

Impacts of marine plastic pollution from continental coasts to
subtropical gyres – Fish, seabirds and other vertebrates in the SE
Pacific

Martin Thiel

Dr. Martin Thiel, Professor of Marine Biology, studies the biology, ecology and diversity of marine communities. In particular, he investigates how rafting dispersal on floating substrata contributes to marine biogeography. Contamination of marine systems with plastic litter not only produces impacts by entanglement and ingestion, but also generates travel opportunities for invasive species to reach distant, new habitats. Martin's research on marine plastics ranges from impact studies to identification of sources with a particular focus on citizen science approaches (for more see www.bedim.cl and www.cientificosdelabasura.cl).

Impacts of marine plastic pollution from continental coasts to subtropical gyres – Fish, seabirds and other vertebrates in the SE Pacific

Martin Thiel

ABSTRACT: Anthropogenic Marine Debris (AMD) in the SE Pacific has been recognized as a serious problem since at least the 1980s. Sampling conducted by the citizen science program “Cientificos de la Basura” (“Litter Scientists”) in the years 2008, 2012, and 2016 indicate that in general AMD abundances on Chilean beaches have remained stable over the last decade, although in the locality most afflicted by this problem (Antofagasta) a continuous increase has been observed. All indicators (AMD abundances, composition and distribution) show that AMD found in coastal waters and on the shores of Chile have local sources (fishing, aquaculture, beach users, rivers). Thus, the observed trends are a reflection of the general problem of what is happening in the country. During the last decade several important citizen initiatives (NGOs, Clean Points, etc.) and government (legislation) have increasingly focused on the problem. However, in spite of all these initiatives, no clear trend of AMD reduction in the Chilean coastal environment and waters is evident. Various indicators show that most AMD from coastal waters of the Humboldt Current System (HCS) is pulled offshore into the South Pacific Subtropical Gyre (SPSG). Indeed, the highest densities of floating micro- and macroplastics are reported from the SPSG, and there is growing concern that abundances and impacts on oceanic ecosystems are increasing. This highlights that in order to improve the conservation of marine life, urgent measures of plastic reduction are needed. These have to involve all sectors of society, including businesses and decision-makers.

Effects of micro plastics exposure on marine fish and invertebrates:
What can we learn from other studies globally, the little we know in the
SE Pacific, and how this could impact Chilean aquaculture and
fisheries.

Mauricio Urbina

Dr. Mauricio Urbina, Professor of Comparative Animal Physiology, studies how aquatic animals adapt and respond to natural and anthropogenically driven changes in their environment (<https://urbinanimalab.wordpress.com/>). His research has contributed to understand the mechanism animals use to overcome several stressors as once, and how they might respond under future climate change scenarios. One of this anthropogenic stressors is plastic pollution, and since 2013 he has been studying the effects of micro plastics exposure and ingestion on marine animals. His research also seeks to improve aquaculture production based on animal physiology, ultimately gaining resilience towards future changes. Mauricio's has authored more than 50 research papers, has been granted more than 5 research grants, and maintains active collaboration with other colleagues around the world.

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Mauricio Urbina

ABSTRACT: Plastic pollution is ubiquitous around the globe. Every single place around the globe that has been sampled, has been found to be contaminated with plastic particles, from the deepest ocean to the top of the Himalayas. The South East (SE) Pacific is not the exception, and marine debris has been recognized as a serious problem long ago. The amount of plastic particles found, however, vary enormously depending on several anthropogenic and environmental conditions. What is even less clear, globally, are the effects of this plastic particles have on marine animals. To date all marine animals that have been experimentally exposed to plastics show detrimental effects (i.e. copepods, worms, bivalves, crabs, and fish). Plastic pollution in aquatic environments is particularly pervasive as aquatic animals are immerse in their medium, and so plastic particles could affect ventilatory structures/function and/or be ingested. In the case of ingestion, plastic particles could block the digestive system, causing animal death. Even if ingested particles could exit the digestive system, several lesions such as inflammation, increased irrigation and lacerations have been reported in the intestine. Digesting plastic particles also come at a cost, resulting in reduced energy available for growth (so far reported in worms and crabs). Therefore, plastic exposure might not cause immediate death, but could affects populations by decreasing their changes of reproduction, ultimately causing tropic changes. The present talk will describe what effects have been reported in animals around the world, the few available studies in animals from the SE and how this could affect the aquaculture industry.

