Corrigendum to: "Species and size selectivity of two midwater trawls used in an acoustic survey of the Alaska Arctic" (Deep-Sea Res. II 135 (2017) 40-50)

Alex De Robertis[1,*], Kevin C. Taylor[2], Kresimir Williams[1], Christopher D. Wilson[1]

[1] *Alaska Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 7600 Sand Point Way NE, Seattle, WA 98115, USA.*

[2] *The Johns Hopkins Applied Physics Laboratory, 11100 Johns Hopkins Rd, Laurel, MD 20723, USA.*

[*] Corresponding author: tel: +1 206 526 4789; fax: +1 206 526 6723

E-mail address: alex.derobertis@noaa.gov (A. De Robertis)

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Here we describe a correction to estimates of the size and species selectivity of two survey trawls in De Robertis et al. (2017a). In that study, trawl selectivity was investigated by equipping a modified Marinovich survey trawl with recapture nets to estimate the degree to which organisms entering the trawl mouth escape during the capture process. On a subset of hauls, paired hauls with both the Marinovich and a larger Cantrawl trawl were conducted. The size and species selectivity of the nets was estimated by combining the catch data from both trawls in a statistical model. Escapement (E) from each section of the Marinovich was characterized as $E = \frac{c_{mar}}{f_{mar}}$ where c_{mar} is the catch in the Marinovich recapture net in a given section of the net and f_{mar} is the fraction of the trawl surface area covered by the recapture nets in that section.

In De Robertis et al. (2017a), f_{mar} of 0.022 was used in the forward portion of the trawl, and 0.055 was used in the aft portion of the trawl. We have discovered that these values were incorrectly computed. The correct value of f_{mar} in the experimental configuration is 0.065 in the forward portion of the trawl, and 0.132 in the aft portion of the trawl. Here we summarize the impacts of this inadvertent error on the selectivity estimates reported in De Robertis et al. (2017a). We also examine the effects of this error on the abundance estimates of acoustic-trawl surveys conducted in the Chukchi Sea in 2012 and 2013 as these surveys applied these selectivity relationships to correct for the selectivity of the survey trawl (De Robertis et al., 2017b).

The proportion of mesh area covered by the recapture net in De Robertis et al. (2017a) was incorrect for two reasons. First, the size of the recapture net was miscommunicated, and the number of meshes covered by the recapture net was under-estimated. Second, the codend was not included in the trawl diagram, and the area of the net covered by the fine-mesh (2 by 3 mm) codend liner was misinterpreted. We thus incorrectly assumed that the liner was placed in the aft section of the net during the survey rather than lining a separate, undocumented codend. These errors were discovered by comparing the trawl with the net diagram. These errors could have been avoided by better documentation of the trawl and recapture nets, and verifying that the recapture nets and trawl matched the net plans as part of the experiment. Corrected diagrams of the trawl and recapture nets as used in the experiment (Figs. S1.1-1.2), and a protocol to estimate recapture net coverage in this and future studies (S2) are given as supplementary material.

The primary consequence of under-estimating f_{mar} by a factor of 3 in the forward section and 2.4 in the aft section is that escapement from the Marinovich trawl was over-estimated. Escapement from the Cantrawl was also over-estimated as this depends on the estimated abundance of fish in the volume sampled which depends on the estimated selectivity of the Marinovich (De Robertis et al., 2017a; their equation 9). The reductions in estimated escapement can be visualized by comparing the revised calculations (Table 1 and Figs. S1.3-S1.7) with those in the original publication (their Table 2, Figs. 4-5 and 7-9).

Although the qualitative pattern of escapement from different sectors of the net is similar to that described by De Robertis et al. (2017a), the proportion of fish escaping though the meshes is smaller (Fig. S1.4). In general, the corrected probability of retention in both nets is higher, but the slope of the curves remains similar (Figs. S1.5-7). The length at 50% retention (L_{50}), which is directly affected by the absolute value of escapement, increases when f_{mar} is corrected (compare Table 1 and De Robertis et al. (2017a), their Table 2). However, the slope of the curve defined by *SR*, which describes the difference in length at 75% and 25% retention (i.e. L_{75} - L_{25}), is less affected. For example, for Arctic cod, the most abundant species, L_{50} for the Marinovich shifts from 6.2 to 5.2 cm after correction, while *SR* is unchanged at 2.2 cm. In the case of the Cantrawl, L_{50} shifts from 5.6 to 5.3 cm, and *SR* is unchanged at 0.8 cm. Stated another way, the primary impact is that the probability of retention increased in both nets (i.e. L_{50} decreased). For example, the probability of retaining a 4 cm Arctic cod increased from 0.11 to 0.23 for the Marinovich after correction, and 0.01 to 0.02 for the Cantrawl. However, *SR* was unaffected in this case. Thus, although the corrected results indicate that the trawls are more likely to retain these small fishes than initially estimated, the relative differences between different sizes, species and trawls are less affected. We regret the error, and the corrected selectivity values and figures presented here should supersede those in the original publication.

The primary application of these selectivity relationships was to estimate selectivity-corrected species and size distributions from trawl catches for use in acoustic-trawl abundance surveys (De Robertis et al., 2017b). These survey estimates are a complex function of acoustic backscatter measurements, trawl catches, selectivity estimates, and the acoustic properties of the organisms. We re-computed the abundance estimates with the corrected selectivity estimates and find that as expected from prior sensitivity analyses (De Robertis et al., 2017b, their Table 3), the effect on abundance estimates is relatively modest.

