Background

Pacific sand lance is a planktonic forage fish, a common prey item, and an essential link in many marine food webs across its broad distribution of coastal regions around the Pacific rim. Past studies suggest that sand lance may be prone to microplastic particle (MP) ingestion. Consequently, there is concern about adverse health effects on populations of sand lance as well as their predators. Microplastics (plastic debris < 5 mm in size) are categorized as either primary or secondary particles, where primary particles are manufactured as such, whereas secondary particles are degradation products from larger plastic structures due to mechanical abrasion or UV exposure.

The objective of this study was to determine the prevalence of microplastics in selected sand lance “spawning” beaches (locations where sand lance eggs were observed), “non-spawning” beaches (locations where sand lance eggs were sampled but were not observed) and “non-lance” “spawning” beaches (locations where sand lance eggs were observed), “non-lance” “spawning” beaches (locations where sand lance eggs were sampled but were not observed) and “non-sampled” beaches (locations that were not sampled for sand lance eggs) on eastern Vancouver Island, BC, Canada. This study employed an “extensive” approach to determine which aspect of the project need be further examined “intensively” in future studies.

Research Questions

- What is the prevalence of MPs at spawning beaches compared to non-spawning beaches?
- What is the prevalence of MP at the beginning of the spawning season compared to later in the spawning season?

Materials and Methods

Samples were collected and processed using previously established protocols.1,3

Sampling:

- Beach substrate samples were collected at 8 spawning, 8 non-spawning, and 5 non-sampled beaches in November 2019 (21) and subsequently collected again at 4 spawning, 3 non-spawning and 5 non-sampled beaches in January 2020 (12).
- The selected beaches were located between Campbell River and Victoria, B.C. (Figure 1).
- At each beach, a 30 m transect was laid parallel along the high tide line, and 8 substrate subsamples were collected using a customized core sampler to obtain the top 5 cm (Figure 2).
- Total sample volume was approximately 1 kg.

Processing:

- Each substrate sample was mixed thoroughly and analysed for both microplastic prevalence (100 g of sample) and particle grain size (approx. 900 g of sample). MPs were extracted from 100 g samples using density separation, where each sample was stirred with saturated NaCl solution (358.9 g/L) at 600 rpm for 2 minutes and left to settle for 6 hours (Figure 3).
- The supernatant was decanted and vacuum filtered using 0.45 μm filter paper. MPs present on the filter paper were counted using a dissecting scope (45x magnification) (Figure 4).
- MPs were categorized as either a fragment, fibre, pellet, foam, or film. This extraction process was repeated three times for each substrate sample and MPs were summed for all three extractions.

Results

- The average number of microplastic particles (±SD) counted per site was 41.54 ± 28.90 MP - 100 g (-33).
- The maximum number of particles per site was 129 MP - 100 g (-6) and the minimum number of particles per site was 4 MP - 100 g. A total number of 1414 MP were counted.
- Three different types of MP were found: fibres (92.5% of total), fragments (7.1% of total) and pellets (0.4% of total) (Figure 5).
- There was no statistically significant difference in MP counts between spawning beaches and non-spawning beaches. (Student’s t- test: t(14) = 0.69, p = 0.500) (Figure 6).
- There was a significant difference in microplastic prevalence in substrate samples collected at the beginning of the spawning season (November) and that collected later in the spawning season (January). (Student’s t- test: t(11) = 3.1, p = 0.009) (Figure 7).

Conclusions

- The presence of sand lance spawning activity was not correlated with MP prevalence in intertidal beach substrate.
- There was a significant temporal variability in MPs in intertidal beach substrate samples.
- There were no apparent trends in spatial variability in MP prevalence at study beaches between Campbell River and Victoria.
- This “extensive” study provides information that should assist with the development of future “intensive” studies, focused on sampling the spawning beaches more frequently over the spawning season.
- The universal presence of MPs in all beach samples examined emphasizes the need for further research in both prevalence and potential health impact of MPs in all marine habitats given the apparent ubiquity of plastic pollution.

References


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Microplastic prevalence at Pacific sand lance (Ammodytes personatus) spawning beaches on eastern Vancouver Island, British Columbia, Canada

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