Microplastics in the marine environment – Global overview – The Mollusks case study - and Identification of International Regulations for the Aquaculture sector

Karla Pozo

Dr. Pozo is a marine Biologist with a PhD in Environmental Sciences obtained at University of Siena in Italy. Besides is associate researcher of the faculty of Engineering and Technology (FIT) at the University of San Sebastian in Concepción, Chile, and at the Research Center for Toxic Compound in the Environment (RECETOX) of Masaryk University in Brno, Czech Republic. Dr. Pozo has strong scientific experience in the field of Persistent Organic Pollutants (POPs) studies in particular to the establishment of national in international networking group. Currently, Dr. Pozo is a principal investigator of the research entitled: ‘Understanding of micro and nanoplastics in the central coastal area of Chile: Transfer into the marine food web’ funded by Chilean Research Council (Conicyt). Dr. Pozo also conduct academic activities such as environmental transfer and fate of chemical in the environment.

Microplastics in the marine environment – Global overview – The Mollusks case study - and Identification of International Regulations for the Aquaculture sector

Karla Pozo

Currently, there is an increasing, public and scientific concern regarding “emerging pollutant” such as plastic particles i.e., microplastics (<5mm). In addition, microplastics can act as transporter and reservoirs of POPs. This process may facilitate the transfer of chemical additives or hydrophobic waterborne pollutants to biota, affecting negatively higher trophic levels on the marine food web and ecosystems. Persistent Organic Pollutants (POPs) and emergent compounds (EC) are ubiquitous in the environment and a global international concern. They have been identified as harmful substances due to their toxicity, persistence and bioaccumulation in humans and wildlife. International regulation and recommendations have been also published, by several institution and working groups and are aimed to reduce plastic contamination in the environment and to find new protection strategies.

Anthropogenic Marine Debris and Remote Sensing: Towards a new challenge for sustainability

Cristian Mattar

Cristian Mattar is Ing. Natural Renewable Resources at University of Chile, he received the MSc and PhD in thermodynamics and Environmental Physics from the University of Valencia, España, in 2009 and 2011, respectively. He is founder membership of the Laboratory for Analysis of the Biosphere (LAB) at University of Chile and he is currently working as Associate Professor at University of Aysén in the Chilean Patagonia. His research expertise is related to calibration and validation of remote sensors, time series analysis over extreme biomes, soil moisture retrievals from satellites, off-shore wind power retrievals using Space Scatterometer information and forecast modeling, regional water balance using remote sensing and in-situ measurements. Dr. Mattar has participated in more than 50 peer-review papers, more than 70 contributions to national and international symposium and guided 20 undergraduates Thesis work in remote sensing for Natural Renewable Resources Eng. at University of Chile. He has led different research projects related to water resources management, biomass monitoring from satellites, Teleconnections Tropical Pacific – Antarctica, Multispectral UAV for precision agriculture and Anthropogenic Marine Debris recognition using very high remote sensing techniques unique in Chile. He has been participated as an international expert in the Copernicus European global data base panel for soil moisture and land surface temperature and carried out the first in-flight calibration of the Chilean Satellite Fasat-C for environmental monitoring. Dr. Mattar has participated in several field campaigns supported by European Space Agency (ESA) such as: DESIREX 2008, Thermopolis 2009, SEN3EXP 2009), the European Union (EODIX 2011) and the first Atacama surface spectral characterization, Chile (ATAFIC 2014).

Anthropogenic Marine Debris and Remote Sensing: Towards a new challenge for sustainability

