Free Fatty Acids in Alaska Pacific Halibut

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Background:

- Marine fish are an important source of protein and essential nutrients such as selenium and Omega-3 fatty acids.
- Pacific halibut are an important sport, commercial and subsistence species in Alaska and Western Canada.
- Free fatty acid profiles were determined for halibut caught during annual IPHC stock assessment surveys and described in relation to region collected, size, and mercury content.

Methods:

- Halibut muscle samples were collected by IPHC samplers during annual stock survey cruises in 2002-2011.
- Samples were processed as skinless muscle tissue and analyzed for total mercury at the Alaska State Environmental Health Laboratory.
- 94 Fatty Acid Methyl Esters (FAME) were measured in skinless white muscle tissue of 103 halibut.

	n	Mean	SD
Length (cm)	103	115.38	22.77
Age (years)	101	15.68	5.41
% Total Lipid	88	1.98	1.48
% Omega-3[1]	103	27.31	10.95
Omega-3s Edible portion (g/100g)	103	0.32	0.27
Omega-6/Omega-3	103	0.145	0.066
Total Mercury mg/Kg	103	0.38	0.35
Selenium Health Benefit Value[2]	103	2.89	4.34
$\delta^{15}N$	46	14.82	1.47

[1]Of Total Fatty Acids
[2] Values >0 demonstrates beneficial ratio: ((Se-Hg)/Se)*(Se+Hg), see Ralston et al. 2016. Only 9 individual halibut had a SHBV < 0.

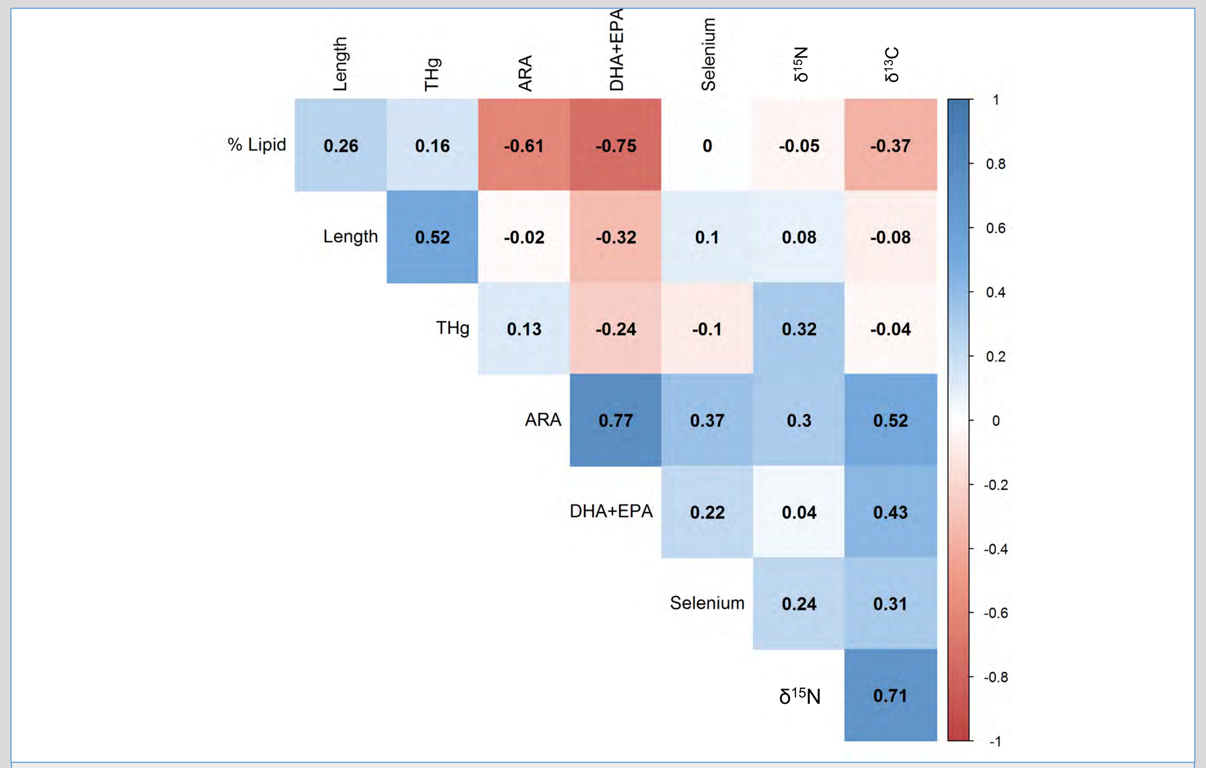

Figure 1: Correlation table (Spearman test). Total Mercury (THg), arachidonic acid (ARA), docosahexaneonic acid (DHA), eicosapentaenoic acid (EPA).

