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THE CURRENT AND PROSPECTIVE STATE OF MICROPLASTIC CONTAMINATION IN THE MARINE ECOSYSTEM

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Abstract

There has been considerable research on microplastics in marine environments. Across the globe scientific field studies and laboratory experiments are constantly producing novel microplastic litter which has been termed as research dedicated microplastic pollution. This study aims to assess peer-reviewed microplastic pollution articles for strengths and flaws. Researchers frequently examine plankton and muddy sediments for microplastics. In this topic, researchers also study vertebrate and invertebrate microplastic ingestion and chemical contaminant interactions. According to empirical data, microplastics threaten various marine creatures. More scientific studies on marine polymer degradation, advanced sampling and laboratory analytical methods, emergent pollution sources, and unanticipated consequences were reviewed and debated. This is the first thorough investigation of microplastics' effects on marine ecosystems and creatures. The current and predicted plastic consumption and disposal practises of humans are expected to increase academic publications. Thus, we suggest new research areas and crucial methods.

Keywords: marine environments, Pollution, Causes, Microplastic

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Introduction

E. J. Carpenter and K. L. Smith first reported plastic pellets in the North Atlantic Ocean in 1972. The Science paper states that plastic manufacture and waste disposal practises may increase sea surface concentrations. Currently, these particles simply serve as an exterior for hydroids, diatoms, and possibly bacteria. Polyethylene pellets were eaten by fish month's later (Carpenter *et al*.,1972). Researchers exploring the lowest plastic debris contamination sizes need the Carpenter and Smith (1972) prediction. Since the mid-20th century, 200 million tonnes of plastics have been produced once a year (Thompson *et al*.,2009; Barnes *et al*.,2009; Andrady, 2011). How much trash will enter the water, break down, and spread is unknown (Barnes *et al*.,2009; Andrady, 2011). Microplastic litter distributes, moves, and accumulates on urban beaches, pristine sediments, and the ocean floor. This broad, long-term ocean contamination threatens marine life. Moldable plastic. You can form synthetics almost any manner (Moore, 2008). Cheap, lightweight, sturdy, durable, and corrosion-resistant plastics. Functional, they provide thermal and electrical isolation (Thompson *et al*.,2009). Plastics are lengthy chains of carbon, oxygen, silicon, hydrogen, and chloride polymers (Shah *et al*.,2008). Low- and high-density polyethylene (PE), PP, PVC, PS, and PET are most popular. These polymers account for 90% of global output (Andrady and Neal, 2009). Consequently, these are the main contaminants in marine and coastal ecosystems (Andrady, 2011; Engler, 2012).

Polymers like PE and PP float underwater. This transports and beaches tonnes of buoyant plastic waste (Thompson *et al*.,2009; Andrady 2011; and Engler 2012). PVC, a denser polymer than water, stores around the entry point but can be transported by currents. Submerged polymers quickly generate microbial films, affecting their hydrophobicity and buoyancy (Lobelle and Cunliffe, 2011). Sinking plastic fragments deposit all plastics, even buoyant ones, on the seafloor (Barnes *et al*.,2009).

Use of pure polymers is limited. Resins are functionalized with additives (Andrady and Neal, 2009; Teuten *et al*.,2009). Plastic additives' health effects on humans and animals are contested (Andrady and Neal 2009; Teuten 2009; Thompson *et al*. 2009; Lithner 2009; Lithner 2011). Thompson *et al*. (2009), Cole *et al*. (2011), and others explain.

Normal plastic trash can also absorb marine hydrophobic contaminants (Thompson *et al*.,2009; Cole *et al*.,2011). Most contaminants are hazardous, bioaccumulative, and persistent (Engler, 2012). Plastics transport pollutants and increase their environmental determination, according to Teuten *et al*. (2009). Plastics are critical for poison delivery to marine life and people (Teuten *et al*.,2009; Tanaka, 2013).

Unlike larger things, plastic particles penetrate the environment immediately (Barnes *et al*.,2009). Virgin plastic pellets (m) are used as abrasives in shot vilifying and household (Fendall and Sewell, 2009) applications and can be unconfined into the environment. In wealthy countries, millions of facial cleansers' PS (m) particles are flushed down the toilet and wash up on beaches daily. When incrusted in Pacific Ocean buoys, the isopod Sphaeroma quoianun can create millions of plastic pellet-like PS fragments (Davidson, 2012).