Tomás Acuña-Ruz¹, Diego Uribe¹, Richard Taylor¹, L. Amézquita¹ and

*Cristian Mattar^{1,2}

Anthropogenic Marine Debris (AMD) is one of the most important pollutants in the oceans. Millions of tons of debris across oceans have created a critical environmental problem. This lecture presents a new challenge to apply advanced techniques in quantitative remote sensing for AMD characterization and classification showing a very high spatial resolution imagery for the purpose of improving the identification of marine debris over beaches. Several samples collected on the shore of Chiloé Island in Chile were processed in laboratory to determine and analyze the spectral signature and physical properties. By using this spectral library, a digital classification method was implemented over World-View 3 imagery covering three beaches selected as test sites. Several classification methods and geospatial analyses were applied to determine land cover classification, with a focus on styrofoam and debris. Four field campaigns were carried out to validate the AMD classification and mass retrievals performed for more than 300 ground based points. The result showed that the AMD hyperspectral library was useful for digital classification resulting in an overall accuracy equivalent to 88% and over 50 tons of debris estimated on the three pilot beaches in Chiloé. These results have proven the feasibility of estimating anthropogenic influence on natural ecosystems through the integration of hyperspectral laboratory measurements and remote sensing for AMD characterization, providing valuable information for further integrated and sustainable management.

¹Laboratory for Analysis of the Biosphere (LAB), University of Chile.

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National Advances for reducing plastics in the marine environment,
policies, regulations and programs.

Joost Meijer

Chemical Engineer

Delft University of Technology, the Netherlands

From 1995 to 2014 in charge of the team on waste management of the Ministry of Environment (ex-CONAMA).

From 2015 senior officer of the waste management team.

Among the principal products prepared:

- Law 20.920 Framework Law on Waste Management, Extended Producers Responsibility and Promotion of Recycling
- Policies on waste management
- Coordination of international cooperation projects

Since 2010 representative in the Working Party on Resource Productivity and Waste, of the OECD.

Since 2011 representative in the Basel Convention, participating in various expert working groups. Actually co-chair of the working group on the review of the Annexes of the Convention.

From 2012 to 2014 member of the Steering Committee of the International Resource Panel.

National Advances for reducing plastics in the marine environment, policies, regulations and programs.

Joost Meijer

The two main instruments related to waste management in our country are the National Waste Policy and Law N°. 20.920, Framework Law on Waste Management, Extended Producers Responsibility and Promotion of Recycling. A third important instrument will be the legislation on Plastic Bags, which is currently being discussed in Congress.

The common goal of these instruments is to reduce the generation of waste and assure an environmentally sound management of waste generated, moving to a circular economy, achieving a sustainable management of natural resources.

From 2010 various studies on packaging waste have been completed. The results of these studies are the basis for the EPR regulation for packaging, which was started the 4th of January of 2018. One of the impacts of this regulation will be more control on packaging waste, among other plastics. Awaiting the regulation, various companies already started to redesign their plastic bottles.

“Aquaculture: waste management regulation”.

Gabriela Quenia Romero Rodríguez

Gabriela Romero, Marine Biologist from the Universidad de Valparaíso, Chile, with a Diploma in Environmental Analysis and Management from the Universidad de Concepción, Chile. Three-month Internship at the International Seabed Authority and participated in the Yeosu Academy of the Law of the Sea. Professional of the Bureau of Environmental Affairs at the Undersecretariat for Fisheries and Aquaculture under the Ministry of Economy, Development and Tourism, evaluating the environmental impacts that different types of projects can cause to the marine and continental ecosystem.

“Aquaculture: waste management regulation”.

Gabriela Romero

ABSTRACT: The Undersecretariat for Fisheries and Aquaculture is an agency of the Chilean Government, under the Ministry of Economy, Development and Tourism and its mission is to develop policies and regulations to manage national fisheries and aquaculture.

Regarding the waste generated by aquaculture activities, the transitory article 13 of the Law No. 20.434 that Modifies the General Law on Fisheries and Aquaculture regarding Aquaculture, establishes the need to issue a specific regulation on the conditions for the treatment and final disposal of solid, liquid, organic and inorganic waste in farming centers, processing plants, collection centers, slaughterhouses, research centers, and other facilities for the production process of aquaculture, focusing on recycling in cases that correspond. In this sense, we are currently working on a proposal for a regulation that will govern the conditions of treatment and disposal of wastes generated in aquaculture facilities.

In addition, it is important to point out that there are other sectoral regulations and regulatory provisions promulgated by other State agencies that the aquaculture sector must comply with in order to treat and dispose its waste. Therefore, it is necessary to improve current sanitary and environmental regulations, address existing legal gaps, and coordinate all stakeholders involved in waste management.

