Snow buntings (Plectrophenax nivealis) as bio-indicators for exposure differences to legacy and emerging persistent organic pollutants from the Arctic terrestrial environment on Svalbard.

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Abstract: Eggs of snow buntings (Plectrophenax nivealis) were applied as a bio-indicator to examine differences in exposure to legacy persistent organic pollutants (POPs) and perfluoroalkyl substances (PFAS) from the terrestrial environment surrounding the settlements of Longyearbyen, Barentsburg and Pyramiden on Svalbard, Norway. Significantly higher concentrations of summed polychlorinated biphenyls (sumPCB7) in eggs collected from Barentsburg (2980 ng/g lipid weight (lw)) and Pyramiden (3860 ng/g lw) compared to Longyearbyen (96 ng/g lw) are attributed to local sources of PCBs within these settlements. Similar findings were observed for p,p'-dichlorodiphenyldichloroethylene (p,p'-DDE) where higher median concentrations observed in Pyramiden (173 ng/g lw) and Barentsburg (75 ng/g lw) compared to Longyearbyen (48 ng/g lw) may be influenced by guano inputs from breeding seabird populations, although other point sources cannot be ruled out. Concentrations of perfluorooctane sulphonate (PFOS) and several perfluorinated carboxylic acids (PFCAs) in snow bunting eggs were found to be statistically higher in the populated settlements of Longyearbyen and Barentsburg compared to the abandoned Pyramiden. Narrow foraging ranges of snow buntings during breeding season was useful in assessing point sources of exposure for PCBs and PFAS at particular sites with extreme differences observed between nest locations. SumPCB7 concentrations ranged from 2 µg/g ww to below detection limits between nest sites located less than a kilometer from each other in Pyramiden. Similar findings were observed in Longyearbyen, where several PFCAs ranged from 2 to 55 times higher between nest sites with similar spatial distances. These findings indicate that snow buntings can be a useful bio-indicator offering high spatial resolution for contaminant source apportionment in terrestrial environments on Svalbard.

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Eggs of snow buntings (Plectrophenax nivealis) were applied as a bio-indicator to examine differences in exposure to legacy persistent organic pollutants (POPs) and perfluoroalkyl substances (PFAS) from the terrestrial environment surrounding the settlements of Longyearbyen, Barentsburg and Pyramiden on Svalbard, Norway. Significantly higher concentrations of summed polychlorinated biphenyls (sumPCB7) in eggs collected from Barentsburg (2980 ng/g lipid weight (lw)) and Pyramiden (3860 ng/g lw) compared to Longyearbyen (96 ng/g lw) are attributed to local sources of PCBs within these settlements. Similar findings were observed for p,p'-dichlorodiphenyldichloroethylene (p,p'-DDE) where higher median concentrations observed in Pyramiden (173 ng/g lw) and Barentsburg (75 ng/g lw) compared to Longyearbyen (48 ng/g lw) may be influenced by guano inputs from breeding seabird populations, although other point sources cannot be ruled out. Concentrations of perfluorooctane sulphonate (PFOS) and several perfluorinated carboxylic acids (PFCAs) in snow bunting eggs were found to be statistically higher in the populated settlements of Longyearbyen and Barentsburg compared to the abandoned Pyramiden. Narrow foraging ranges of snow buntings during breeding season was useful in assessing point sources of exposure for PCBs and PFAS at particular sites with extreme differences observed between nest locations. SumPCB7 concentrations ranged from 2 µg/g ww to below detection limits between nest sites located less than a kilometer from each other in Pyramiden. Similar findings were observed in Longyearbyen, where several PFCAs ranged from 2 to 55 times higher between nest sites with similar spatial distances. These findings indicate that snow buntings can be a useful bio-indicator offering high spatial resolution for contaminant source apportionment in terrestrial environments on Svalbard.