Alaska Forum on the Environment
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Fukushima Radiation-Related Concerns. Public Health Implications

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Concerns over Fukushima radiation releases

- Radiation exposure concerns from
  - Seafood, Water, Migrating birds
- Media reports and analyses not necessarily informed
- Some publicized published studies modeled elevated risks of morbidity and mortality from Fukushima-related radiation
- Fukushima incident-related National Poison Data System calls (3/11/11 – 4/18/11)*
  - 400 calls
    - 340 information requests
    - 60 exposures (None classified as probable exposures)

*Law *et al.*, 2013

State and Federal Response

- **Alaska**
  - Land animals, fish, marine mammals, shellfish, and seaweed safe to eat.
- **California**
  - Samples fish, water, and air. No health and safety concerns to California residents.
- **Oregon**
  - Coastal water monitoring suspended in 11/2011 because there were no findings above naturally occurring background radiation levels.
- **Washington**
  - Radioactivity found in tuna in 2011 and 2012 off Japan and California coasts far below what would pose a health risk.
- **EPA, FDA, and NOAA joint release**
  - No radiation levels of concern in water, sediment, or seafood (measured or expected).

FDA
Derived Intervention Levels

- For radionuclides expected in the entire diet during the first year following accidental releases of radionuclides
- Presumed contamination would occur in 30% of dietary intake (Exception for I-131 in babies – 60 days)
- 03/2011 – 06/2012, FDA tested 1313 samples from Japan (199 seafood or seafood products)
  - 1312 samples had no Iodine-131, Cesium-134, Cesium-137, or other gamma-ray emitting radionuclides of concern
  - 1 sample contained detectable levels of Cesium, but below Derived Intervention Level

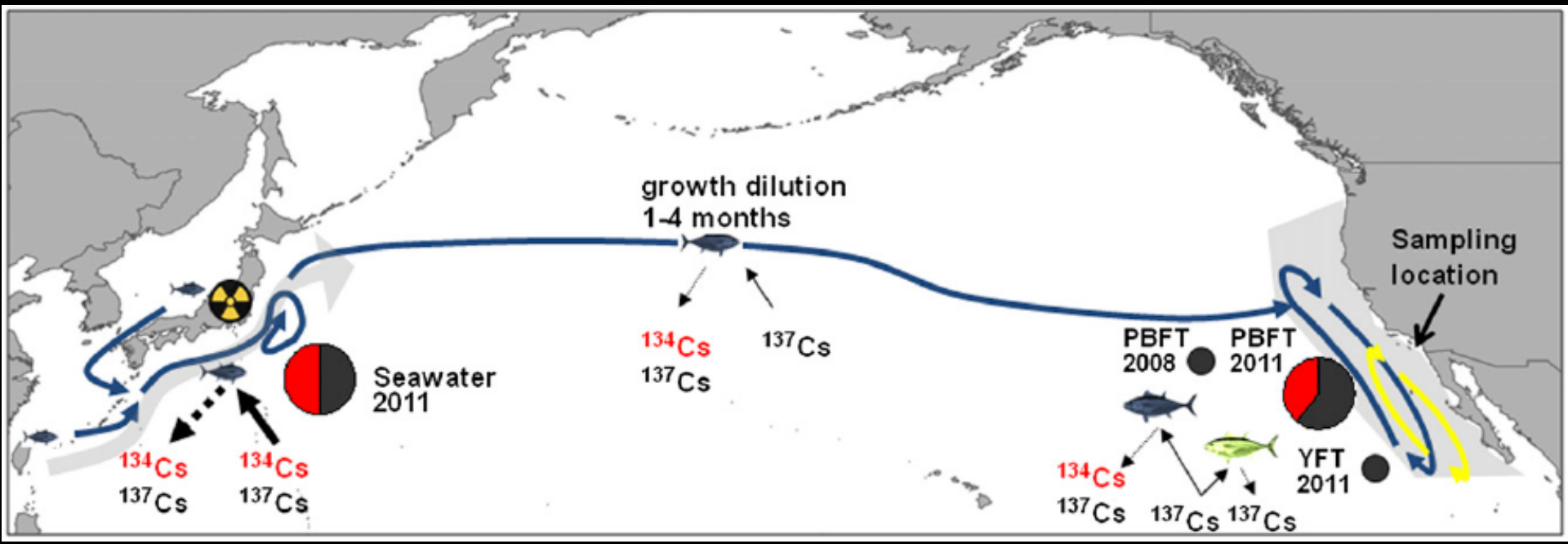
Case Study: Pacific Bluefin Tuna Caught in California Waters

