Extent of man-made radioactivity from 1950's nuclear weapons testing at the Montebello Islands Western Australia.

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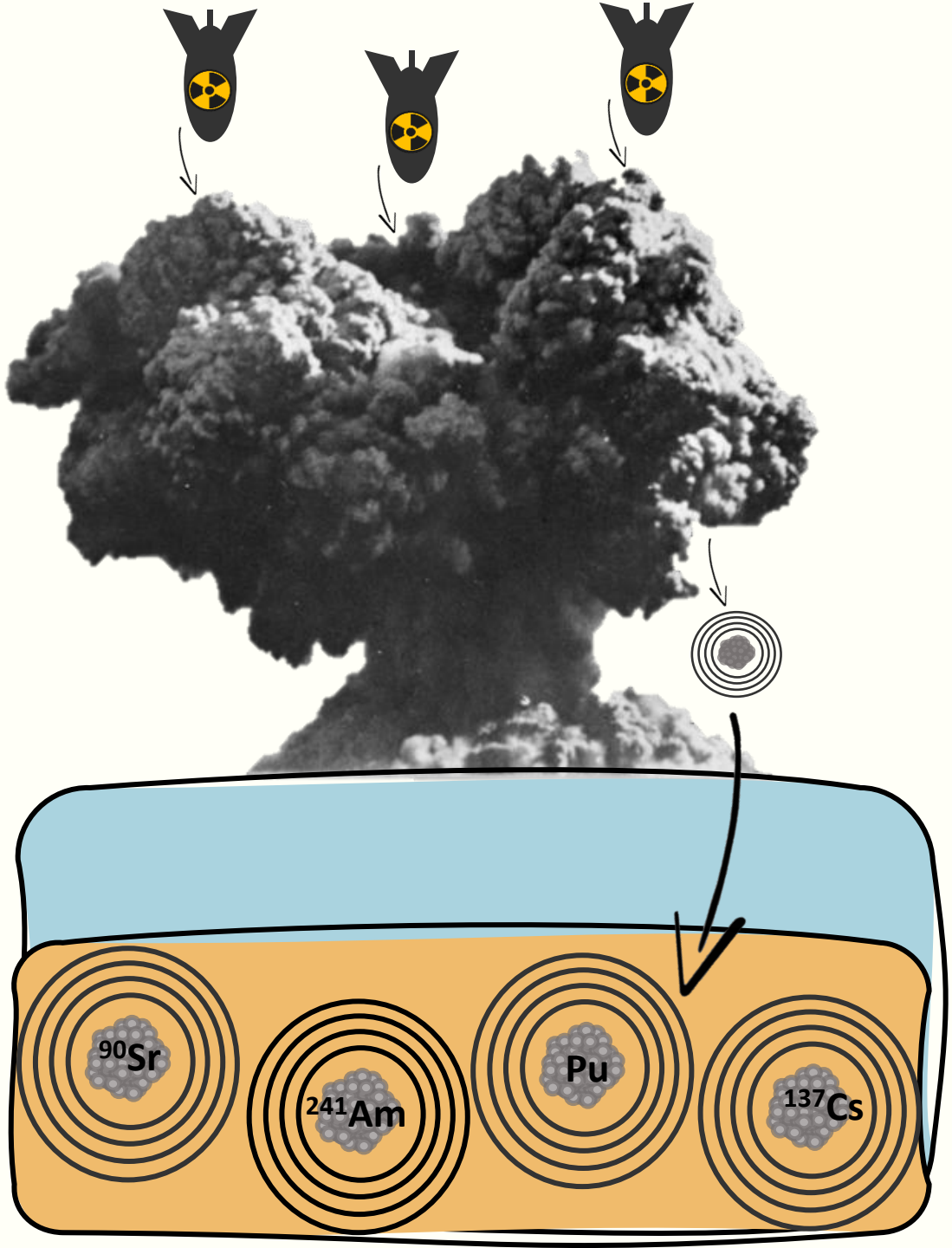
JUSTIFICATION

- Little known about man-made radionuclide persistence in marine sediments of this nuclear legacy site[1]
- Interested in radionuclides that are particle reactive and have long half lives
- Type and degree of use of the marine park is changing[1]

	^{90}Sr	^{137}Cs	^{241}Am	^{239}Pu
Half-life (yr)	29	30	432	24, 100



[1] Johansen, M. P., et al., 2019 *Plutonium and other radionuclides persist across marine-to-terrestrial ecotopes in the Montebello Islands sixty years after nuclear tests,* Sci. Total Environ.

AS THE REGION IS BECOMING MORE POPULAR..

Coral Expeditions Gearing Up For A Bumper Adventure Season In 2022

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After a bruising time dealing with the pandemic this year, Coral Expeditions is gearing up for a bumper expedition season in 2022 with new voyages to Tasmania and the Coral Coast in Western Australia.