Degradation and fragmentation of larger polymers create microscopic fragments (Shah *et al*.,2008; Costa, 2010; Andrady, 2011). Chemical degradation lowers polymer molecular weight (Andrady, 2011). The most common polymers, PE and PP, are heavy and non-biodegradable (Shah *et al*.,2008). UV solar radiation causes photo-oxidative, thermal, and chemical destruction in the marine environment. More polymers can biodegrade microbially (Andrady 2011, Shah *et al*. 2008). Light-induced oxidation is many times stronger than other degradation (Andrady, 2011). Significant plastic degradation makes it unstable enough to break into powdered bits when exposed to sea motion (Andrady, 2011). This continues molecularly (Andrady, 2011) (Barnes *et al*.,2009).

Plastics have rapidly migrated to new locations and marine habitats (Barnes *et al*.,2009; Ryan, 2009). Microplastics concentrate in subtropical gyre centres, but their seaborne mobility and transit, especially vertically, remain unclear (Hidalgo-Ruz *et al*.,2012). Everyone can access environmental microplastics, beginning with the most basic organisms and progressing up the food chain (Oliveira *et al*.,2012; Wright, 2013). Internal abrasion and obstruction might result from microplastic consumption. Possible population-level effects are unclear (Wright *et al*.,2013). Halobates micans and H. sericeus use plastic pellets for oviposition, which can affect their population and dissemination (Majer *et al*.,2012; Goldstein, 2012). 24% of western Atlantic pellets (N > 1000) had eggs, most of which were healthy. H. sericeus adult, juvenile, and egg abundance substantially associated with North Pacific Ocean microplastics. Plastics may transport organisms to previously unknown mobility levels (Barnes *et al*.,2009), even if estimating the scale of this problem is problematic.

Carpenter *et al.* (1972) projected that microplastic contamination would seriously impact ecosystems and organisms. Scholarly papers have supported Buchanan's (1971) core work since then. The newest microplastics at sea research on marine biota risks is organised, critically evaluated, and synthesised by this initiative. Plastic contamination was classified by size class using Arthur *et al*. (2009) microplastics (fragments and primary-sourced plastics less than 5 mm). If pollution is stopped immediately, it will last for generations (Barnes *et al*.,2009), making repeated critical assessments necessary.

Results

Scientific literature was categorised by study focus describe microplastics in plankton, sandy and muddy sediments, vertebrates, invertebrates, and chemical pollutants. The most important field findings were assessed for progress.

Discussion

Plastics break down into minute and nanoscale particles in the ocean (Andrady, 2011), but no long-term studies have been done to estimate how long they stay in the ecosystem. If these pieces aren't totally mineralized (biodegraded) quickly, we need to consider ways to reduce their damage (Roy *et al*.,2011).

Scientificn Conclusion and Advice

More knowledge implies more accountability. Review articles on coastal and marine microplastic pollution must be synthesised into actionable advice for all plastics value chain partners. Source control and managing the massive environmental passives produced over the past 60 years (when plastics became disposable) are two of the biggest concerns today.

References

A.L. Andrady (2011) Microplastics in the marine environment. Mar. Pollut. Bull. Volume 62, Issue 8, August 2011, Pages 1596-1605.

Karen Ashton, Luke Holmes, Andrew Turner (2010) Association of metals with plastic production pellets in the marine environment. Mar. Pollut. Bull. Volume 60, Issue 11, November 2010, Pages 2050-2055.

Stephanie Avery-Gomm a, Patrick D. O'Hara b, Lydia Kleine c, Victoria Bowes d, Laurie K. Wilson e, (2012) Northern fulmars as biological monitors of trends of plastic pollution in the eastern North Pacific, Pollut. Bull. Mar. Volume 64, Issue 9, September 2012, Pages 1776-1781.

S. Avery-Gomm a, J.F. Provencher b, K.H. Morgan c, D.F. Bertram c (2013)

Plastic ingestion in marine-associated bird species from the eastern North Pacific , Mar. Pollut. Bull. Volume 72, Issue 1, 15 July 2013, Pages 257-259.