Radiation detected in Pacific Bluefin Tuna

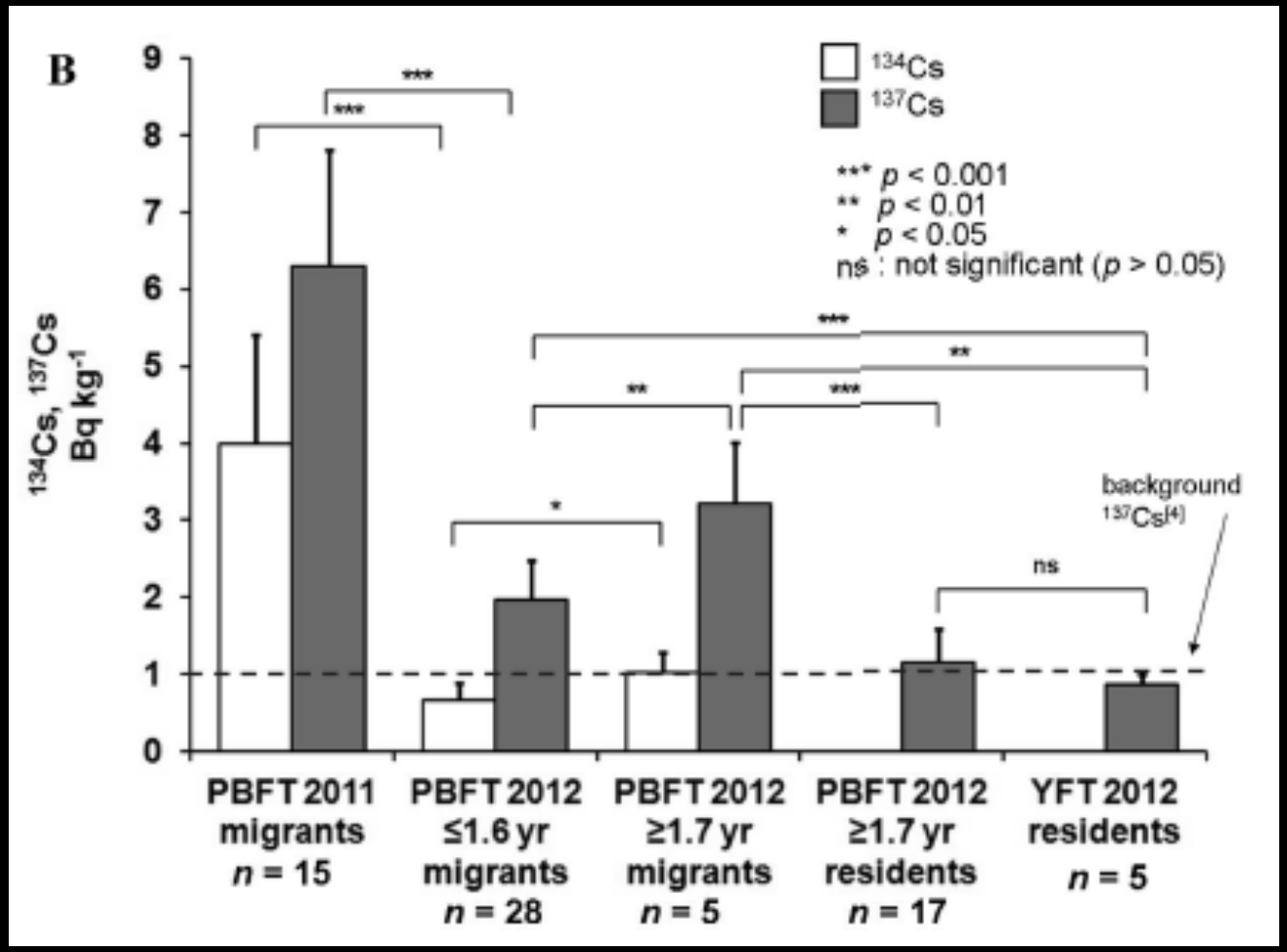
- NOAA-funded research led by Stanford University
- Caught Pacific Bluefin Tuna (PBFT) fish from California coastal waters
- Pacific Bluefin Tuna
  - Spawn in the western Pacific Ocean
  - Juveniles forage in the waters around Japan then either remain in the western Pacific or migrate eastward to California waters
  - Youngest tuna in California waters (approximately 1–1.5 years old) likely migrated from Japan within preceding year
  - Larger, older tuna in California waters are primarily residents for >1 year