Management and Reduction of Coastal Solid Waste in Salmon Aquaculture

Daniel Jimenez

He is a veterinarian from the Autonomous University of Barcelona. He graduated with a Masters in Preventive Veterinary Medicine and a Doctorate in Pathology from the University of California-Davis. Working experience include post-graduate research in Molecular Biology and working with government institutions in the US (California Food Dept Agriculture and United States Dept. Agriculture) and Norway as researcher for the Norwegian Veterinary Institute. He moved to Chile in January 2016 and worked as manager in the area of Analysis in Intesal.

Management and Reduction of Coastal Solid Waste in Salmon Aquaculture

Daniel Jimenez

Presentation is divided in 3 areas:

- 1. Industry introduction:** Brief overview of current and future trends in Aquaculture, Role of the Salmon Research Institute Chilean (Intesal) and the Salmon Aquaculture Association (SalmonChile) and then National and regional importance of Salmon Aquaculture in Chile.
- 2. National Laws and Regulations**
- 3. Industry Actions for the Management of Solid Waste:** Small scale initiatives for cleaning and maintenance of beaches (2001-2007), Large scale interventions in beach areas with major aquaculture presence (2015 until now) and finally talk about collection, analysis and systematization of data on waste generation and disposal.

Macro- and micro-plastic debris in the Korean coastal environment

Sang Hee Hong

Ms. Sang Hee Hong is a Principal Research Scientist at Korea Institute of Ocean Science and Technology (KIOST). She received PhD degree from Ewha Womans University in 2002, and has worked for KIOST. She has been conducting research on marine pollution issues for nearly 20 years with related projects on the environmental fate of organic pollutants such as persistent organic contaminants and endocrine disrupting chemicals in the marine environment. She has published over 90 peer-reviewed articles which are related to marine pollution and analytical method development. Her current interest is to understanding the fate and effect of plastic marine debris and microplastics on marine ecosystem.

Macro- and micro-plastic debris in the Korean coastal environment

Sang Hee Hong

Main content:

- Contamination characteristics of macro- and micro-plastic marine debris in the Rep. of Korea
- Key issues and national efforts to prevent marine debris.

Micro-plastics in Dredged Material: Nature & Extent, Effects, and Risk

David Moore, PhD

Dr. Moore is a Senior Research Scientist with the US Army Corps of Engineers Research and Development Center in Vicksburg, MS. He has a Ph.D. in Environmental Health, a BS in Biology and over 30 years professional experience in the assessment and management of sediments. David currently leads the risk focus area for the USACE, he helped develop both the ocean and inland testing manuals for the assessment of dredged materials and co-developed the Environmental Residue Effects Database for the assessment of bio-accumulated tissue residues. He has authored over 30 publications on the assessment, evaluation and management of contaminated sediments. He currently serves as one of the US representatives on the PIANC International Working Group 175 on Risk Management of Navigation Infrastructure and on the organizing committee for a jointly sponsored SETAC and ESA International Pellston Workshop on the Application of Ecosystem Services in Environmental Decision Making.

Micro-plastics in Dredged Material: Nature & Extent, Effects, and Risk
David W. Moore*, Burton Suedel*, Andrew McQueen*, Justin Wilkens*,
and Mark Ballentine*...

David W. Moore

Micro-plastics are ubiquitous in the environment as a consequence of widespread use, historic disposal practices and other ongoing source inputs (e.g., municipal sewage treatment facilities, storm water discharges, etc.). Data recently published by Lonnstedt and Eklov (Science 352:2016) indicated significant effects of micro-plastics on early life stages of perch. The International Maritime Organization (IMO) and the United States National Oceanographic and Atmospheric Administration National Ocean Service (NOAA NOS) have issued bulletins regarding the potential ecological effects of micro-plastics in the marine environment. Despite increasing evidence suggesting micro-plastics being harmful to aquatic life, there is no clear understanding of mode of action or the potential role sediment associated micro-plastics may play in affecting aquatic biota. The USACE ERDC is currently conducting research to better understand the occurrence and concentrations of micro-plastics in bottom sediments across the contiguous US and the potential for adverse effects on aquatic life to inform a risk based understanding of micro-plastics related to dredging and dredged material management. The project includes an initial review of the literature to document the current state of the science with regard to micro-plastics in the aquatic environment. Representative inland and coastal sediments as well as dredged materials routinely managed in support of navigation will be surveyed and methods evaluated for the detection and quantification of micro-plastics in sediments. The ultimate goal of this research effort is to establish a risk based context for micro-plastics relating to dredging operations and whether risk management procedures are necessary or possible.