Adil Bakir a b, Steven J. Rowland b, Richard C. Thompson (2012) Competitive sorption of persistent organic pollutants onto microplastics in the marine environment.Mar. Pollut. Bull. Volume 64, Issue 12, December 2012, Pages 2782-2789.

Christiana M. Boerger a, Gwendolyn L. Lattin a, Shelly L. Moore b, Charles J. Moore a (2010) Plastic ingestion by planktivorous fishes in the North Pacific Central Gyre.Mar. Pollut. Bull. Volume 60, Issue 12, December 2010, Pages 2275-2278.

J.B. Buchanan (1971)Pollution by synthetic fibres. Mar. Pollut. Bull. Volume 2, Issue 2, February 1971, Page 23.

Henry S. Carson, Steven L. Colbert, Matthew J. Kaylor, Karla J. McDermid (2011) Small plastic debris changes water movement and heat transfer through beach sediments.Mar. Pollut. Bull. Volume 62, Issue 8, August 2011, Pages 1708-1713.

Michiel Claessens a, Steven De Meester a, Lieve Van Landuyt b, Karen De Clerck b, Colin R. Janssen a (2011) Occurrence and distribution of microplastics in marine sediments along the Belgian coast Mar. Pollut. Bull. Volume 62, Issue 10, October 2011, Pages 2199-2204.

Fernanda I. Colabuono a, Viviane Barquete b, Beatriz S. Domingues c, Rosalinda C. Montone a (2010) Polychlorinated biphenyls and organochlorine pesticides in plastics ingested by seabirds Mar. Pollut. Bull. Volume 58, Issue 1, January 2009, Pages 93-96.

Matthew Cole a, Pennie Lindeque a, Claudia Halsband b, Tamara S. Galloway (2011) Microplastics as contaminants in the marine environment: a review.Mar. Pollut. Bull. Volume 62, Issue 12, December 2011, Pages 2588-2597.

Amandine Collignon , JeanHenri Hecq , François Glagani , Pierre Voisin , France Collard , Anne Goffart (2012) Neustonic microplastic and zooplankton in the North Western Mediterranean Sea. Mar. Pollut. Bull.

Matthew. Volume 64, Issue 4, April 2012, Pages 861-864 .

Timothy M. Davidson (2012) Boring crustaceans damage polystyrene floats under docks polluting marine waters with microplastic.Mar. Pollut. Bull. Volume 64, Issue 9, September 2012, Pages 1821-1828.

Miriam J. Doyle , William Watson , Noelle M. Bowlin , Seba B. Sheavly (2011)Plastic particles in coastal pelagic ecosystems of the Northeast Pacific Ocean.Mar. Environ. Res. Volume 71, Issue 1, February 2011, Pages 41-52.

Satoshi Endo a, Reiko Takizawa a, Keiji Okuda a, Hideshige Takada a, Kazuhiro Chiba b, Haruyuki Kanehiro c, Haruo Ogi d, Rei Yamashita d, Takeshi Date (2005) Concentration of polychlorinated biphenyls (PCBs) in beached resin pellets: variability among individual particles and regional differences. Mar. Pollut. Bull. Volume 50, Issue 10, October 2005, Pages 1103-1114.

Marcus Eriksen , Nikolai Maximenko , Martin Thiel , Anna Cummins , Gwen Lattin , Stiv Wilson , Jan Hafner , Ann Zellers, Samuel Rifman (2013) Plastic pollution in the South Pacific subtropical gyre. Mar. Pollut. Bull. Volume 68, Issues 1–2, 15 March 2013, Pages 71-76.

Lisa S. Fendall, Mary A. Sewell (2009) Contributing to marine pollution by washing your face: microplastics in facial cleansers.Mar. Pollut. Bull. Volume 58, Issue 8, August 2009, Pages 1225-1228.

Mara Fisner, Satie Taniguchi , Fabiana Moreira, Márcia C. Bícego ,Alexander Turra a (2013) Polycyclic aromatic hydrocarbons (PAHs) in plastic pellets: variability in the concentration and composition at different sediment depths in a sandy beach.Mar. Pollut. Bull. Volume 70, Issues 1–2, 15 May 2013, Pages 219-226.

Kalliopi N. Fotopoulou, Hrissi K. Karapanagioti (2012) Surface properties of beached plastic pellets. Mar. Environ. Res. Volume 81, October 2012, Pages 70-77.

