

NATIONAL PERSPECTIVE
Philippines

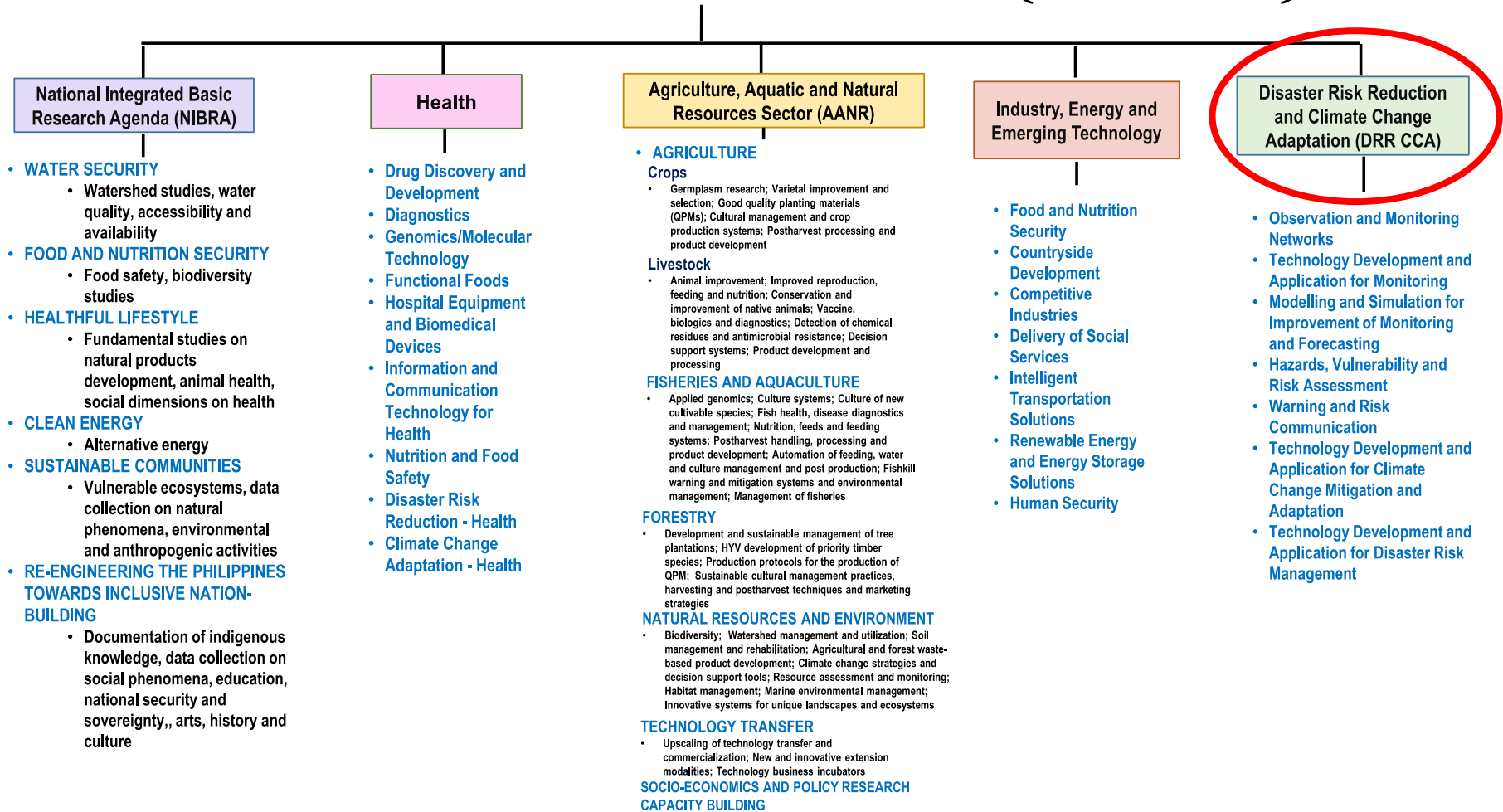
Angel T. Bautista VII, PhD

Philippine Nuclear Research Institute –
Department of Science and Technology (DOST-PNRI)

National Agenda on R&D: Science for the People

Department of Science and Technology

HARMONIZED NATIONAL R&D AGENDA (2017-2022)



National Agenda on Environment: Ensuring Ecological Integrity, Clean and Healthy and Environment

Department of Environment and Natural Resources



↑ ↑ ↑

ECOLOGICAL INTEGRITY ENSURED AND SOCIO-ECONOMIC CONDITIONS OF RESOURCE-BASED COMMUNITIES IMPROVED THROUGH SUSTAINABLE INTEGRATED AREA DEVELOPMENT

↑

Biodiversity and functioning of ecosystem services sustained

- ✓ Intensify sustainable management of natural resources
- ✓ Expand development of resource-based enterprises/industries
- ✓ Mainstream ecosystem values into national and local development planning

↑

Environmental quality improved

- ✓ Strengthen enforcement of environmental laws
- ✓ Promote sustainable consumption and production (SCP)

↑

Adaptive capacities and resilience of ecosystems increased

- ✓ Strengthen implementation of CCA and DRR at the local level across sectors
- ✓ Strengthen implementation of response, recovery, and rehabilitation efforts
- ✓ Strengthen monitoring and evaluation of effectiveness of CC and DRMM actions

2040

AMBISYON
NATIN 2040

MATATAG, MAGINHAWA AT PANATAG NA BUHAY

2022



TO LAY DOWN THE FOUNDATION FOR INCLUSIVE GROWTH, A HIGH-TRUST AND RESILIENT SOCIETY, AND A GLOBALLY-COMPETITIVE KNOWLEDGE ECONOMY