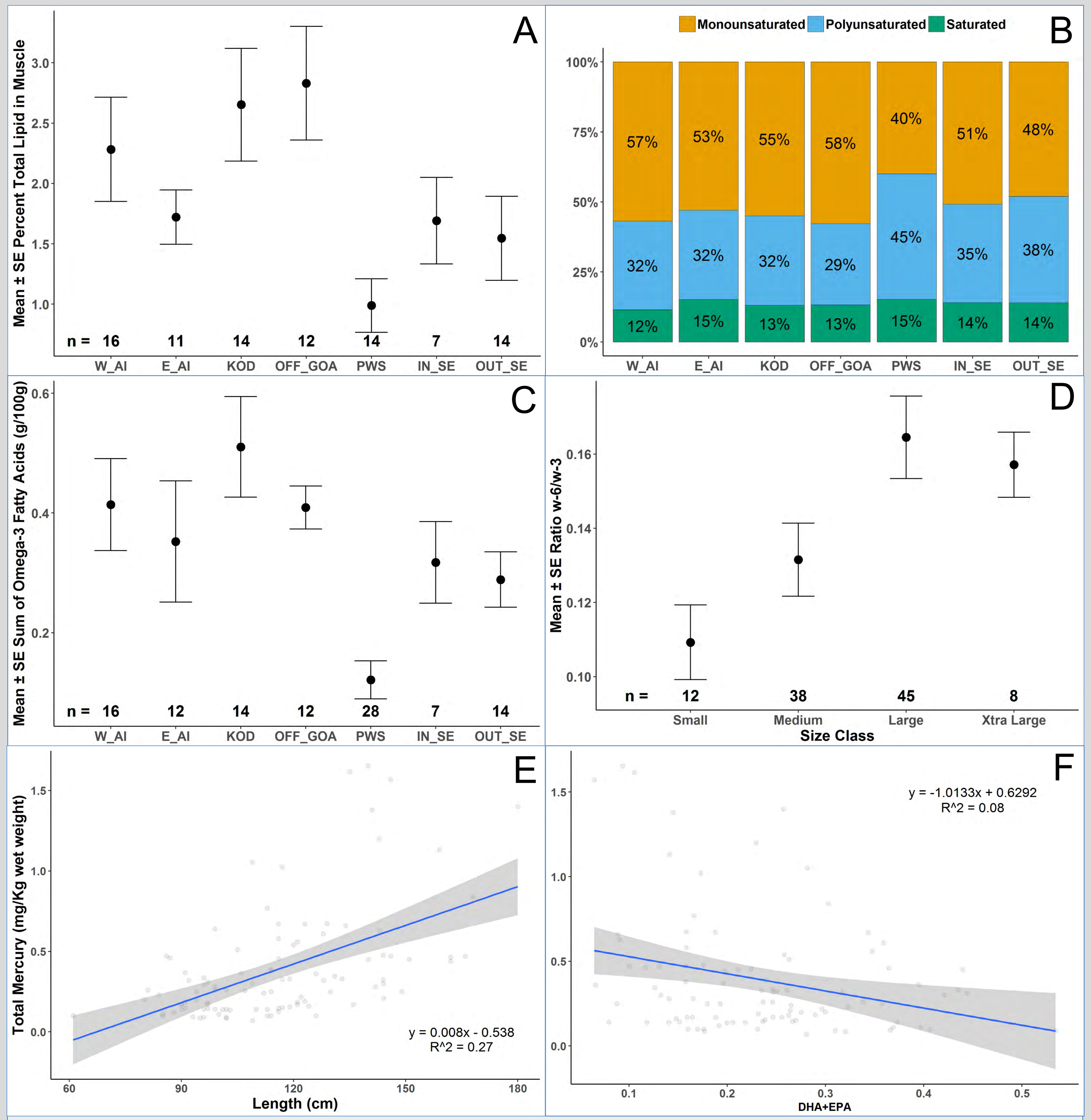

Figure 2: Mean percent total fat by region collected (A); Proportion of mono-, poly-, and saturated fats by region collected (B); Mean edible portion (g/100g) of Omega-3 fatty acids by region (C); Mean ratio of Omega-6 to Omega-3 fatty acids by size class: Small = 80-89.5cm, Medium = 89.5-112.5cm, Large- 112.5-148cm, Xtra large = >148cm (D), Relationship between total mercury and fork length in halibut, n=103 (E); Relationship between total mercury and the two main Omega-3 fatty acids, DHA and EPA, n=103 (F). W_AI = Western Aleutian Islands, E_AI = Eastern Aleutian Islands, KOD = Kodiak, OFF_GOA = Offshore Gulf of Alaska, PWS = Prince William Sound, IN_SE = Inside Southeast, and OUT_SE = Outside Southeast.