Madigan *et al.*, 2012, 2013

Pacific Bluefin Tuna Migration

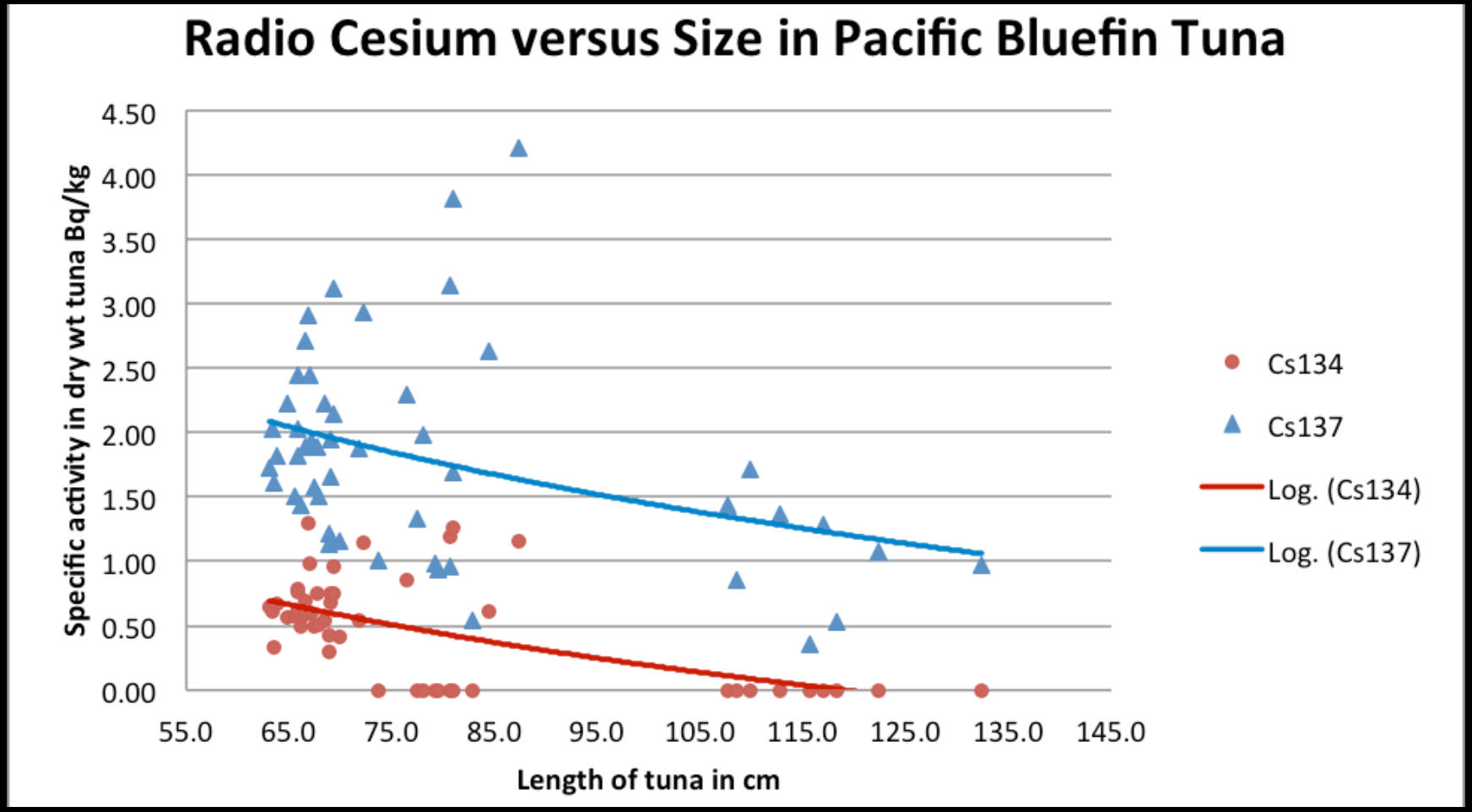


Cesium Levels Declining in Tuna – California, 2011 to 2012



Madigan et al., 2013

Pacific Bluefin Tuna Radiation by Fish Length- CA 2012



Plotted from Madigan *et al.*, 2013 by California Dept. of Health Radiologic Health Branch (DRAFT)

Is There Health Risk from Consuming These Tuna?

Table 1. Committed effective dose to humans from ingesting PBFT calculated on the basis of Fukushima-derived Cs concentrations and natural radionuclides in fish in San Diego, August 2011, or potentially present in Japan, April 2011

Radionuclide	PBFT source	Mean (±SD) (Bq·kg^{-1} dry)	Mean (±SD) (Bq·kg^{-1} wet)†	DC (nSv·Bq^{-1})‡	nSv (from 200 g)§	nSv (from 1 kg)	μSv (annual consumption)*
^{134}Cs	United States, August 2011	4.0 (1.4)	1	19	3.7	18.5	0.4
^{137}Cs		6.3 (1.5)	1.5	13	4.0	19.9	0.5
^{40}K		347 (49)	84.7	6.2	105	525	12.7
^{210}Po		79	19.3	1,200	4,632	23,160	558
^{134}Cs	Japan, April 2011	60.0	14.6	19	56	278	15.7
^{137}Cs		94.5	23.1	13	60	299	16.9
^{40}K		347 (49)	84.7	6.2	105	525	29.7
^{210}Po		79	19.3	1,200	4,632	23,160	1,310

*Annual per capita consumption rates (24.1 and 56.6 kg·y^{-1} in the US and Japan, respectively) are for all types of finfish and shellfish combined, whereas the dose calculations conservatively assumed the entire consumption was solely of contaminated tuna.

Fisher *et al.*, 2013

Exposure and Cancer Risk Assumptions

- Consuming 12 ounce of tuna per day (95th percentile fish consumption rate among recreational fishermen) (conservative assumption)
- Consuming this tuna for 1 year (~273 pounds)
- Radiation Exposure = 2.8 milliSv (4.7 microSv from Cesium ~ 1/600 total)
  - Cesium dose
    - ~ 1 dental X-ray
    - ~ half the daily background dose received by the average person
    - ~ 12% dose from cosmic rays flying LA-NY
- Excess Cancer Risk (above background) = 2 cancers in each 10,000,000 people exposed
- **This cancer risk is EXTREMELY LOW**

Cancer Risk in Perspective

~**1 in 2 males** and **1 in 3 females** will develop cancer in their lifetime in the U.S.