"MALASAKIT"
ENHANCING THE
SOCIAL FABRIC



"PAGBABAGO"
INEQUALITY-REDUCING
TRANSFORMATION



"PATULOY NA PAG-UNLAD"
INCREASING GROWTH
POTENTIAL



Promote Philippine culture
and values



Expand
economic
opportunities



Increase access
to economic
opportunities



Promote
technology
adoption



Stimulate
innovation

R&D programs and projects

corals · forest soil carbon · food authenticity and traceability

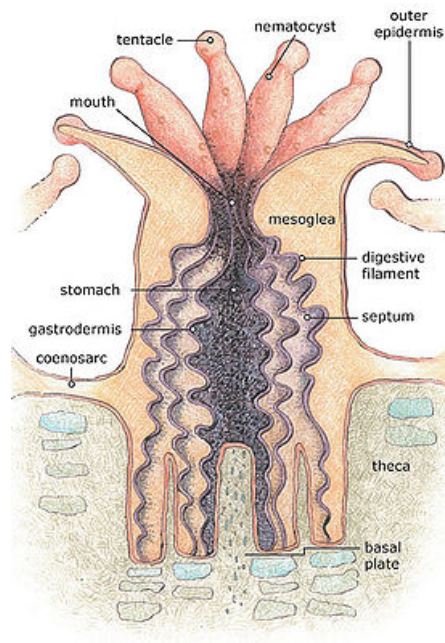


Corals

3DXCT and Iodine-129

P. Samaniego 2010

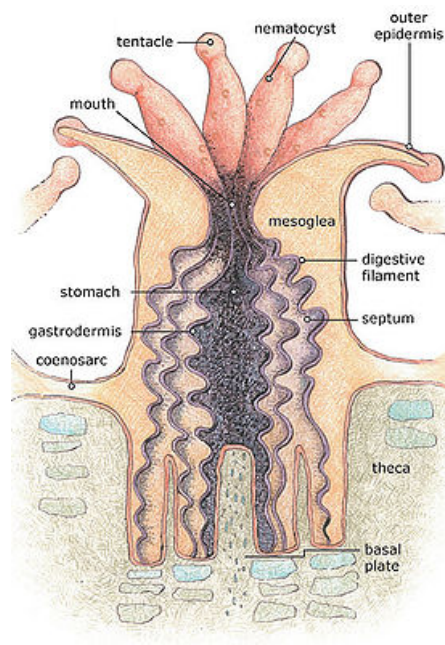




Corals

Massive corals (*Porites spp.*)

Produces growth bands year per year.



Corals

Massive corals (*Porites spp.*)

Produces growth bands year per year.

Record changes in marine conditions in the past.

Can help us understand possible changes in the future.

Coral Work

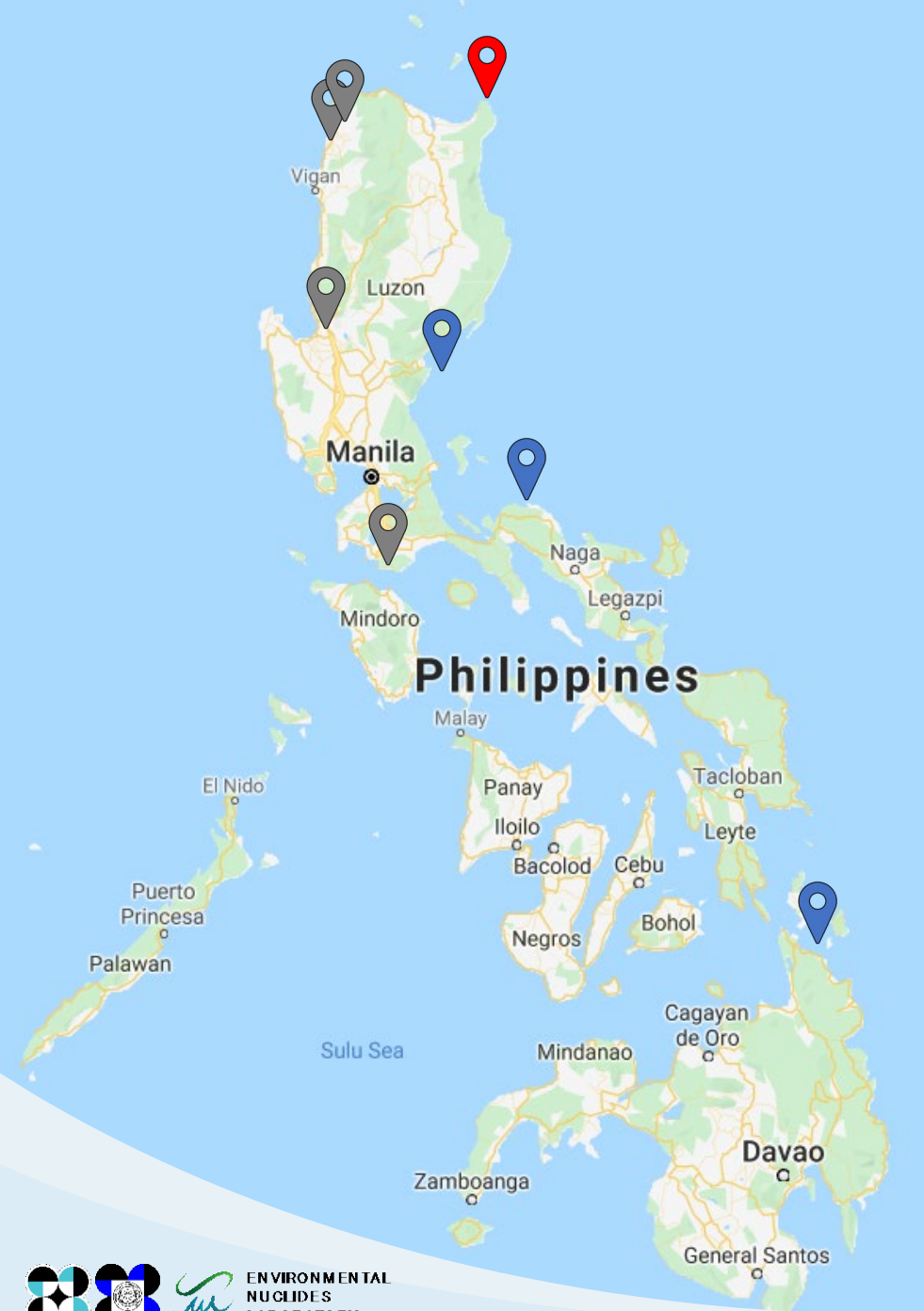
Coral Sites:

3 modern and 4 fossil corals. 1 more modern coral is targeted to be sampled in 2021.

