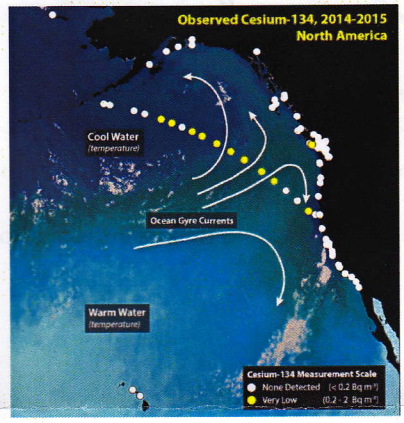
CMER
Center for Marine & Environmental Radioactivity

Woods Hole Oceanographic Institution

June 26, 2015

Dr. Lucas Hart
41 Foxfield Drive
Port Townsend, WA 98368

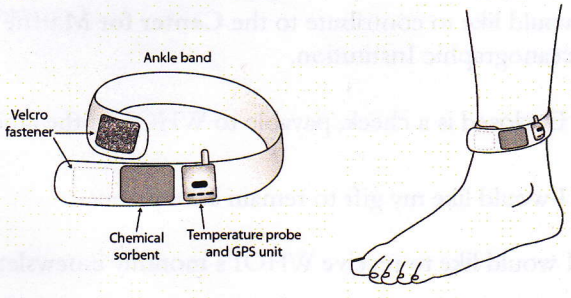
Dear Lucas,



OurRadioactiveOcean.org reached several milestones this year, thanks to your generous support. So far, you have helped us collect more than 140 samples along the coast. The samples are giving us a clearer picture of how the radionuclide, cesium-134, which can only come from Fukushima, is arriving along the shoreline. Support from LUSH Cosmetics, Woods Hole Sea Grant, and the Pacific Blue Foundation also helped us expand our offshore sampling off California. More than 300,000 people have visited our website, and we have received nearly 450 donations. As a thank you for your support, we have also enclosed a brochure highlighting our key findings.

As you may know, we found our first evidence of Fukushima radioactivity along the West Coast in April at a dock in British Columbia. Special thanks go to Mr. Grigg's class at the Ucluelet Elementary School for collecting the sample in collaboration with the Ucluelet Aquarium. We have continued to monitor this site and have only found this tiny signal in one of 10 samples since then. These results would not have been possible without support from citizen scientists like you—so keep the samples coming!

We have also been looking for an easier way to sample without having our donors ship water, and we think we've found the solution: a wearable device that makes every volunteer a data point! We are developing an ankle band that swimmers and surfers can wear to collect cesium samples and other data in the ocean—all while they swim or surf. We call it the **RadBand** and we envision pairing it with a smartphone app that provides real-time data on ocean tides and waves in addition to results on cesium and other contaminants.



But to get the **RadBand** to market**, we need your help.** We are testing the ankle strap and sensors, and refining the procedures we will use to ensure it takes accurate measurements in our lab at the Center for Marine and Environmental Radioactivity. Our goal is to get the **RadBand** ready for use as soon as possible and your support will help us finish this work.

While a gift of any size will make an impact, **your gift of $100** will also qualify you to become a WHOI Associate. You will receive a subscription to WHOI's magazine, *Oceanus*, as well as invites to special events. With **your gift of $1,000** you will become a member of the 1930 Society, giving you greater access to learn more about the cutting edge research happening every day at WHOI. Of course, we will keep you updated with our results from OurRadioactiveOcean.org and on our progress developing the **RadBand** at the Center for Marine and Environmental Radioactivity.

Thank you for your continued support as we strive to better understand our radioactive planet.

Sincerely,

Ken Buesseler
Director, Center for Marine and Environmental Radioactivity
Woods Hole Oceanographic Institution

P.S. If you'd like to make your donation online, please visit www.whoi.edu/CMER .

Please return this form with your contribution.
***Thank you** for your support!*

Dr. Lucas Hart
41 Foxfield Drive
Port Townsend, WA 98368

I would like to contribute to the **Center for Marine and Environmental Radioactivity** at the Woods Hole Oceanographic Institution.

☐ Enclosed is a check, payable to WHOI, in the amount of $ ________________

☐ I would like my gift to remain anonymous.