MariaCristina Fossi , Cristina Panti , Cristiana Guerranti , Daniele Coppola , Matteo Giannetti , Letizia Marsili , Roberta Minutoli (2012)Are baleen whales exposed to the threat of microplastics? A case study of the Mediterranean fin whale (Balaenoptera physalus)Mar. Pollut. Bull. Volume 64, Issue 11, November 2012, Pages 2374-2379.

J.P.G.L. Frias a, P. Sobral a, A.M. Ferreira Organic pollutants in microplastics from two beaches of the Portuguese coast (2010) Mar. Pollut. Bull. Volume 60, Issue 11, November 2010, Pages 1988-1992.

Michael Fry D., Stewart I. Fefer , Louis Sileo (1987) Ingestion of plastic debris by Laysan Albatrosses and Wedge-Tailed Shearwaters in the Hawaiian Islands.Mar. Pollut. Bull. Volume 18, Issue 6, Supplement B, June 1987, Pages 339-343.

Erin R. Graham , Joseph T. Thompson (2009) m Deposit- and suspension-feeding sea cucumbers (Echinodermata) ingest plastic fragments J. Exp. Mar. Biol. Ecol. Volume 368, Issue 1, 15 January 2009, Pages 22-29

Holly Gray, Gwendolyn L. Lattin, Charles J. Moore (2012) Incidence, mass and variety of plastics ingested by Laysan (Phoebastria immutabilis) and Black-footed Albatrosses (P. nigripes) recovered as by-catch in the North Pacific Ocean.Mar. Pollut. Bull. Volume 64, Issue 10, October 2012, Pages 2190-2192

Murray R Gregory (1977) Plastic pellets on New Zealand beaches.Mar. Pollut. Bull. Volume 8, Issue 4, April 1977, Pages 82-84.

M.R. Gregory (1983) Virgin plastics on some beaches of eastern Canada and Bermuda.Mar. Environ. Res. Volume 10, Issue 2, 1983, Pages 73-92.

M.R. Gregor (1996) Plastic ‘scrubbers’ in hand cleansers: a further (and minor) source for marine pollution identified.Mar. Pollut. Bull. Volume 32, Issue 12, December 1996, Pages 867-871

Jesse P. Harrison a, Jesús J. Ojeda b c, María E. Romero-Gonzále (2012) The applicability of reflectance micro-Fourier-transform infrared spectroscopy for the detection of synthetic microplastics in marine sediments.Sci. Total Environ. Volume 416, 1 February 2012, Pages 455-463.

Valeria Hidalgo-Ruz a b, Martin (2013) Thiel Distribution and abundance of small plastic debris on beaches in the SE Pacific (Chile): a study supported by a citizen science project.Mar. Environ. Res. Volumes 87–88, June–July 2013, Pages 12-18.

Hisashi Hirai , Hideshige Takada , Yuko Ogata , Rei Yamashita , Kaoruko Mizukawa , Mahua Saha , Charita Kwan , Charles Moore , Holly Gray , Duane Laursen , EriR. Zettler , John. Farrington , Christopher M. Reddy , Emily E. Peacock , Marc W. Ward (2011) Organic micropollutants in marine plastics debris from the open ocean and remote and urban beaches.Mar. Pollut. Bull. Volume 62, Issue 8, August 2011, Pages 1683-1692.

Juliana A. Ivar do Sul, Monica F. Costa (2007) Marine debris review for Latin America and the Wider Caribbean Region: from the 1970 until now and where do we go from here? Mar. Pollut. Bull. Volume 54, Issue 8, August 2007, Pages 1087-1104.

Juliana A. Ivar do Sul , Monica F. Costa a, Mário Barletta , Francisco José A. Cysneiros (2013) Presence of pelagic microplastics around an Archipelago of the Equatorial Atlantic.Mar. Pollut. Bull. Volume 75, Issues 1–2, 15 October 2013, Pages 305-309.

Hrissi K. Karapanagioti a, Irene Klontza (2008) Testing phenanthrene distribution properties of virgin plastic pellets and plastic eroded pellets found on Lesvos island beaches (Greece).Mar. Environ. Res. Volume 65, Issue 4, May 2008, Pages 283-290.