Comparison of modern corals vs. fossil corals to compare modern and geologic environmental settings.

Studies:

1. $^3\text{DXCT}$ for reconstructing SST in modern and fossil corals.
2. ^{14}C dating of fossil corals (sea-level rise).
3. ^{129}I to detect signals from Nuclear Weapons Testing, Fuel Reprocessing, and Accidents



Natural: SST reconstruction



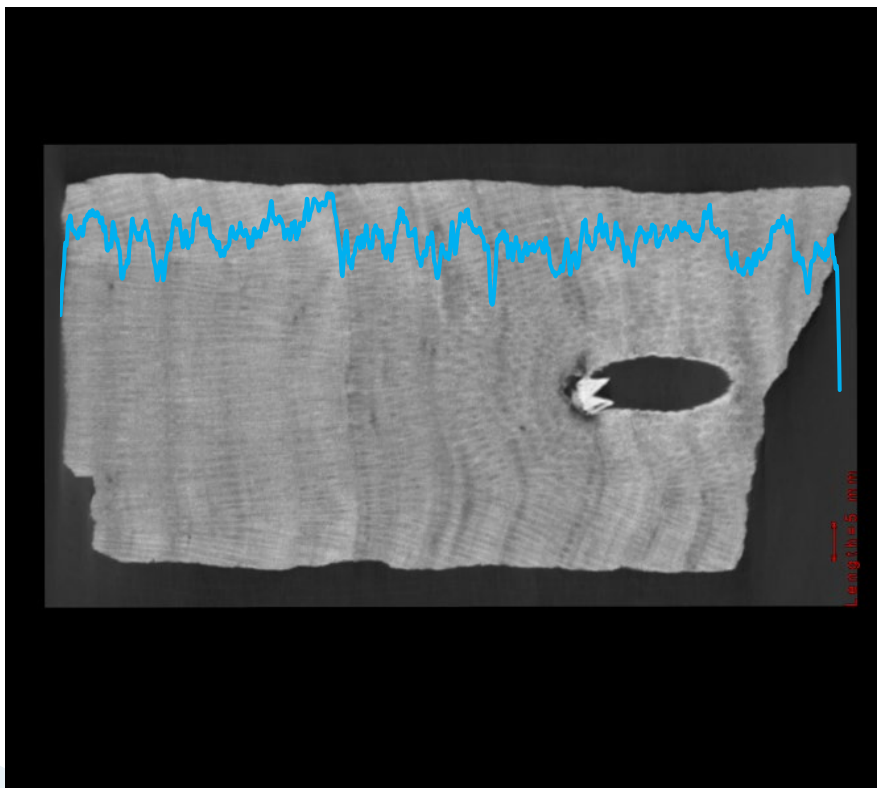
<https://4nsi.com/>

Analysis:

3D X-Ray Computed Tomography
(Admatel, Philippines)

Spatial Resolution: 54 μm (coral age
equivalent **time resolution ≈ 2.5 days**)

Natural: SST reconstruction



Analysis:

3D X-Ray Computed Tomography
(Admatel, Philippines)

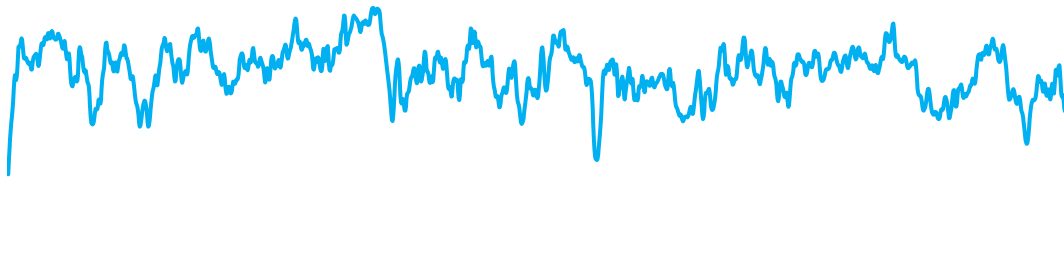
Spatial Resolution: 54 μm (coral age
equivalent **time resolution** ≈ 2.5 days)

Concept:

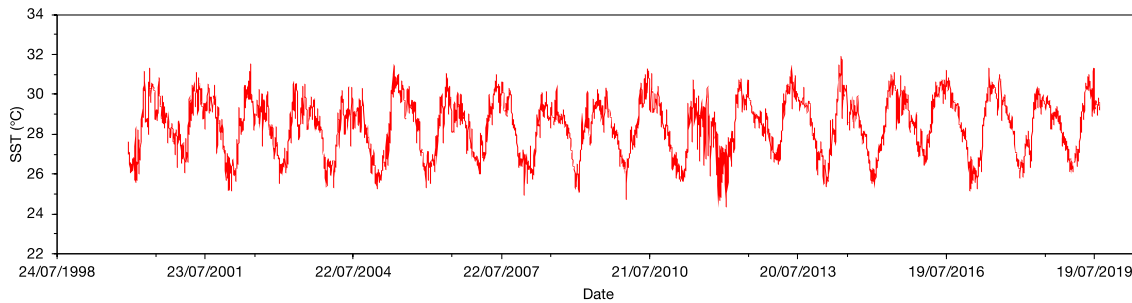
X-rays (gray values) show the relative
density of the corals.

Density of the corals are related to SST
(corals are denser in warmer waters).