(SEER.cancer.gov)

Cesium in Arctic Marine Mammals **pre-Fukushima**

- Measured 137Cs in muscle of *12 polar bears, 15 ringed seals, 10 hooded seals, 7 bearded seals, 14 harp seals, one walrus, one white whale, and one blue whale* (2000-2003) from Svalbard and the Barents and North Greenland Seas
- Mean concentration highest for polar bears (**0.72 Bq/kg** wet weight) and lowest for bearded seals (**0.22 Bq/kg**); below detection limit for the walrus.
- No age related patterns in Cs levels (polar bears and hooded seals)
- **Pacific bluefin tuna (1.5 Bq/kg)** caught off the California coast > arctic marine mammals pre-Fukushima

Andersen et al (2006)

Possible Consequences of Misinformation on Radiation

- Not eating healthful and nutritious traditional foods
- Commercial losses
  - Jobs
  - Money
  - Livelihoods
- Undue stress

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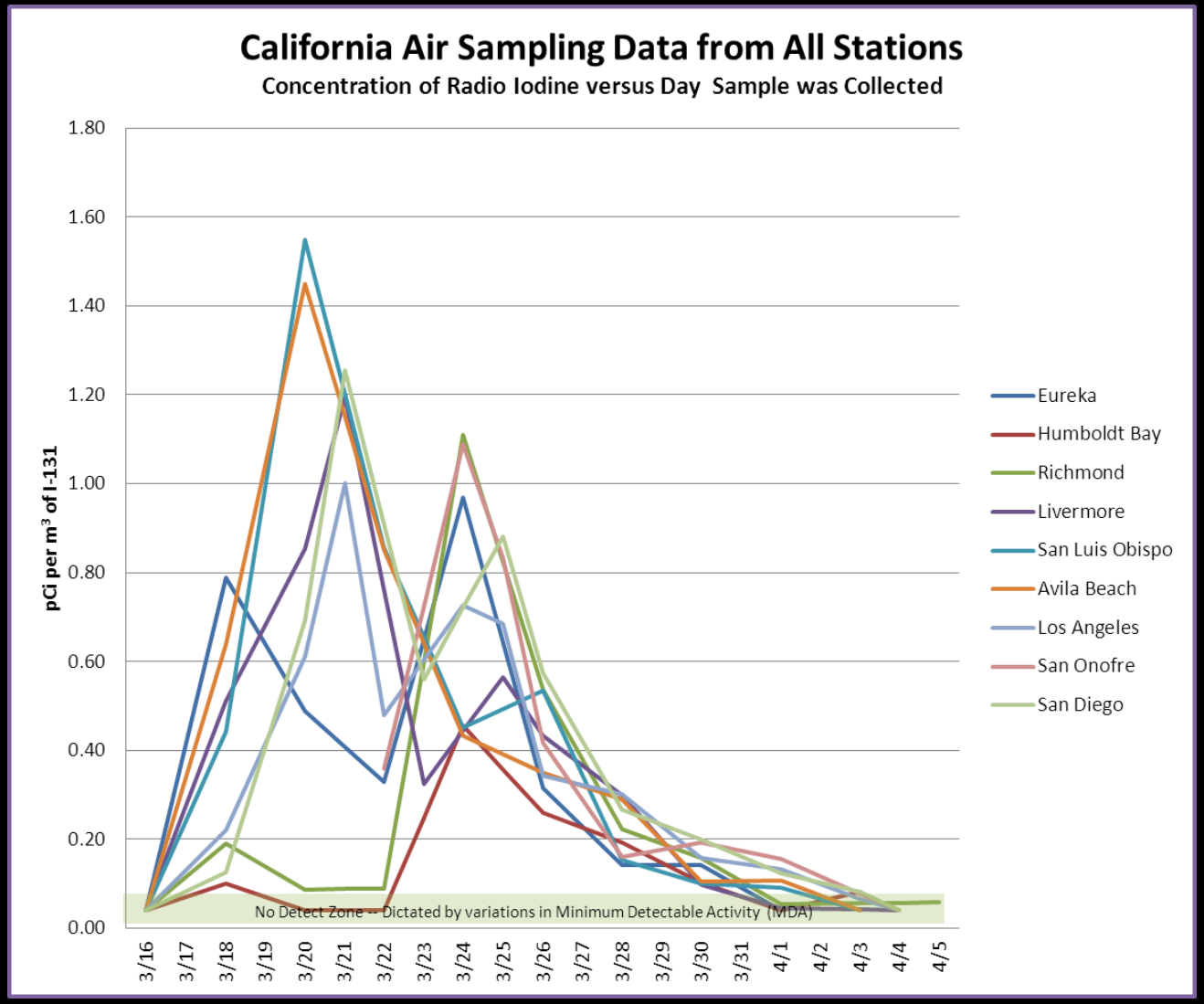
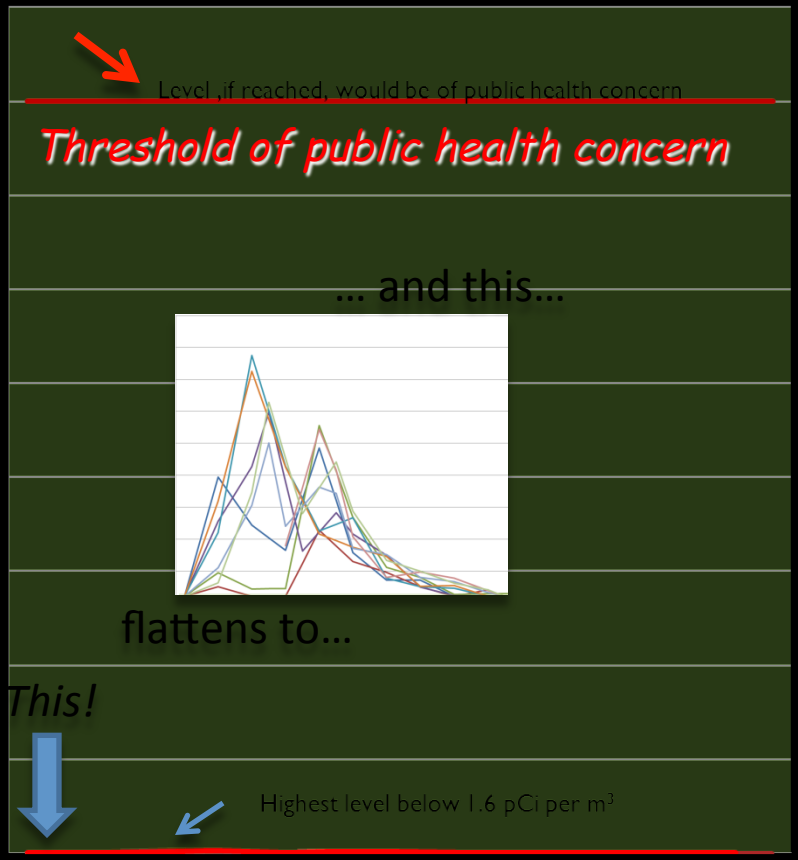

California Air Sampling Data from All Stations
Concentration of Radio Iodine versus Day Sample was Collected
pCi per m3 of I-131
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
3/16
3/17
3/18
3/19
3/20
3/21
3/22
3/23
3/24
3/25
3/26
3/27
3/28
3/29
3/30
3/31
4/1
4/2
4/3
4/4
4/5
No Detect Zone -- Dictated by variations in Minimum Detectable Activity (MDA)
Eureka
Humboldt Bay
Richmond
Livermore
San Luis Obispo
Avila Beach
Los Angeles
San Onofre
San Diego