H.K. Karapanagioti a, S. Endo b, Y. Ogata c, H. Takada (2011) Diffuse pollution by persistent organic pollutants as measured in plastic pellets sampled from various beaches in Greece. Mar. Pollut. Bull. Volume 62, Issue 2, February 2011, Pages 312-317.

Hosny K. Khordagui , Ahmed H. Abu- Hilal (1994) Industrial plastic on the southern beaches of the Arabian Gulf and the western beaches of the Gulf of Oman Environ. Pollut. Volume 84, Issue 3, 1994, Pages 325-327.

Susanne Kühn , Jan A. van Franeker (2012) Plastic ingestion by the northern fulmar (Fulmarus glacialis) in Iceland. Mar. Pollut. Bull. Volume 64, Issue 6, June 2012, Pages 1252-1254.

Takashi Kusui , Michio Noda (2003) International survey on the distribution of stranded and buried litter on beaches along the Sea of Japan. Mar. Pollut. Bull. Volume 47, Issues 1–6, January–June 2003, Pages 175-179.

G.L. Lattin , C.J. Moore , A.F. Zellers , S.L. Moore , S.B. Weisberg (2004) A comparison of neustonic plastic and zooplankton at different depths near the southern California shore.Mar. Pollut. Bull. Volume 49, Issue 4, August 2004, Pages 291-294.

Valerie A. Lindborg , Julia F. Ledbetter , Jean M. Walat , Cinamon Moffett (2012) Plastic consumption and diet of Glaucous-winged Gulls (Larus glaucescens). Mar. Pollut. Bull. Volume 64, Issue 11, November 2012, Pages 2351-2356.

Delilah Lithner, Jeanette Damberg, Göran Dave, Åke Larsson (2009) Leachates from plastic consumer products — screening for toxicity with Daphnia magna.Chemosphere. Volume 74, Issue 9, March 2009, Pages 1195-1200.

Delilah Lithner, Åke Larsson, Göran Dave (2011) Environmental and health hazard ranking and assessment of plastic polymers based on chemical composition.Sci. Total Environ. Volume 409, Issue 18, 15 August 2011, Pages 3309-3324

Delphine Lobelle, Michael Cunliffe (2011) Early microbial biofilm formation on marine plastic debris.Mar. Pollut. Bull. Volume 62, Issue 1, January 2011, Pages 197-200.

A.L. Lusher a, M. McHugh b, R.C. Thompson (2013) Occurrence of microplastics in the gastrointestinal tract of pelagic and demersal fish from the English Channel.Mar. Pollut. Bull. Volume 67, Issues 1–2, 15 February 2013, Pages 94-99.

A.P. Majer , M.C. Vedolin , A. (2012) Turra Plastic pellets as oviposition site and means of dispersal for the ocean-skater insect Halobates. Mar. Pollut. Bull. Volume 64, Issue 6, June 2012, Pages 1143-1147.

Karla J. McDermid, Tracy L. McMullen (2004) Quantitative analysis of small-plastic debris on beaches in the Hawaiian Archipelago.Mar. Pollut. Bull. Volume 48, Issues 7–8, April 2004, Pages 790-794.

Nikolai Maximenko a, Jan Hafner a, Peter Niiler (2012) Pathways of marine debris derived from trajectories of Lagrangian drifters Mar. Pollut. Bull. Volume 65, Issues 1–3, 2012, Pages 51-62.

Kaoruko Mizukawa , Hideshige Takada , Maki Ito , YeoBee Geok , Junki Hosoda , Rei Yamashita , Mahua Saha , Satoru Suzuki , Carlos Miguez , João Fria, JoanCepeda Antunes , Paula Sobral , Isabelina Santos , Cristina Micaelo , Ana Maria Ferreira (2013) Monitoring of a wide range of organic micropollutants on the Portuguese coast using plastic resin pellets.Mar. Pollut. Bull. Volume 70, Issues 1–2, 15 May 2013, Pages 296-302.

Charles James Moore (2008) Synthetic polymers in the marine environment: a rapidly increasing, long-term threat.Environ. Res. Volume 108, Issue 2, October 2008, Pages 131-139.

C.J Moore a, S.L Moore a, M.K Leecaster b 1, S.B Weisberg (2001) A comparison of plastic and plankton in the North Pacific Central Gyre.Mar. Pollut. Bull. Volume 42, Issue 12, December 2001, Pages 1297-1300.

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