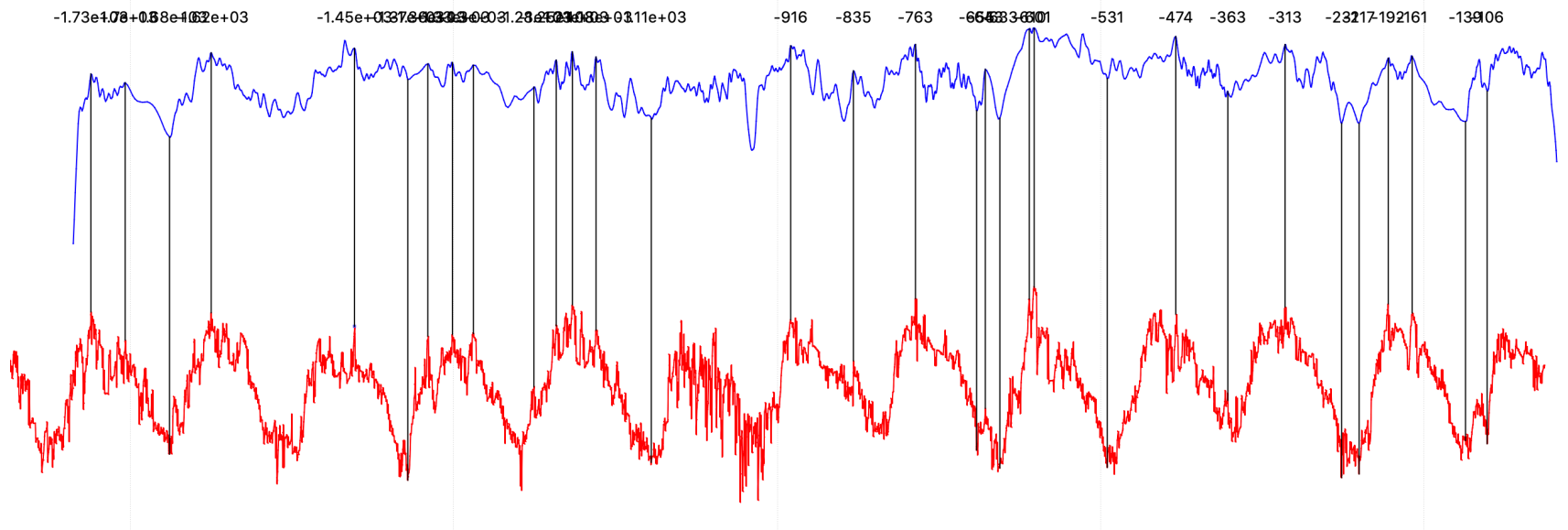
Using X-ray gray values, we can
reconstruct SST from the coral cores.



Coral X-Ray
Gray Values

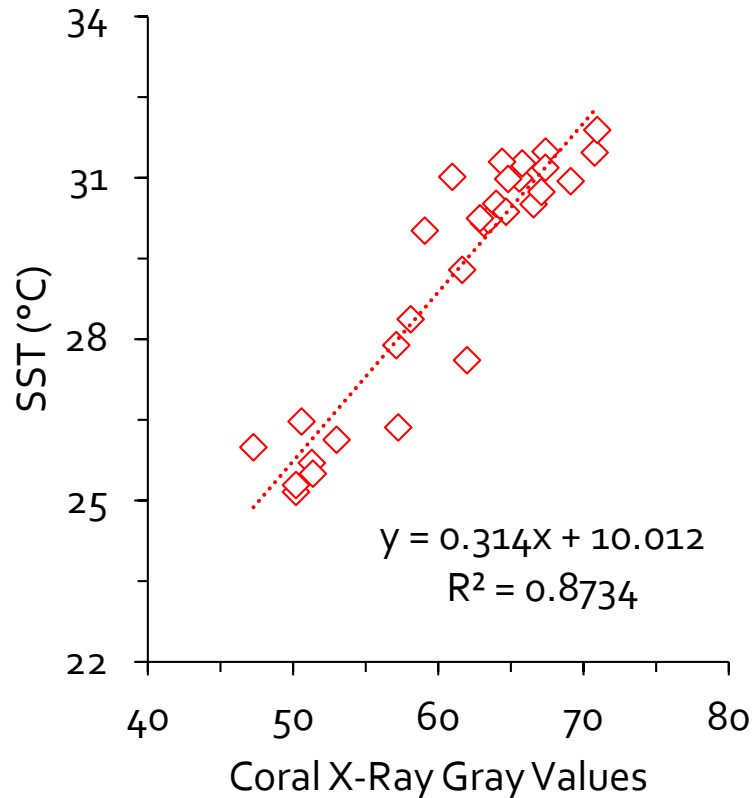


Daily SST based
from OISST (1981-
present)



Coral X-ray and OISST matching
 This will confirm coral age dating.
 Basis of SST reconstruction for the rest of the coral core.

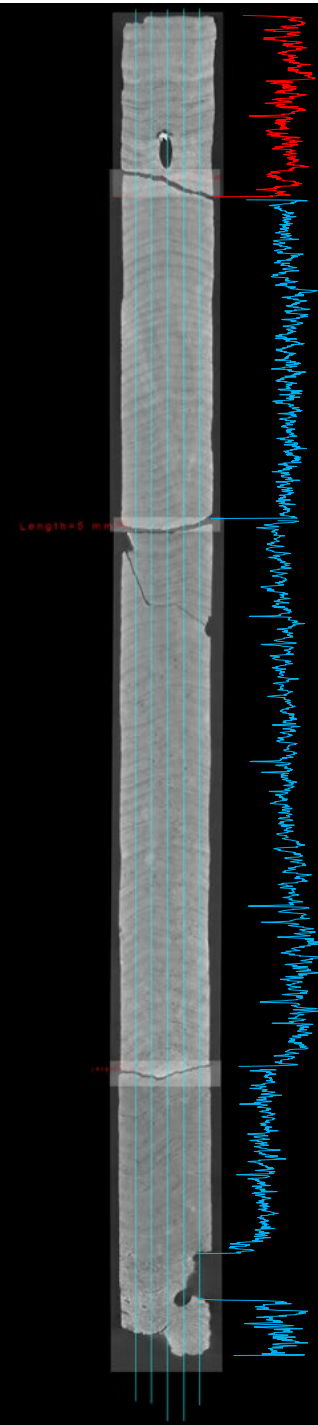
Natural: SST reconstruction



SST vs. X-Ray Gray Value:

Equation can be used to **reconstruct SST** for the rest (i.e., parts older than 1981) of the coral core **at a resolution of up to 2.5 days**.