☐ I would like to receive WHOI's monthly e-newsletter.

Email address: ______________________________________

How radioactive is our ocean?

A guide to natural and man-made sources of radiation in the environment post-Fukushima

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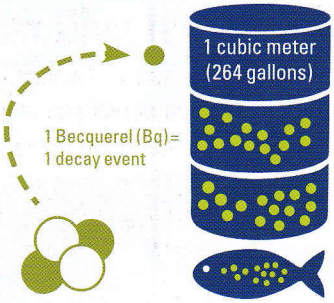
What is radiation?

Radiation is caused by unstable atoms breaking down and emitting high energy particles. The number of these events per second is called a Becquerel (Bq). The total number of Bq is often reported per cubic meter of (264 gallons) of seawater or kilogram (2.2 pounds) of fish.

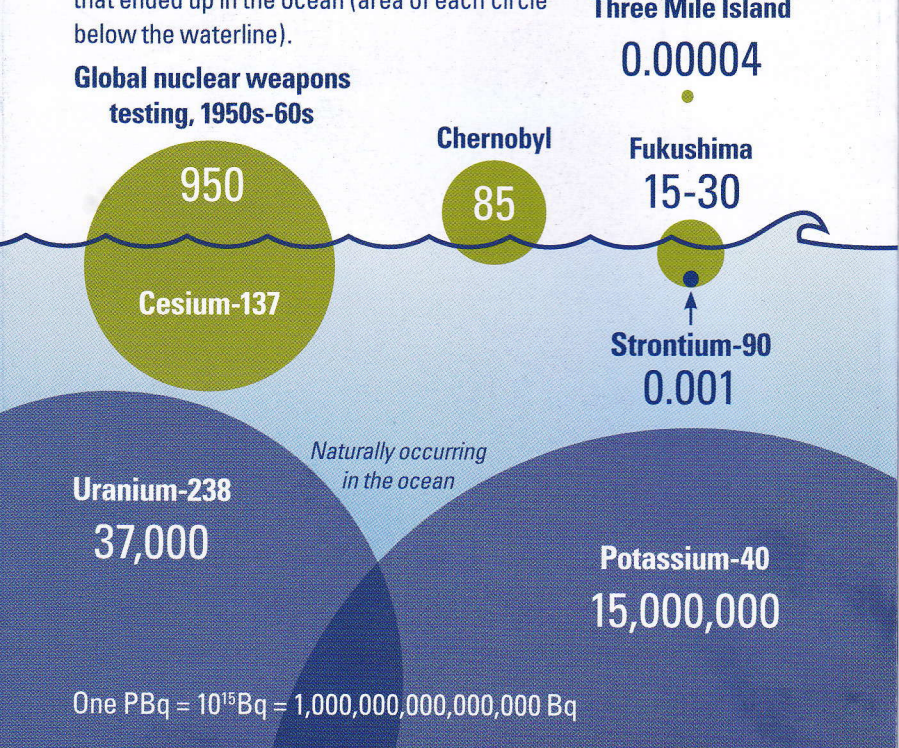


Fukushima contaminants of concern

	Cesium-134	Cesium-137	Strontium-90
Half-life:	2 years	30 years	29 years

Radioactivity in the ocean

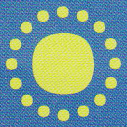
Proportion of total radioactivity released (in PBq)* that ended up in the ocean (area of each circle below the waterline).



One PBq = 10^{15} Bq = 1,000,000,000,000,000 Bq

Radiation dose and exposure

100,000
Lifetime risk of cancer is evident (annual)



1,000
EPA dose limit for one individual (annual)

400
Average dose from natural radiation in food (annual)

0.001
Swimming in ocean every day on the West Coast (annual)

1,000,000 micro-Sieverts

Dose is measured by the Sievert (Sv) a unit of radiation absorption by the human body.

