	5-8-75
20	" "	<u>Malka</u>	5-15-75
21	" "	<u>Malka</u>	5-26-75

Table 2. Results of night acoustic surveys in the Gulf of Georgia, February 17, 1975 to May 26, 1975

Survey number	Date	Surface area 10^6 m^2	Relative biomass estimate 10^6 lb
12	2-17-75	211	2.5
14	3-27-75	231	2.9
	3-29-75	93.2	.79
15	4-7-75	210	3.7
	4-8-75	"	4.7
	4-9-75	"	6.3
	4-10-75	"	6.4
16	4-16-75	201	8.7
	4-18-75	"	6.6
17	4-24-75	200	20.
	4-25-75	200	23.
18	4-30-75	"	11.
19	5-8-75	"	24.
20	5-15-75	"	11.
21	5-26-75	"	12.

Table 3. Initial results of acoustic surveys in Puget Sound,
November 12, 1974 to March 21, 1975

Survey number	Area	Date	Day/ night	Surface area 10^6 m^2	Relative biomass estimate 10^6 lb
4	Narrows	11-12-74	day	10.7	1.9
"	Nisqually Reach	"	"	12.9	.10
"	Case Inlet	"	"	44.5	2.3
"	Drayton Passage	"	night	8.7	.32
"	Carr Inlet	"	"	53.7	4.4
"	" "	11-13-74	day	62.4	2.1
"	Hale Passage	"	"	4.8	2.6
7	Nisqually Reach	1-13-75	day	12.9	.54
	Case Inlet	"	"	51.1	.43
	Drayton Passage	"	night	8.7	.05
8	South Case Inlet	1-19-75	night	23.8	.50
9	Carr Inlet	1-22-75	day	62.4	5.8
	" "	"	night	"	7.6
10	Protection Island and Discovery Bay	2-3-75	night	25.9	4.3
	"	2-4-75	day	"	3.5
11	Upper Hood Canal	"	"	24.9	2.0
"	"	"	night	"	2.0
"	Lower Hood Canal	"	"	21.7	.33
12	Bellingham Bay	2-19-75	day	12.6	.62
	Padilla Bay	"	"	10.7	2.4
13	Nisqually Reach	3-17-75	day	12.9	.96
	Case Inlet	"	night	51.1	1.8
	Drayton Passage	"	"	8.7	.16
	Carr Inlet	3-18-75	day	62.4	3.7
	" "	"	night	"	2.1