OISST record is only until year 1981.





layer where
sample was
acquired

- coral head clast in a gravelly tidal channel deposit
- outcrop elevation is more than 100 m
- coral sample still aragonite -> unusual to find aragonitic samples at this elevation in the Philippines

knowing the age of the sample will provide clues
to the relative sea level changes in the area

Actual Code	Radiocarbon Age (^{13}C corrected, in BP)	Radiocarbon age unc	Calendar Age	BC or AD?	Median
FPS 1	44142.65844	735.093589	46731- 43567	BC	45037
FPS 2	48189.92302	1025.663408	too old for MARINE 13 Calib Curve (only until 46806 BP in radiocarbon age)		

- Obtained coral age falls within Marine Isotope Stage 3 (between 60 and 25 ka B.P.)
- Sea level at this point was 60 m to 90 m below present sea level
- Current elevation of coral sample is around 100 m above sea level -> indicates very rapid vertical uplift
- *However, obtained age date is near MARINE 13 Calibration Curve boundary*

Man-Made: Nuclear Activities

Analysis:

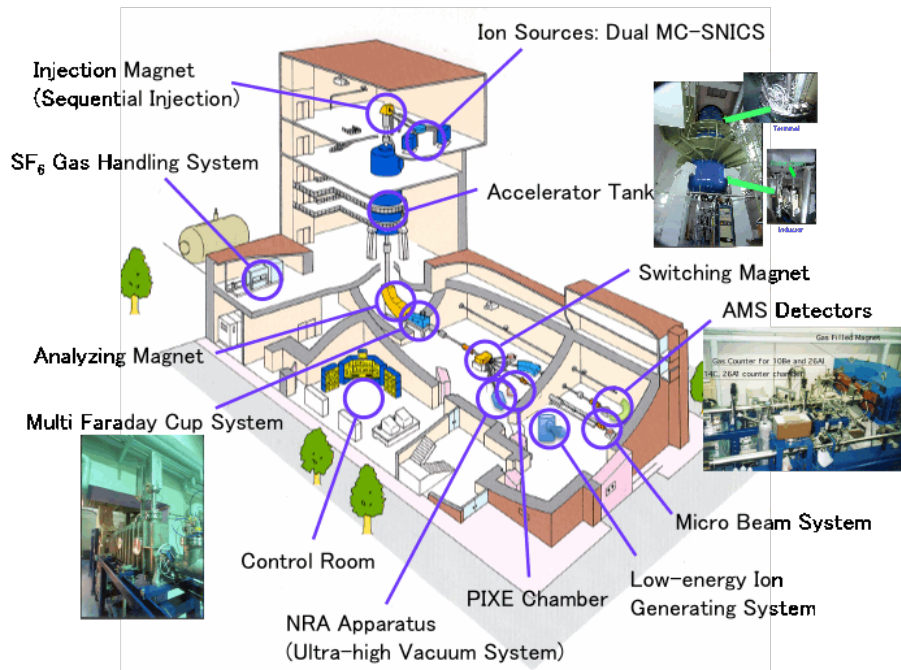
$^{129}\text{I}/^{127}\text{I}$ measurement using Accelerator Mass Spectrometry (AMS) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) in MALT, University of Tokyo, Japan

Concept:

Iodine-129 or ^{129}I mainly comes from human nuclear activities such as nuclear weapons testing, nuclear fuel reprocessing, and nuclear accidents

Measuring ^{129}I in coral cores will allow us to reconstruct the historical impact of nuclear activities.

Resolution: One to 0.5 year



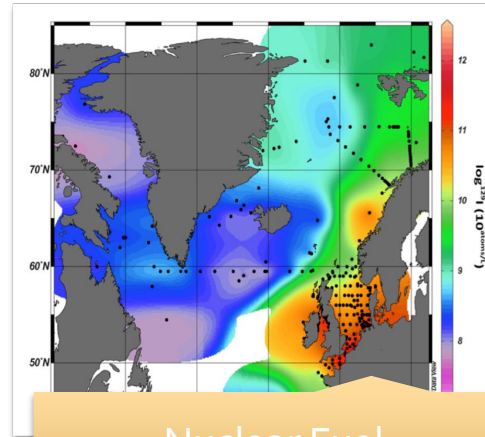
<http://malt.um.u-tokyo.ac.jp/introduction.html>

Man-Made: Human Nuclear Activities



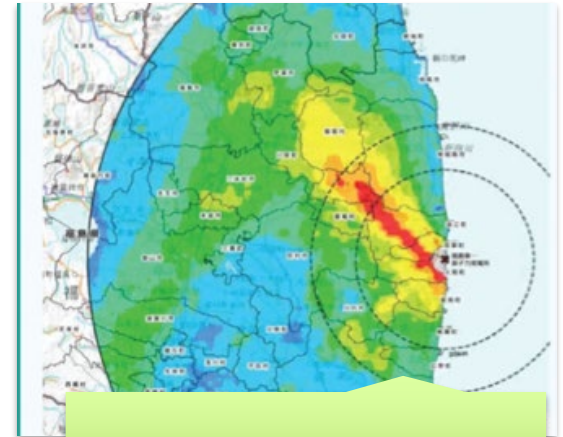
Nuclear Weapons Testing

<http://atlanticsentinel.com/wp-content/uploads/2013/04/French-nuclear-weapons-test.jpg>