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A Case study: clean-up efforts and progress to remove 49 tons of plastic pellets from the South African coast.

Ulric van Bloemestein

Ulric is an Assistant Director for the National Department of Environmental Affairs in South Africa. His portfolio includes the disposal of waste at sea and oil spill response. Ulric has a Masters in Reptile behavioural ecology and completed a doctorate in environmental management – implementation of the London convention in Southern Africa. However, his greatest achievement is his two children.

A Case study: clean-up efforts and progress to remove 49 tons of plastic pellets from the South African coast.

Ulric van Bloemestein

On October 2017, the east coast (Durban) of Southern Africa was devastated by a storm surge which had resulted in a substantial economic and environmental impact. Vessels, due the storm surge, lost their mooring in the Ports of Durban and had subsequently collided. As the storm surge worsened two cargo containers from a vessel were lost and released 49 tonnes of plastic pallets into the port marine environment. The case study will provide insight into the scale of the incident and methodologies used to remove the plastic from the sediment within the port and surrounding beaches. The Plastic pallets contamination within the sediment further impacted the dredging, disposal and beach nourishment activities within the port. Although the influence of plastic pollution from vessels are considered relatively small, there is sufficient evidence to suggest that the localized immediate impact of the incident to the environment requires further investigation. It is concluded that the method of packaging the plastic pallets must be revised and further research into the impacts and clean-up methodologies is needed local and internationally.

Plastics in Canada

Julia Brydon

Julia Brydon is a Marine Protection Officer with the Disposal at Sea program at Environment and Climate Change Canada. Julia is an environmental scientist by training, specializing in water and sediment quality and impacts of pollution. She has been with Canada's federal government for thirteen years, where she has worked in a number of areas prior to disposal at sea, including stormwater runoff, watershed management, wastewater effluent and contaminated sites.

Plastics in Canada

Julia Brydon

This presentation provides an overview of plastic pollution globally and in Canada, and of Canada's domestic approach to plastic pollution prevention. The presentation includes a spotlight on the aspects of this approach that are relevant to the London Protocol and Convention. Work being conducted by the G7 under Canada's presidency is described, along with a description of a research grant program related to preventing marine pollution from aquaculture operations.

The marine litter in Italy: The role of ISPRA

Cristian Mugnai

Cristian Mugnai, PhD in Environmental Sciences, is a Research technologist at Italian Institute for environmental protection and Research (ISPRA) based in Rome (Italy). He worked at Institute of Marine Science, National Research Council (ISMAR-CNR) based in Bologna as a temporary researcher and visited the Department of Geography, University of Toronto, Canada as a post doctoral fellow. His 15-year expertise is based on the study of the impact of human activities on the marine environment. His main field of interest is the integrated chemical- ecotoxicological characterization of coastal and harbour sediments addressed to their management. He provides support to the Italian Ministry of Environment on environmental issues of harbour dredging and on the drafting of technical regulation on sediment handling. He has been involved since 2003 as advisor of the Italian delegation to the London Convention and London Protocol 1996 consultative meetings and scientific group meetings, as well as expert at MED- POL meetings in the framework of UNEP-MAP.

The marine litter in Italy: The role of ISPRA

Cristian Mugnai

Marine litter is increasingly affecting the marine environment, with more than 80% of plastics originating from Land –Based sources. The main impact on wildlife can be associated to entanglement (mostly affecting turtles) and ingestion (affecting birds, turtles and fishes). In the latter case, microplastics which end up in water bodies become ingested and incorporated into the bodies and tissues of marine organisms . The role of ISPRA mainly consists: at National Level, in supporting the Ministry of Environment in the implementation of the Marine Strategy Framework Directive (Descriptor 10) through the coordination of Monitoring Programs on "Microplastics" and beach litter; at International level, in the participation at European and regional level in technical Working groups (Task Group Litter) and (ECAP/CORMON) production of Reports ISPRA participates as a partner to several EU funded projects on data collection of marine litter and implementation of practical actions to reduce it.