400,000

100,000

1,000

0

1,000,000
Temporary radiation sickness

~400,000
Maximum dose immediately outside Fukushima reactors (per hour)

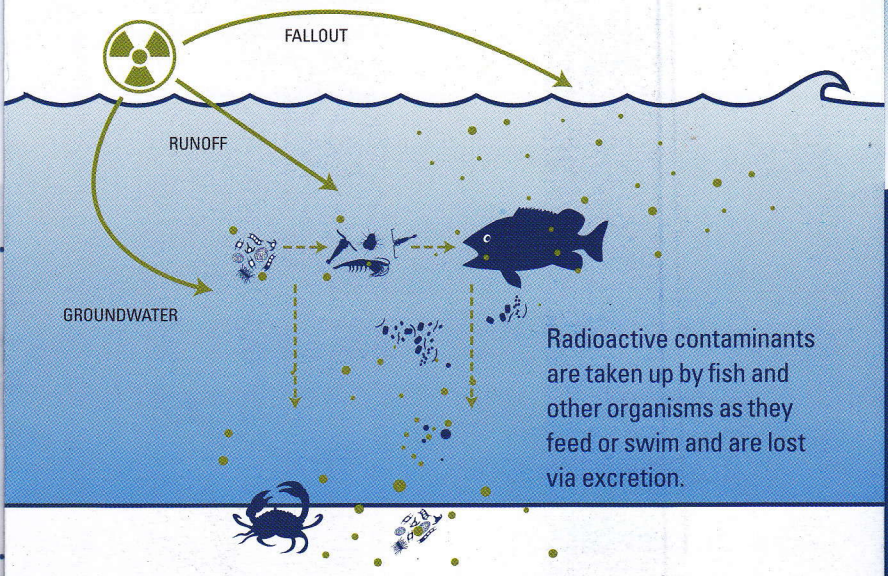
10,000
Average full body CT scan

40
Flight from New York to LA (total)

5
Dental x-ray

SOURCES: HARVARD MEDICAL SCHOOL, EPA, FDA, THE GUARDIAN, BBC

Radioactivity in marine life



Radioactive contaminants are taken up by fish and other organisms as they feed or swim and are lost via excretion.

Radioactivity in fish

Time it takes to flush out radioactive contaminants.