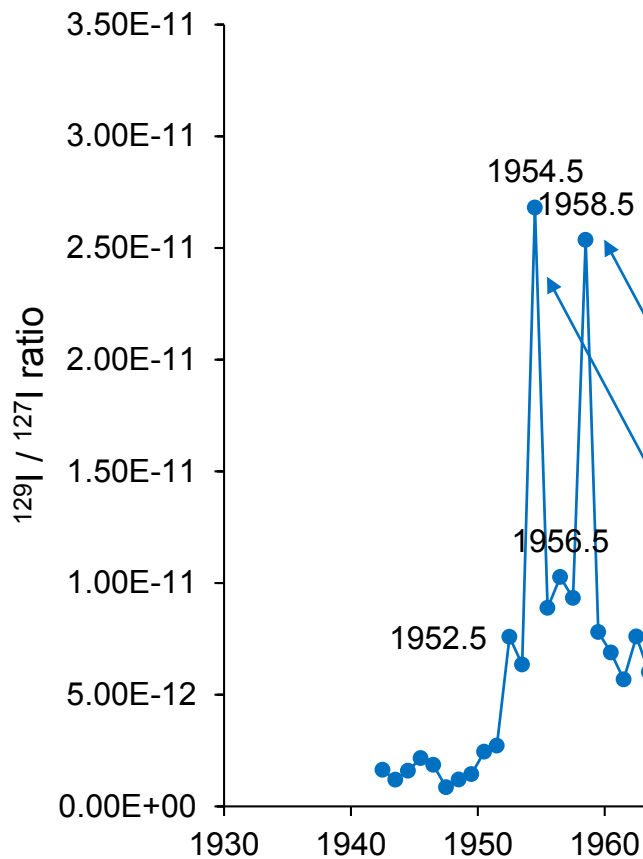
Nuclear Fuel
Reprocessing

He et al., 2013



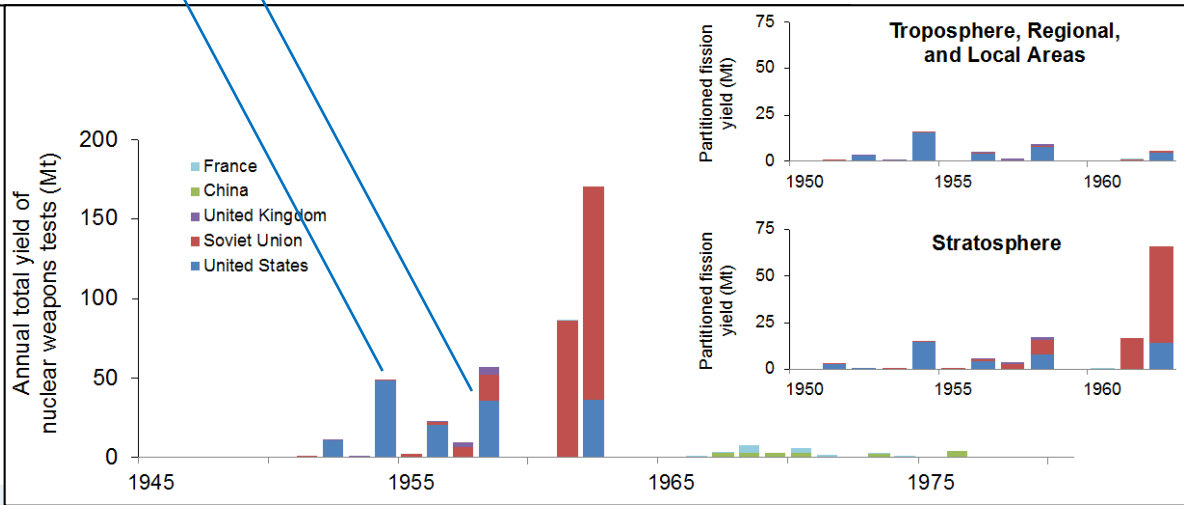
Nuclear Accidents

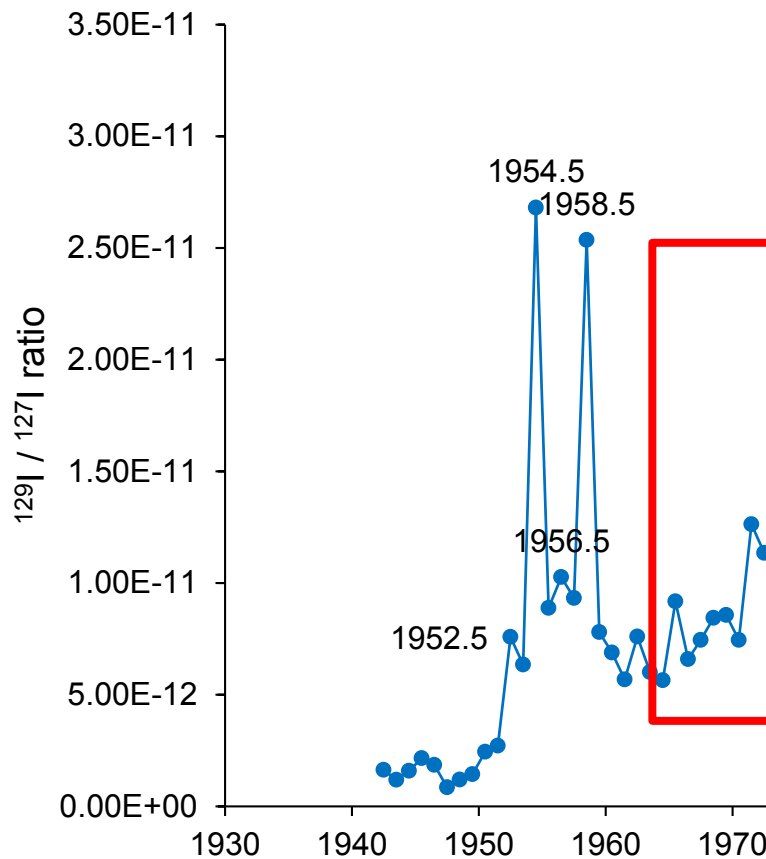
<http://www.world-nuclear-news.org>



^{129}I in coral cores

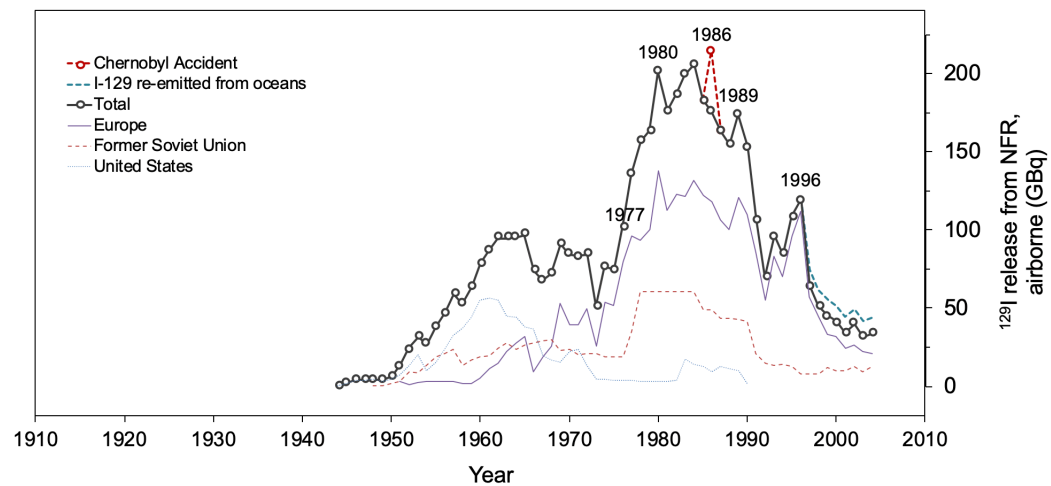
1. Nuclear Weapons Testing

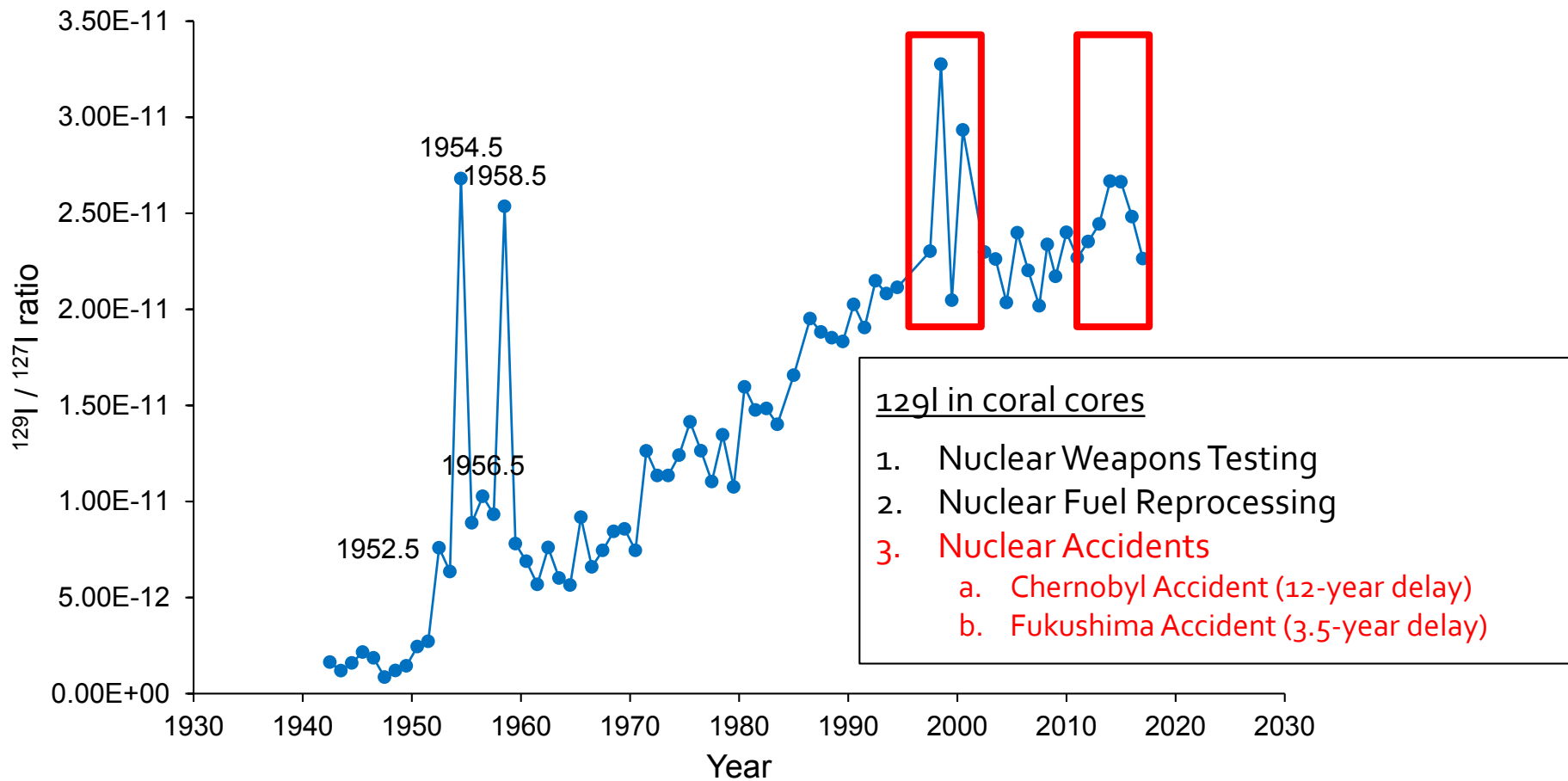




^{129}I in coral cores

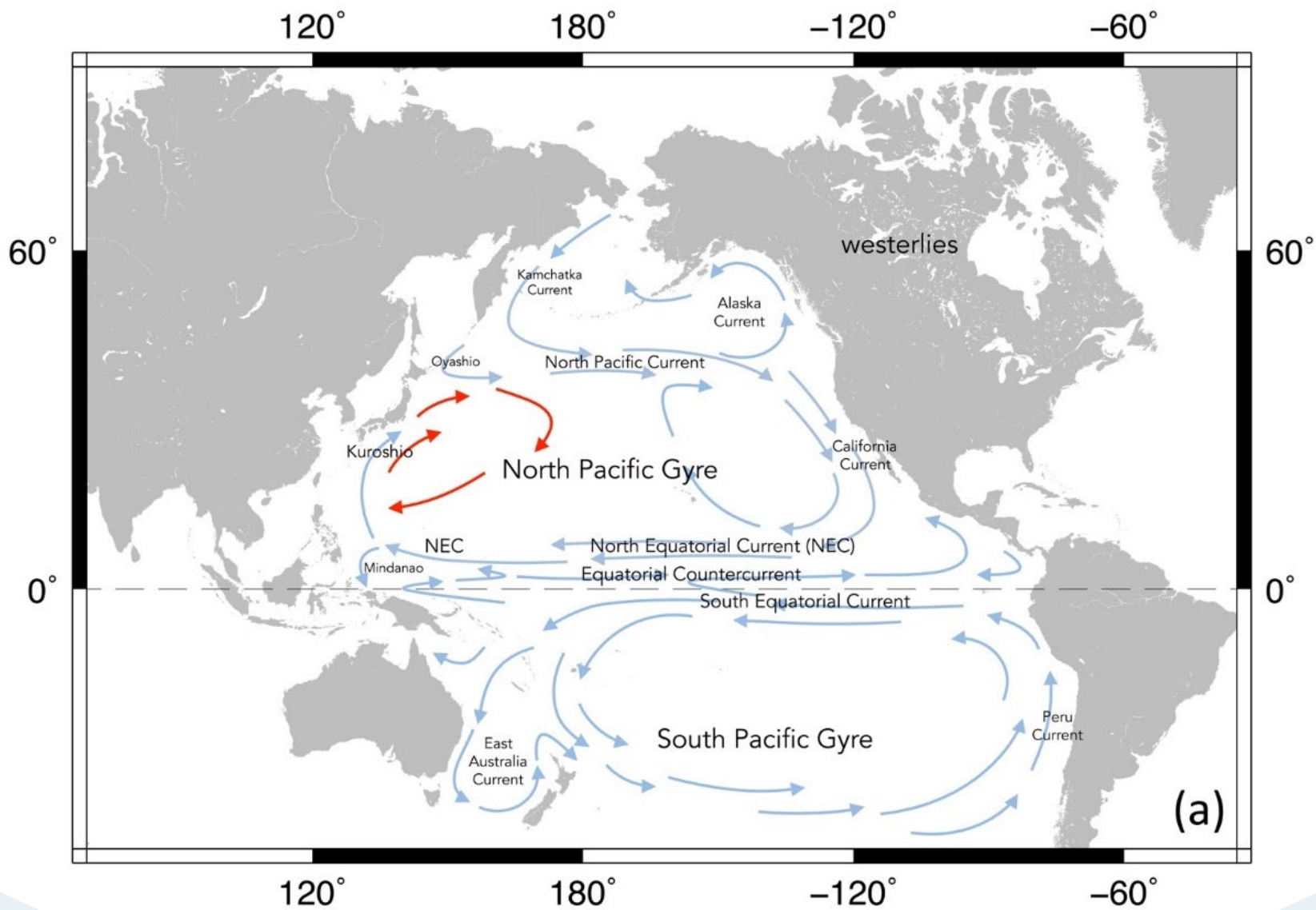
1. Nuclear Weapons Testing
2. Nuclear Fuel Reprocessing





^{129}I in coral cores

1. Nuclear Weapons Testing
2. Nuclear Fuel Reprocessing
3. Nuclear Accidents
 - a. Chernobyl Accident (12-year delay)
 - b. Fukushima Accident (3.5-year delay)

