Volvo Ocean Race

Science programme

Preliminary results Leg 7 – Auckland to Itajaí
Preliminary results Leg 7

Compiled using data provided by Dr Toste Tanhua & Dr-Ing. Sören Gutekunst, GEOMAR Helmholtz Centre for Ocean Research Kiel funded by Cluster of Excellence Future Ocean with contributions from Shaun Dolk, National Oceanic & Atmospheric Administration.

With particular thanks to the Turn the Tide on Plastic and Team AkzoNobel race teams, and notably Liz Wardley and Nicolai Sehested of those teams respectively, for facilitating and conducting the data collection.

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This report forms part of a suite of reports summarising the progress of data collection and preliminary analysis including:

Volvo Ocean Race Science Programme - Legs 1 to 4 - Final edition includes a more detailed overview of the Science Programme and a summary of preliminary results for Legs 1, 2, 3 & 4.

Volvo Ocean Race Science Programme – Leg 6 preliminary results_FINAL summarises Leg 6 preliminary results
Executive Summary

The Volvo Ocean Race Science Programme continues to contribute data to extend scientific knowledge of microplastics distribution and other parameters that indicate overall ocean health.

Leg 7 of the race from Auckland, New Zealand to Itajaí, Brazil provided a rare opportunity to sample the most remote marine locations on the planet for microplastics and oceanographic measurements. Scientific Drifter buoys were also deployed in an area lacking drifter buoy coverage.

Samples were collected along this leg by two racing boats as both Turn the Tide on Plastic and Team AkzoNobel carried sampling units.

Based on the preliminary results of analysis the most notable finding from this geographically extreme region is that microplastics were present in all but one sample including a relatively high concentration in a sample from the remotest reaches of the entire race route. One sample off the east coast of South America recorded zero microplastics particles. This is only the second Volvo Ocean Race sample to measure a zero value.

Oceanographic measurements indicated the lowest pH values (most acidic) measured to date along the race route in the South Pacific due to a combination of high dissolved carbon dioxide, low temperature and low salinity.

Collaboration, Funding and Support

The onboard sampling component of the science programme is a collaboration between Volvo Cars, GEOMAR Helmholtz Centre for Ocean Research Kiel (funded by Cluster of Excellence Future Ocean), SubCtech GmbH, bbe Moldaenke, Turn the Tide on Plastic and Team AkzoNobel crews. Volvo Cars is funding the onboard equipment through profits from the sale of their Cross Country Volvo V90 Ocean Race edition cars.

The scientific drifter buoys are part of the National Oceanic and Atmospheric Administration’s (NOAA) drifter programme.

The sharing of meteorological data measured from the boats is part of a pilot project developed by JCOMM (Joint technical Commission for Oceanography and Marine Meteorology, WMO – IOC) partners.

These organisations are brought together by the Volvo Ocean Race sustainability programme, in order to increase ocean knowledge, pioneer a new area of data collection and advance the technology of instrumentation in order to contribute to create a global map of standardised data, specifically in the area of microplastic concentration.
Onboard sampling

© Ainhoa Sanchez | Volvo Ocean Race
Preliminary results

Provided by Dr Toste Tanhua and Dr-Ing. Sören Gutekunst, GEOMAR Helmholtz Centre for Ocean Research Kiel

Leg 7: Auckland to Itajaí

Into the world’s most remote ocean

Leg 7 saw the boats traversing the South Pacific and rounding Cape Horn in a race from Auckland to Itajaí in Brazil. This provided access to some of the most remote marine locations on the planet as the boats passed south of Point Nemo, the point further from land than any other location on earth. Some of the areas sampled have never previously been sampled for microplastics.

The preliminary results presented here for microplastics are those from Turn the Tide on Plastic sampling effort only. To maintain continuity of the existing dataset analyses of Turn the Tide on Plastic samples were prioritised and Team AkzoNobel sample results will be presented at a later stage.

It is important as always to remember the preliminary nature of these results and also to view them with consideration of ocean currents and the ‘averages’ that the numbers represent due to the potential geographical range of a single sample.

The most notable finding from this geographically extreme region is that microplastics were present in all but one sample including a relatively high concentration in a sample from the remotest reaches of the entire race route. One sample off the east coast of South America recorded zero microplastics particles. This is only the second Volvo Ocean Race sample to measure a zero value.

Remote but not isolated

In the South Pacific microplastic concentrations ranged between 45 particles/m³, in the sample closest to New Zealand, and 9 particles/m³ in the remote open ocean. Notably one of the most remote samples measured a microplastic concentration of 26 particles/m³ from one of the sample areas closest to Point Nemo.

This illustrates very clearly the all-pervading nature of microplastic pollution in a boundary-less ocean environment explaining why some experts refer to microplastic pollution as a ‘plastic smog’ in the sea.

Ocean currents mean that these extreme reaches of the world’s oceans are remote but not isolated from this anthropogenic problem.

Having rounded Cape Horn concentrations recorded were between 0 and 95 particles/m³. A level of 57 particles/m³ was measured in the sample taken closest to Cape Horn.

