

## Appendix B

### Acoustic-trawl estimates of sardine biomass off the west coasts of the United States of America and Canada during summer 2012

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This report summarizes acoustic-trawl method (ATM) estimates of the sardine distribution and abundance from the summer 2012 survey (SaKe 2012) off the west coasts of the USA and Vancouver Island, Canada (**Fig. 1**). The survey was conducted from NOAA FSV *Bell M. Shimada*. A cruise report and a manuscript including details of the ATM, these results, and the biomass estimates of other coastal pelagic fish species (CPS) are being finalized.

The ATM survey totaled 3632 n.mi. of trackline spanning over 39 614 n.mi.<sup>2</sup> and the expected distribution of the northern stock of Pacific sardine (**Fig. 1**). During daylight, from sunrise to sunset, multi-frequency echosounders were used to sample acoustic backscatter from CPS. During nighttime, surface trawls were used to identify the proportions of CPS and their lengths. Due to their temporal-spatial proximity, data from trawl catches conducted each night were combined into clusters. Overall, 31 catch clusters included CPS and these clusters included an average catch of 274 sardine (median = 7).

For biomass estimation, the survey area was split into three strata, each having relatively homogeneous species composition and density (Fig. 1; **Table 1**). The Oregon-California stratum contained the largest concentration of CPS backscatter and trawl clusters with sardine (**Figs. 1 & 2**). Sardine were concentrated north of San Francisco, off northern California and southern Oregon (**Fig. 2**).

The three strata (**Table 1**) contained a total sardine biomass of 0.341 Mt ( $CI_{95\%} = [0.188; 0.688]$ ;  $CV = 33.4\%$ ). The sardine abundance was comprised mostly of sardine with modal standard length ( $SL$ ) ~ 21 cm, corresponding to the putative 2009 cohort (**Table 2**).

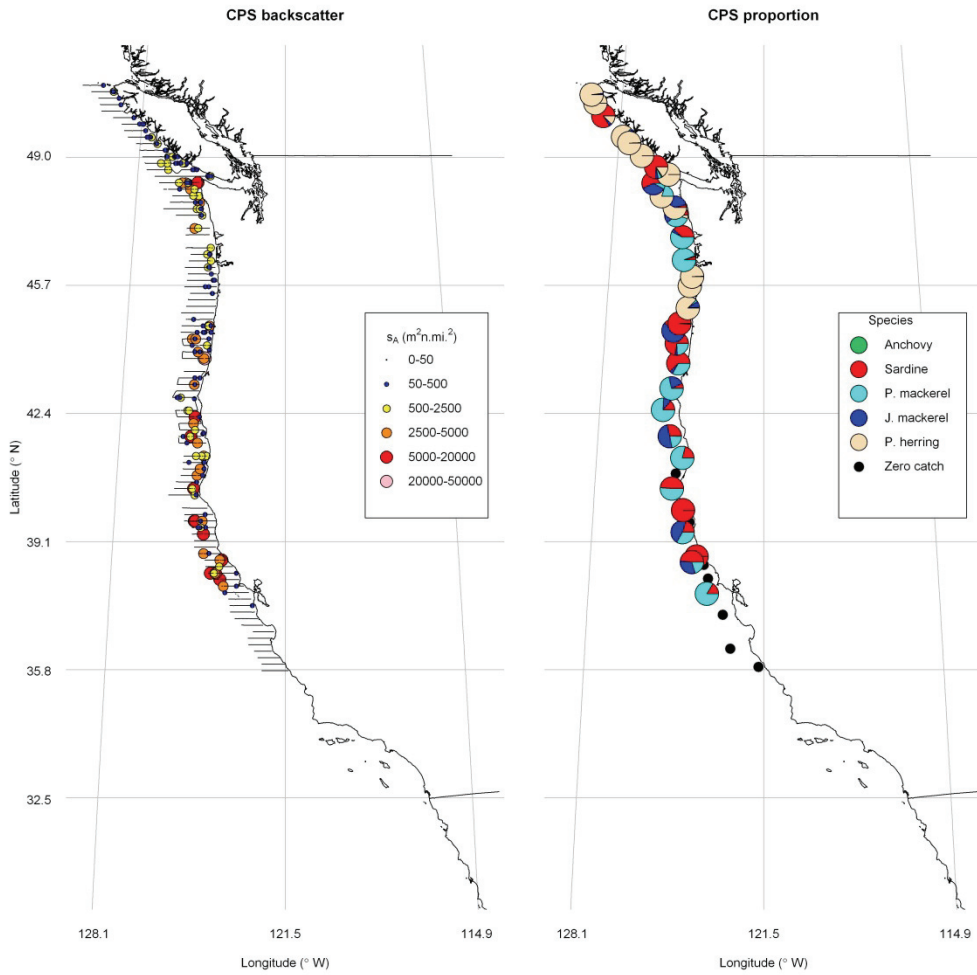
**Table 1.** Sardine biomass by stratum for the summer 2012 survey.