Coral's popular Kimberley sailings which kicks in in March to October next year are almost sold out with "a few vacancies" in March and October, commercial director Jeff Gillies told *Cruise Passenger.*

"Forward bookings have been exceptional for all three vessels, *Coral Geographer, Coral Adventurer* and *Coral Discoverer.* We will have the biggest inventory and biggest deployment in the Kimberley when the season starts in March till October next year.

Pilbara RED Grants to diversify the regional economy

Friday, 4 March 2022

- Five Pilbara projects to receive $707,000 in Regional Economic Development (RED) Grant funding
- McGowan Government's RED Grants supporting local capability and diversifying economies in regional WA

Five Pilbara organisations will receive more than $700,000 for projects that diversify regional economies under round four of the McGowan Government's Regional Economic Development (RED) Grants program.

The RED Grants program is a McGowan Government initiative that is investing $40.8 million over seven years in projects to stimulate diversification and local capability in Western Australian regions.

Round four of the Pilbara RED Grants will deliver $707,000 to five projects that build on the region's strengths in tourism, creative and cultural industries, and business and technological innovation.

Kuarlu Marine Charters will use a $250,000 RED grant to establish a marine charter operation in Onslow with a focus on engaging and training local youth while providing tourism experiences including sightseeing, fishing, whale watching, trips to the Mackerel and Montebello Islands, and cultural tours.

Output aims

"Practical"

- Useable and tangible information on high activity areas for stakeholders
  - DBCA, tourists, charter companies, research scientists
- Contribution to literature and development of knowledge about radionuclide persistence in marine environments and nuclear legacy sites

"Theoretical"

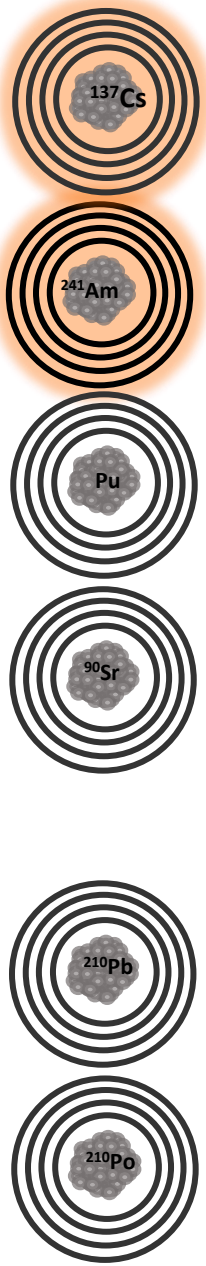
- To better understand the behaviour and distribution of radionuclides in the environment
- To understand if there is a risk to biological life
  - Becomes of greater importance to understand as the use of area changes with time…

AIMS

1. WHAT is the spatial distribution of man-made radionuclides in the marine surface sediment of the region?

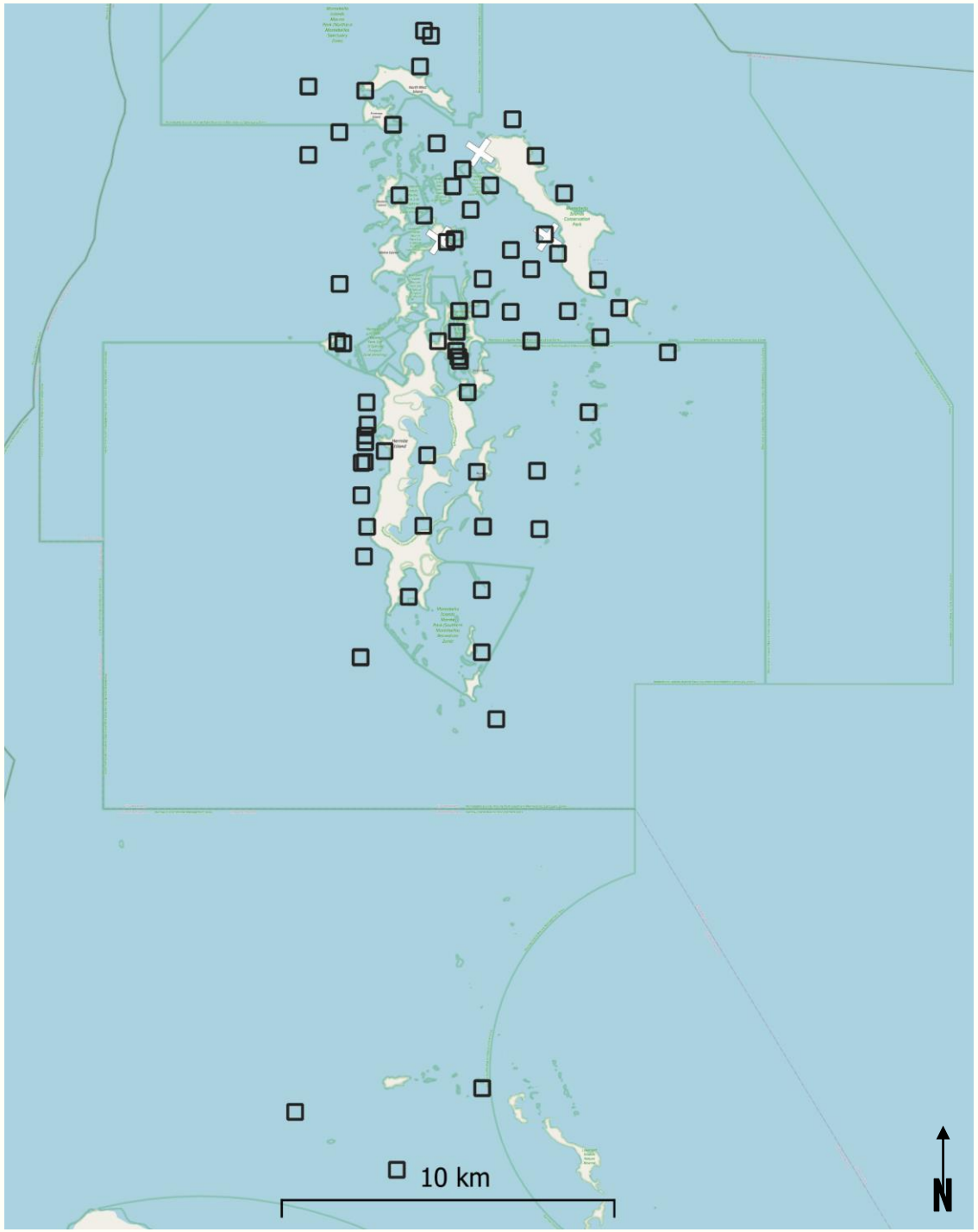
2. WHAT is the vertical distribution of anthropogenic and natural radionuclides in sediment cores taken from different environments and locations within the region?