The 0 level was recorded east of Argentina in an area largely influenced by the Malvinas or Falklands current which originates in the south. This is only the second sample from the whole route sampled by Turn the Tide on Plastic to measure zero microplastic particles. The other zero level was recorded in a sample taken from an area south of the Great Australian Seabight during Leg 3.

Lower values of 12 and 19 were recorded as the boat progressed north and the highest recorded level for this leg was 95 particles/m³, measured in the sample taken closest to Brazilian mainland.

The infographic presented on the next page illustrates the preliminary dataset generated by Turn the Tide on Plastic sampling effort to date. Notably some values are different to those presented in earlier reports as improved algorithms have allowed for more accurate preliminary results output.
Microplastics Data

1. North Atlantic Ocean and Mediterranean Sea: The highest microplastics levels are attributed to the proximity to the coast, strong ocean currents and main shipping routes.

2. Atlantic Ocean: Progressing south, levels decreased with distance from land, with a relative increase closer to South America, an area with strong surface currents.

3. South African coast: Microplastic pollution near Cape Town may partly originate further north as the strong Agulhas current flows from the northern Indian Ocean and past the South African coast.

4. Indian Ocean: Relatively high microplastic content in these remote areas are likely due to currents originating further north.

5. South of Great Australian Bight: One of only 2 sample areas where no microplastics were found.

6. Australian coast: Microplastic concentrations will be affected by currents coming from the northern Indian Ocean & Indonesian archipelago.

7. From Melbourne to Hong Kong: Recorded levels were lower in the open water of the Equatorial Pacific.

8. Philippine Sea: The measurement of 75 particles/m³ may be due in part to patchiness of particle distribution as higher levels were recorded in a more inshore sample from this area.

9. South China and North Philippine Sea: High levels were measured in an area coinciding with the Kuroshio current which feeds into the North Pacific Subtropical Gyre.

10. Equatorial Pacific: Average levels in this region were higher than recorded on the previous leg. Prevailing currents have a significant impact on microplastic distribution in this area.

11. Approach to New Zealand: Progressing south through the Coral Sea the concentration increased steadily to a level of 60 particles/m³ in the sample closest to Auckland.

12. Remote Pacific near Point Nemo: Microplastic levels of 9-26 particles/m³ in an area further from land than anywhere else on Earth. & a level of 57 particles/m³ off Cape Horn.

13. South America east coast: Only the second sample point along the race route with 0 microplastic particles recorded.

14. Approach to Brazil: An increased level was recorded in the sample closest to South American mainland.
Measurements in the southeast Pacific showed relatively high dissolved CO₂ concentrations (420-430 ppm). This was in contrast to relatively lower CO₂ concentrations in the Indian Ocean sector of the Southern Ocean. This can be attributed to the more southerly passage of the boats through surface waters affected by 'upwellings' from deeper water. Water that reaches the surface due to upwelling typically has relatively high pCO₂ concentrations and these upwellings play an important role in the cycling of carbon in the ocean.
Oceanography

Due to the input of Antarctic water into this region Leg 7 salinity measurements recorded were low (a minimum of SSS 34.2 practical salinity units). Temperature was also the lowest recorded along the race route to date (a minimum of SSS 6 degrees celsius). Low primary productivity was reflected by algae content as low as 1 mg/m³. All of these circumstances lead to the lowest pH values recorded along the route to date.
Drifter Buoys

Photo © Sam Greenfield | Volvo Ocean Race
During Leg 7 six of the competing boats deployed a scientific drifter as they passed 54 degrees south.

These Leg 7 deployments are particularly valuable because this region sees low volumes of vessel traffic and is one of the largest uninterrupted ocean basins in the world. Therefore data from autonomous platforms, i.e. drifters, provide data otherwise unattainable.

View the track of any of the Volvo Ocean Race Leg 7 drifter buoys at: http://osmc.noaa.gov/Monitor/OSMC/OSMC.html
See more

Watch:
https://www.facebook.com/volvooceanrace/videos/10156929010347437/

Media Mentions:
http://www.dailymail.co.uk/wires/ap/article-5743765/Round-world-sailing-race-works-protect-racetrack.html
https://patch.com/rhode-island/newport/volvo-ocean-race-shines-spotlight-ocean-pollution
https://www.thetimes.co.uk/article/plastic-waste-discovered-in-remote-part-of-the-ocean-njp86nl9

Previous reports:
Volvo Ocean Race Science Programme – Preliminary Results Leg 1, 2, 3 & 4
Volvo Ocean Race Science Programme – Leg 6 preliminary results_FINAL

Interesting links:
https://www.nasa.gov/topics/earth/features/perpetual-ocean.html

View the Volvo Ocean Race Drifter buoys:
- Search for the Volvo Ocean Race drifter buoys in the list at http://www.aoml.noaa.gov/phod/dac/deployed.html
- Insert the WMO# of one of the buoys at http://osmc.noaa.gov/Monitor/OSMC/OSMC.html, change the time range, display ‘All Positions’ and refresh the map to see the track line from where each buoy has been transmitting.
- Alternatively, access the ‘Platform Info’ to view the raw near-real-time data.

References:

Volvo Ocean Race
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With the support of

Volvo