Conclusions:

- Lipids in Pacific halibut differ by region and fish size
- Of the halibut in this study, those from PWS and the Eastern Aleutian Islands had the most unique fatty acid profiles
- The amount of Omega-3 fatty acids in an edible portion of halibut is largely dependent on the percentage of total fat in the fish
- As you would expect, the accumulation of mercury is correlated with fish size
- There was no clear relationship between mercury accumulation and essential fatty acids in halibut sampled for this study
- The use of multiple ecological chemical tracers is valuable for characterizing Pacific halibut trophic and contaminant dynamics

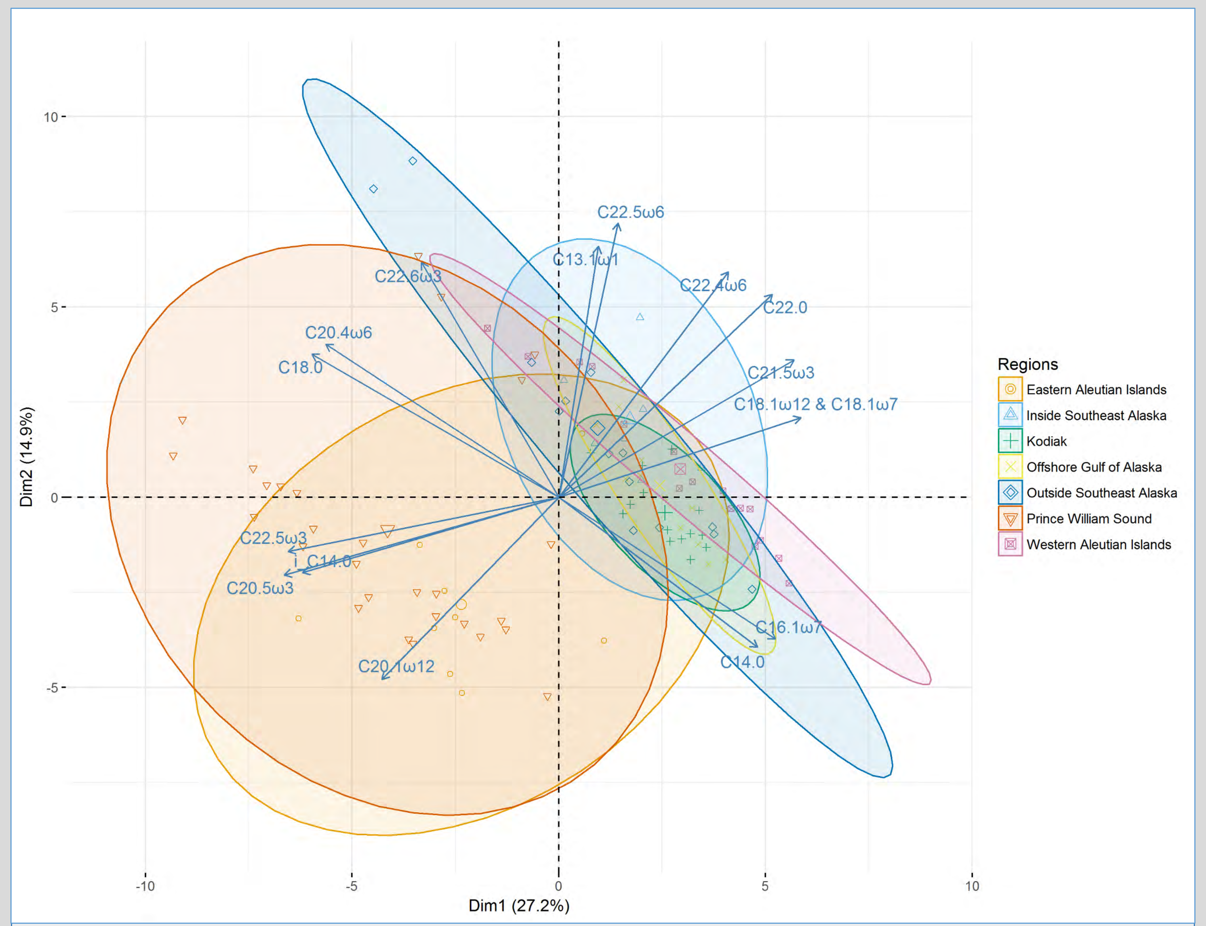

Figure 3: Biplot of principal component analysis of halibut FAMEs. Only the top 15 contributing FAMEs are plotted (arrows). Ellipses represent the 95% CI of groups (Region) for individuals.