Total estimates for Arctic cod were within 0.7% of the previous estimates and those of other, less abundant species differed by at most 9.9% (Table 1). In addition, the reduced selectivity shifted size distributions sizes towards larger: mean length increased by up to 1.1% for Arctic and saffron cod, and by up to 7.9% for capelin and herring (Table 1). These differences are small because the acoustic-trawl estimates are sensitive to the relative change in escapement between species and size classes (i.e. changes in size and species composition) rather than the absolute changes in escapement. Thus, the impact of the error described above on the acoustic-trawl abundance estimates reported by De Robertis et al. (2017b) is modest, and does not appreciably alter the conclusions of that study. A revised data set with abundances computed with the corrected f_{mar} parameter is available for use in future studies (De Robertis, 2021).

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Table 1. Revised logistic selection curve parameters with bootstrapped confidence intervals. Methods are equivalent to those in De Robertis et al. (2017a) but with a correction for the degree of coverage of the recapture nets. L_{50} is the length in cm at 50% retention, and *SR* is the length in cm between 75 and 25% retention. Scientific names are follows: Arctic cod (*Boreogadus saida*), saffron cod (*Eleginus gracilis*), Arctic sand lance (*Ammodytes hexapterus*), Pacific capelin (*Mallotus villosus*). In the case of Arctic sand lance and capelin, some of the point estimates of L_{50} and SR fall outside of the 90% bootstrap confidence interval, which suggests that these values are affected by a small number of trawl hauls. Large values of SR imply little size selectivity across the observed size range. Note that *A. hexapterus* is referred to as Arctic sand lance (Orr et al., 2015), while this species was referred to as Pacific sand lance in De Robertis et al., 2017a,b.

Species Group	Marin. L_{50} (cm) (90% CI)	Marin. *SR* (cm) (90% CI)	Can. L_{50} (cm) (90% CI)	Can. *SR* (cm) (90% CI)
Arctic cod	5.2 (4.7,5.9)	2.2 (1.6, 3.1)	5.3 (4.1, 5.8)	0.8 (0.7, 1.0)
saffron cod	10.3 (8.3, 19.7)	6.1 (4.2, 14.2)	6.3 (-15.5, 24.4)	1.1 (-1.3, 3.3)
Arctic sand lance	11.1 (6.5, 18.9)	5.9 (2.1, 15.6)	257.2 (-64.3, 94.4)	77.5 (-19.7, 24.9)
capelin	-48.2 (-31.7, 45.7)	-88.8 (-56.3, 59.4)	6.2 (-4.3, 18.5)	1.0 (-12.2, 7.5)
other fishes	9.3 (8.2, 24.5)	5.2 (4.3, 15.7)	13.0 (9.1, 34.0)	2.9 (1.8, 9.0)
jellyfish	3.2 (-0.8, 3.8)	1.3 (0.1, 1.5)	89.4 (-437.6, 557.7)	52.6 (-283.8, 342.4)

Table 2. Revised abundance of fishes by year and area estimated with acoustic-trawl methods in the 2012 and 2013 Arctic EIS surveys of the northern Bering and Chukchi continental shelf. The abundance in various survey sub-regions is given for comparison with the previously published results (De Robertis et al, 2017a; their table 3). A summary of the percent changes in abundance $\left[\left(1-\frac{N_{corr}}{N_{orig}}\right)*100\right]$and mean length $\left[\left(1-\frac{\bar{L}_{corr}}{\bar{L}_{orig}}\right)*100\right]$ comparing the original estimates of De Robertis et al. (2017b) (*orig*) and the corrected estimates (*corr*) is provided.

Species	**Year**	**N. Bering** (No. fish)	**S. Chukchi** (No. fish)	**N. Chukchi** (No. fish)	**Entire area** (No. fish)	**Common area** (No. fish)	**Change in abundance** (% in entire area)	**Change in length** (% of mean length)
Arctic cod	2012	$6.5\cdot10^{9}$	$2.0\cdot10^{8}$	$8.0\cdot10^{10}$	$8.6\cdot10^{10}$	$8.6\cdot10^{10}$	0.2	0.5
	2013	$2.8\cdot10^{2}$	$2.3\cdot10^{9}$	$2.5\cdot10^{11}$	$2.5\cdot10^{11}$	$2.4\cdot10^{11}$	-0.7	1.0
Saffron cod	2012	$5.8\cdot10^{7}$	$6.9\cdot10^{8}$	$6.6\cdot10^{8}$	$1.4\cdot10^{9}$	$1.4\cdot10^{9}$	7.5	1.1
	2013	$1.3\cdot10^{7}$	$4.4\cdot10^{9}$	$1.5\cdot10^{9}$	$5.9\cdot10^{9}$	$5.9\cdot10^{9}$	2.3	0.3
Capelin	2012	$3.3\cdot10^{8}$	$2.9\cdot10^{8}$	$7.5\cdot10^{8}$	$1.4\cdot10^{9}$	$1.1\cdot10^{9}$	5.2	7.9
	2013	$6.2\cdot10^{8}$	$3.3\cdot10^{7}$	$1.1\cdot10^{9}$	$1.8\cdot10^{9}$	$1.7\cdot10^{9}$	9.9	3.9
Herring	2012	$1.3\cdot10^{9}$	$1.7\cdot10^{8}$	$1.3\cdot10^{7}$	$1.5\cdot10^{9}$	$1.5\cdot10^{9}$	-1.1	2.0
	2013	$7.5\cdot10^{9}$	$4.2\cdot10^{7}$	$1.5\cdot10^{5}$	$7.6\cdot10^{9}$	$6.6\cdot10^{9}$	0.1	0.8