The influx of marine debris from the 2011 Great Japan Tsunami to North American shorelines

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Five million tons entered the ocean
4.8 to 12.7 million tons debris entering the ocean annually

(Jambeck et al 2015 Science)
Research Questions

- Can we detect the debris influx from tsunami?
- How does it compare to background levels of marine debris?
- What is the cumulative influx of debris?

4.8 to 12.7 million tons debris entering the ocean annually
Shoreline Data Sources

1. NOAA Shoreline Monitoring
2. Great Canadian Shoreline Cleanup surveys
3. NOAA disaster debris reports
NOAA Marine Debris Monitoring and Assessment Project

Debris monitoring
- Accumulation surveys
- Standing stock surveys
- Over 800 surveys
- More than 120 sites
- 2011 - present
Olympic Coast National Marine Sanctuary (OCNMS) Shoreline Surveys

- National Marine Debris Monitoring Program
- Washington State
- 2001- early 2011
- 47 beaches
- 11 sites match post-2011 survey
- Indicator items only
Marine Debris - Indicator Items

- Balloon
- Plastic bag
- Plastic bottle
- Straw

- Fishing line
- Buoy
- Trap
Debris increased 10-times over baseline

- 0.5 debris items/100m/day
- 0.04 debris items/100m/day
Total debris arrivals

- All debris
- Indicator debris

Debris/100m/day

Debris arrival highest in BC and Hawaii, Alaska*

AK – few accumulation surveys
BC – driven by a few high surveys
HI – most debris of all states
Alaska – debris arrived early

Mean debris/100m/day

 NOAA Standing stock surveys
Barge removed almost 3,400 tonnes of debris from Alaska
Shoreline Cleanup data

- British Columbia
- 81 sites
- 2008 - present
- Debris weight (kg)
British Columbia – 5 time increase in debris
Significant debris loads removed in BC

Cumulative debris removed (metric tons)

Cumulative tons

kg/cleanup

Debris/cleanup (metric tons)
Significant debris loads removed in BC

September 2016 – more than 120 tons removed by two barges

Cumulative debris removed (metric tons)

Cumulative tons

kg/cleanup
Disaster debris reports
Disaster debris sightings varied over time

WA, OR, CA landfall – 1141 reports
Correlations in peaks of debris

Disaster debris sightings – North American landfall

Beach debris accumulation – WA, OR, CA
Model predictions

Source: Nikolai Maximenko, UH
Model tracer correlated with monthly debris landings

\[ R^2 = 0.2575 \]
Conclusions

- Substantial, significant increase in marine debris landfall attributed to the tsunami
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- Debris landfall consistent with modeling predictions
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• Significant debris load to coastal ecosystems
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• Debris landfall consistent with modeling predictions
• Significant debris load to coastal ecosystems
• Affected regions need continued cleanup and monitoring for impacts of debris and possible introductions of invasive species
Acknowledgements

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