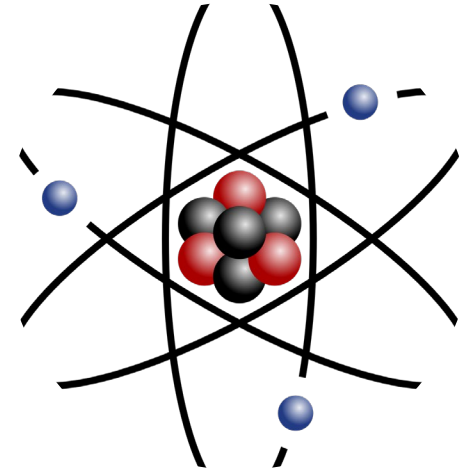


Conclusions

$^{3}\text{DXCT}$ of corals can be used for age dating and reconstruction of past sea surface temperature.

Radiocarbon (^{14}C) of fossil corals gives us a glimpse about past sea-level changes.

^{129}I in corals can be used to reconstruct impacts of nuclear activities.



ReforeStable Carbon-Plus:

Stable Isotopes-Based Evaluation of the Climate Change Mitigation Potential, Recovery Status, and Resilience of Reforested Soils Under the National Greening Program

Food Authenticity and Traceability Using Isotope Techniques Program

Project 1: Organic Products and Halal Food
Authenticity Testing Using Isotope and Nuclear-
Based Methodologies
Mr. Raymond J. Suggang, PNRI

Project 2: Adulteration Detection and
Fingerprinting of **Philippine Honey** Using Stable
Isotopes (Phase 2)
Dr. Angel T. Bautista VII, PNRI

Project 3: Tracing the Geographic Origin of
Philippine Carabao Mango Through Chemoisotopic
Fingerprinting
Mr. Gerald Dicen, PNRI

Project 4: Stable Isotope Profiling of Coffee and
Cacao Beans in the Philippines by IRMS and XRF for
Origin Identification
Dr. Emmanuel Garcia, DLSU

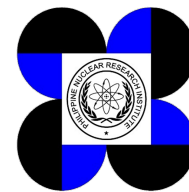


Two (2) Years

Year 1: 31,570,391.32

Year 2: 14,408,766.15

Total: 45,979,157.47





Thank you very much!