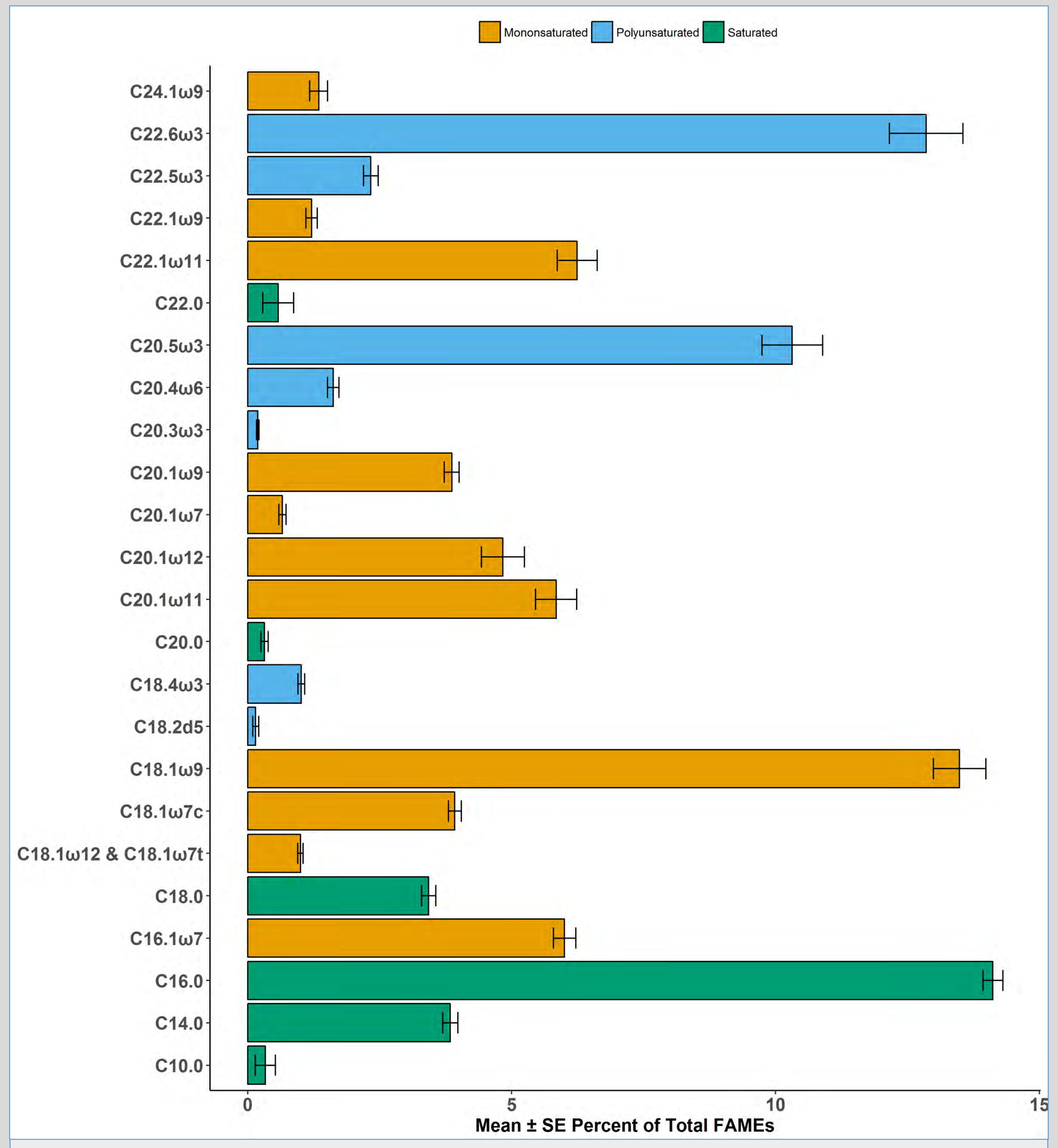

Figure 4: Mean percent of total FAMEs for all halibut (n = 103). Only FAMEs with at least one halibut with > 2% of a given FAME were included.

References:

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