Stratum		Transect		Trawls		Sardine		
Name	Area (n.mi.)	Number	Distance (n.mi.)	CPS clusters (number)	Sardine (number)	Biomass (1000 tons)	95% confidence interval (1000 tons)	CV (%)
Vancouver Island	7370	15	698	8	1051	18.675	2.661 - 54.017	61.9
Washington-Oregon	10 832	20	915	9	3516	13.335	3.918 - 27.559	42.9
Oregon-California	17 295	39	1614	14	3920	308.821	150.872 - 650.235	37.3
Central California	4169	11	390	0	0	0	NA	NA
<b>Total</b>	<b>39 666</b>	<b>85</b>	<b>3632</b>	<b>31</b>	<b>8487</b>	<b>340.8311</b>	<b>187.666 - 687.523</b>	<b>33.4</b>

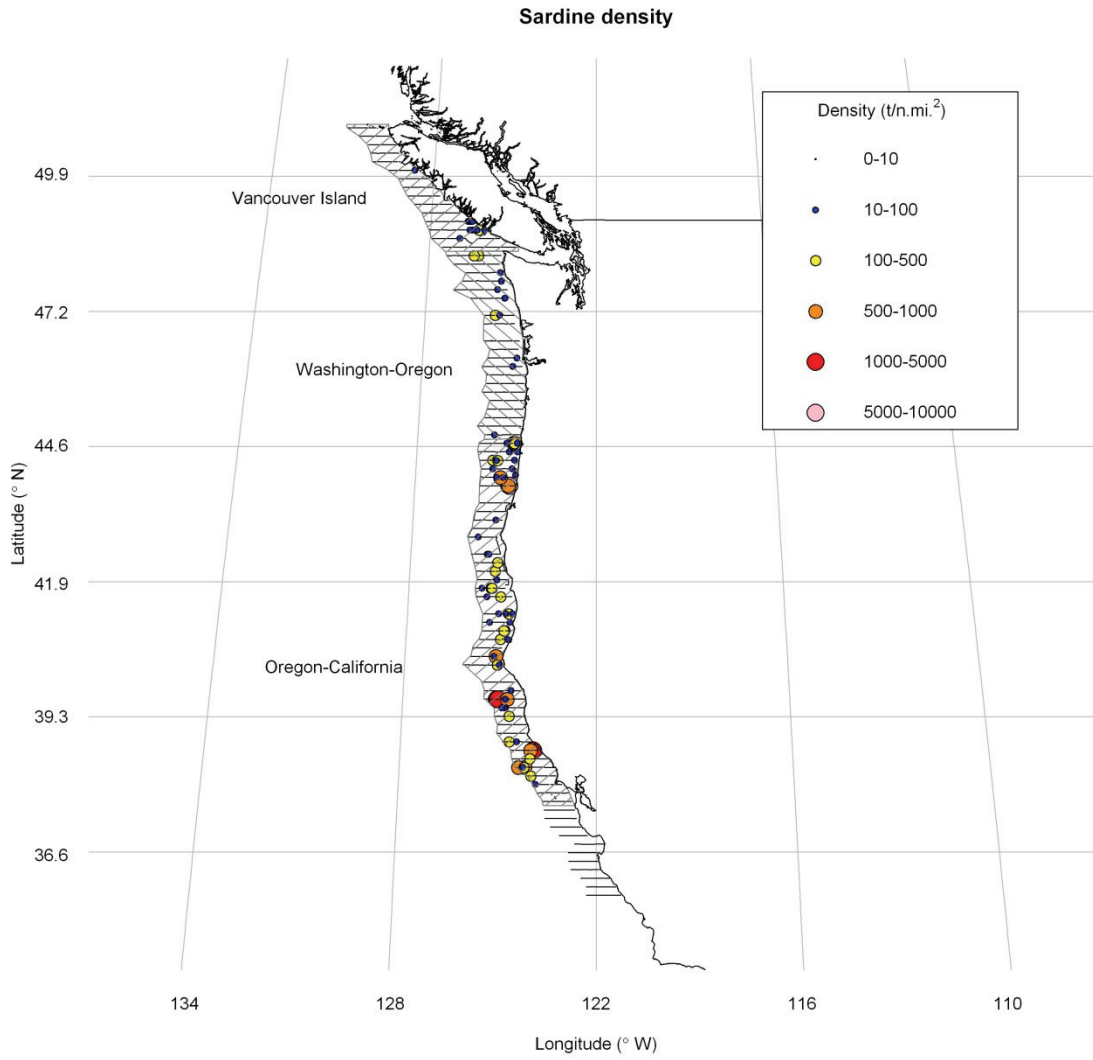
**Table 2.** Sardine abundance versus standard length for the summer 2012 survey using all positive sardine clusters (see Fig. 2).

Standard length (cm)	All clusters (number);
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	1906030
19	10394493
20	732568840
21	1160073971
22	372313768
23	243284246
24	148308909
25	15833336
26	1290773
27	0
28	0
29	0
30	0

**Figure 1.** Acoustic backscatter from coastal pelagic fish species (CPS; left); and proportions of CPS in trawl clusters (right).



**Figure 2.** Sardine biomass densities versus stratum (Table 1) estimated using the acoustic-trawl method (ATM).



**Figure 3.** Sardine abundance versus standard length for the summer 2012 survey (SaKe 2012). Data for the entire survey are provided in **table 2**.