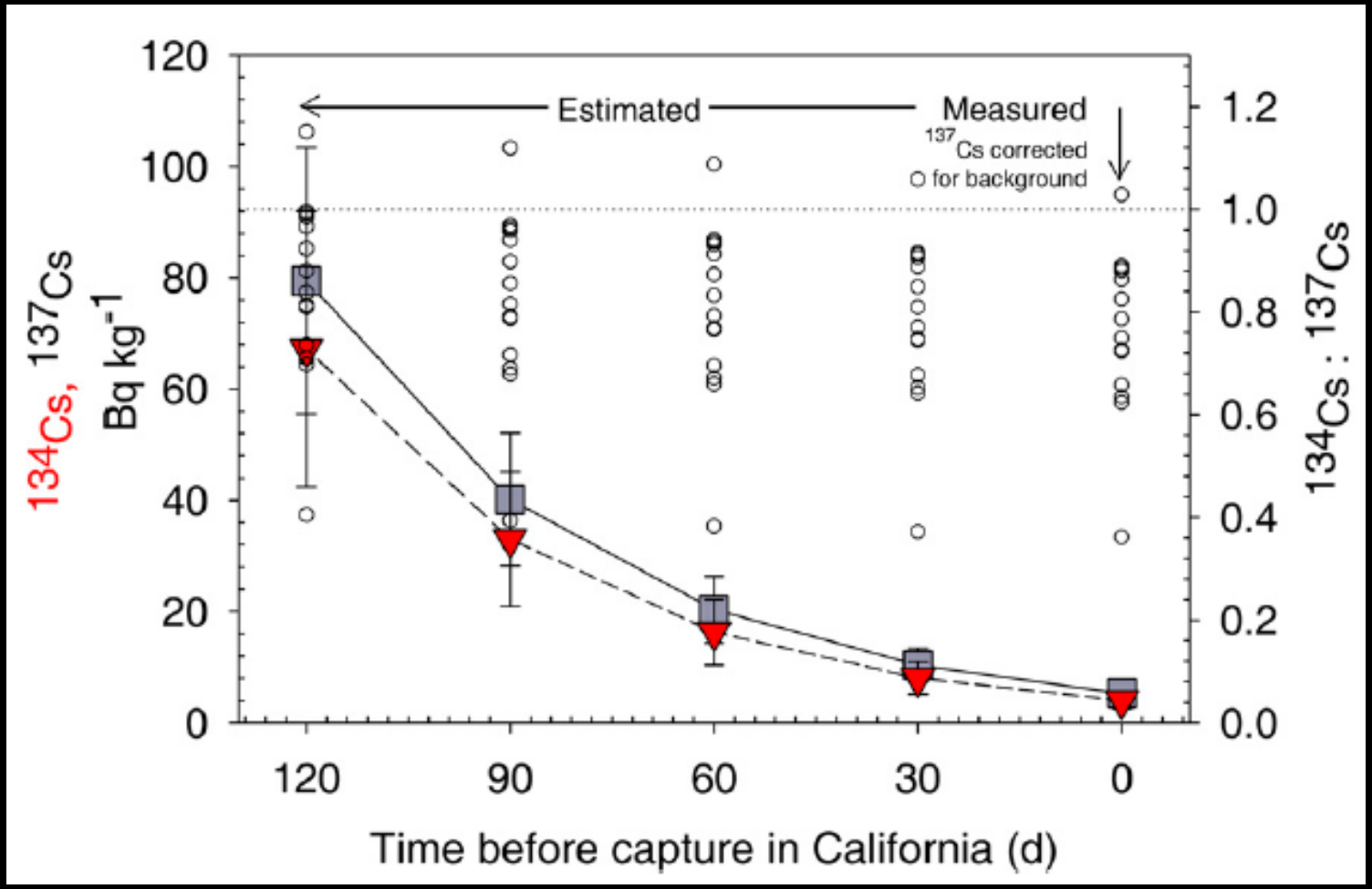
WRONG



RIGHT

especially after seeing the first graph…

Pacific Bluefins Caught in CA - 2011



Madigan *et al.*, 2012

The closer to California, the *less* radioactive the tuna