Cesium-137
Taken up in muscles/organs

WEEKS

Strontium-90
Taken up in bones

YEARS

Seafood caught above radiation limits*

**Limits set by Japan (100 Bq/kg) and US (1000 Bq/kg) for fish sold in those countries.*

2011
Near Fukushima

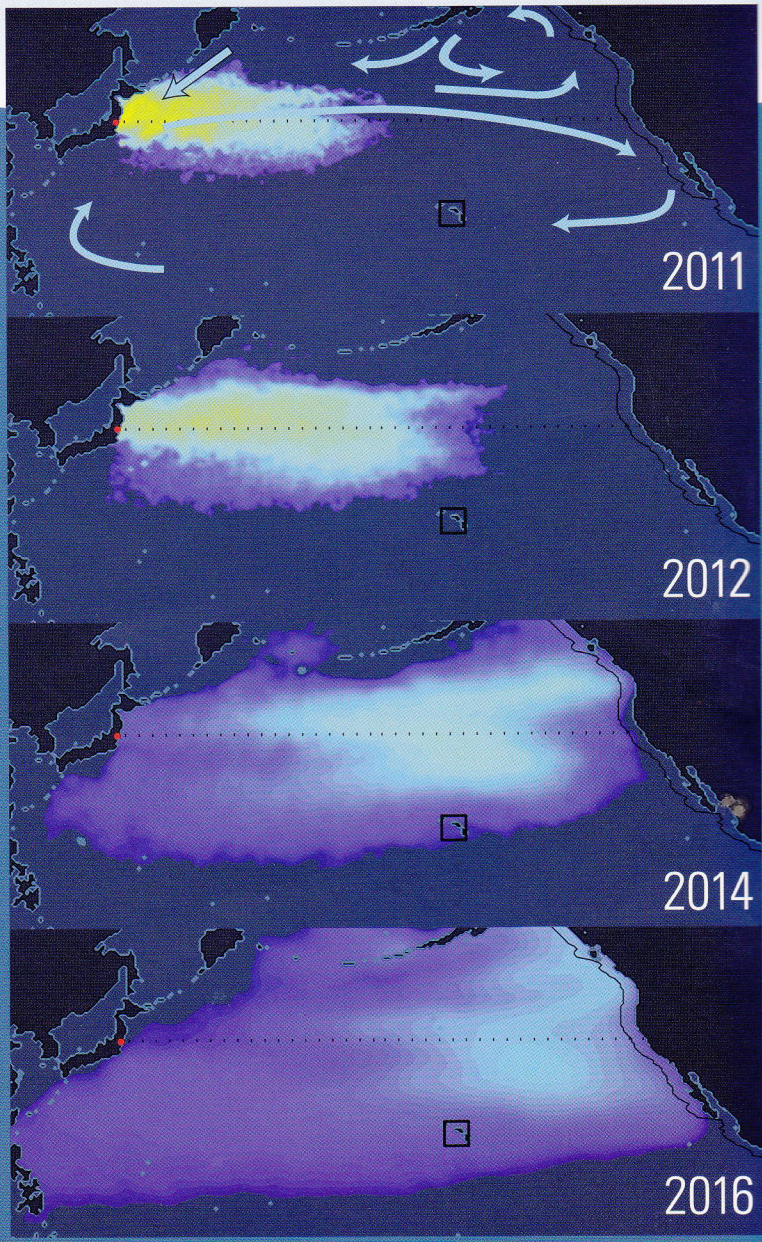
2014
Near Fukushima

2014
U.S. West Coast

All fish contain trace levels of cesium-137 from nuclear weapons testing. Additional cesium from Fukushima closed fisheries in some areas of coastal Japan in 2011.

How fast will radioactivity spread?

Radioactive materials released into the ocean from the Fukushima Dai-Ichi nuclear power plants are spread by ocean currents and diluted by seawater along the way.



Cesium 137 (Bq/m³)

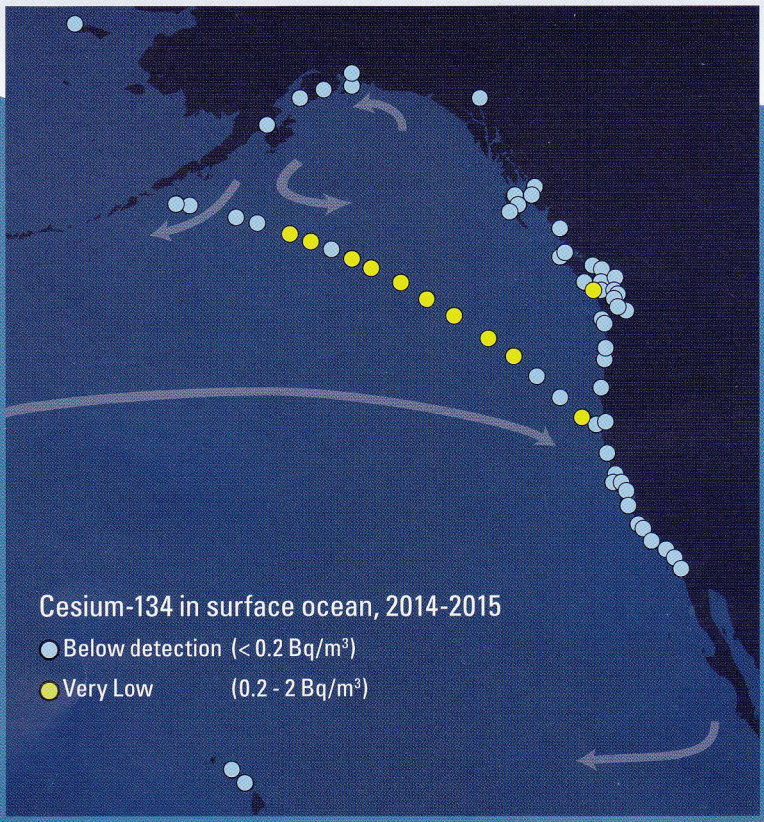
0.1 1 10 100 1,000 10,000

7,400: Maximum level allowed by US EPA for Cs-137 in drinking water

ROSSI ET AL. 2012/2014

How can we be sure?

Since 2011, scientists—with the help of interested citizens—have been sampling seawater across the Pacific to track the spread of radioactive isotopes released from Fukushima.



If you would like to join the growing group of interested citizen-scientists who are helping collect samples, or if you can help fund analysis of our growing collection of samples, please visit our website:

ourradioactiveocean.org

Find more information at: www.whoi.edu/cmer