-WHAT DOES THIS DISTRIBUTION SUGGEST IN TERMS OF TRANSPORT OF RADIONUCLIDES OVER TIME?



SAMPLING DESIGN

- Fieldtrip to the Montebello Islands in July 2020
- Collection of surface marine sediments: ‘grabs’
- Systematic grid sampling program to delineate from detonation sites but following the reported north-west plumes
- Collection of marine and mangrove sediment cores



METHODOLOGY

- Identified and quantified gamma emitting ^{241}Am and ^{137}Cs
  - ^{241}Am is the decay product of ^{241}Pu; indicator of Pu presence
  - ^{137}Cs is a fission product from the detonations

68 samples counted by gamma spectrometry

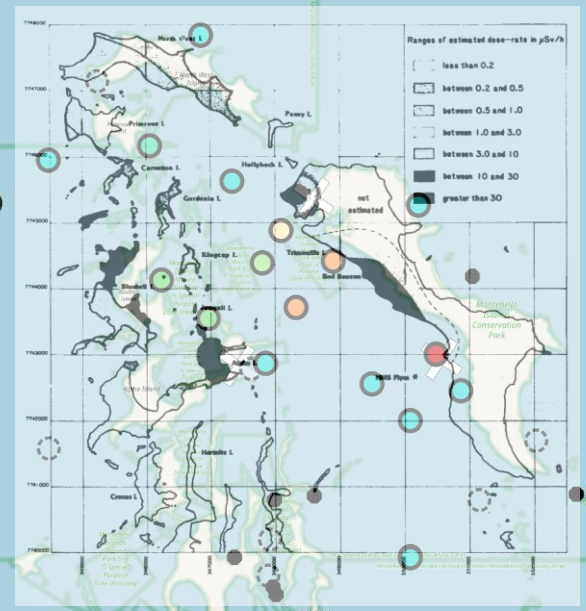
21 with ^{241}Am quantified above minimum detectable activity (Max MDA 1.6 Bq/kg, Min MDA 0.3 Bq/kg)

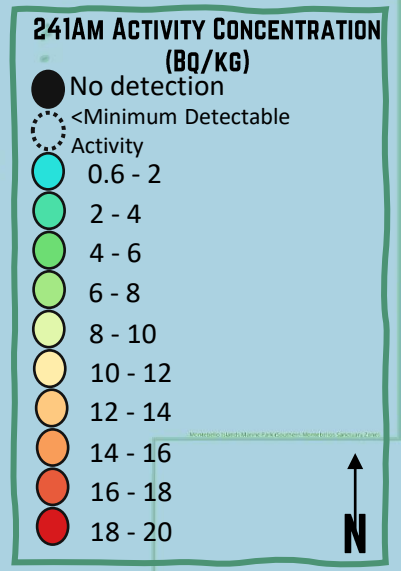
Results

- Surface sediment samples with quantifiable ^{241}Am activity concentrations follow the original plume north-west direction from the detonation sites

BUT

- One of the highest ^{241}Am activity concentrations was observed in the Lowendal Islands far south of the detonation sites or plume trajectories

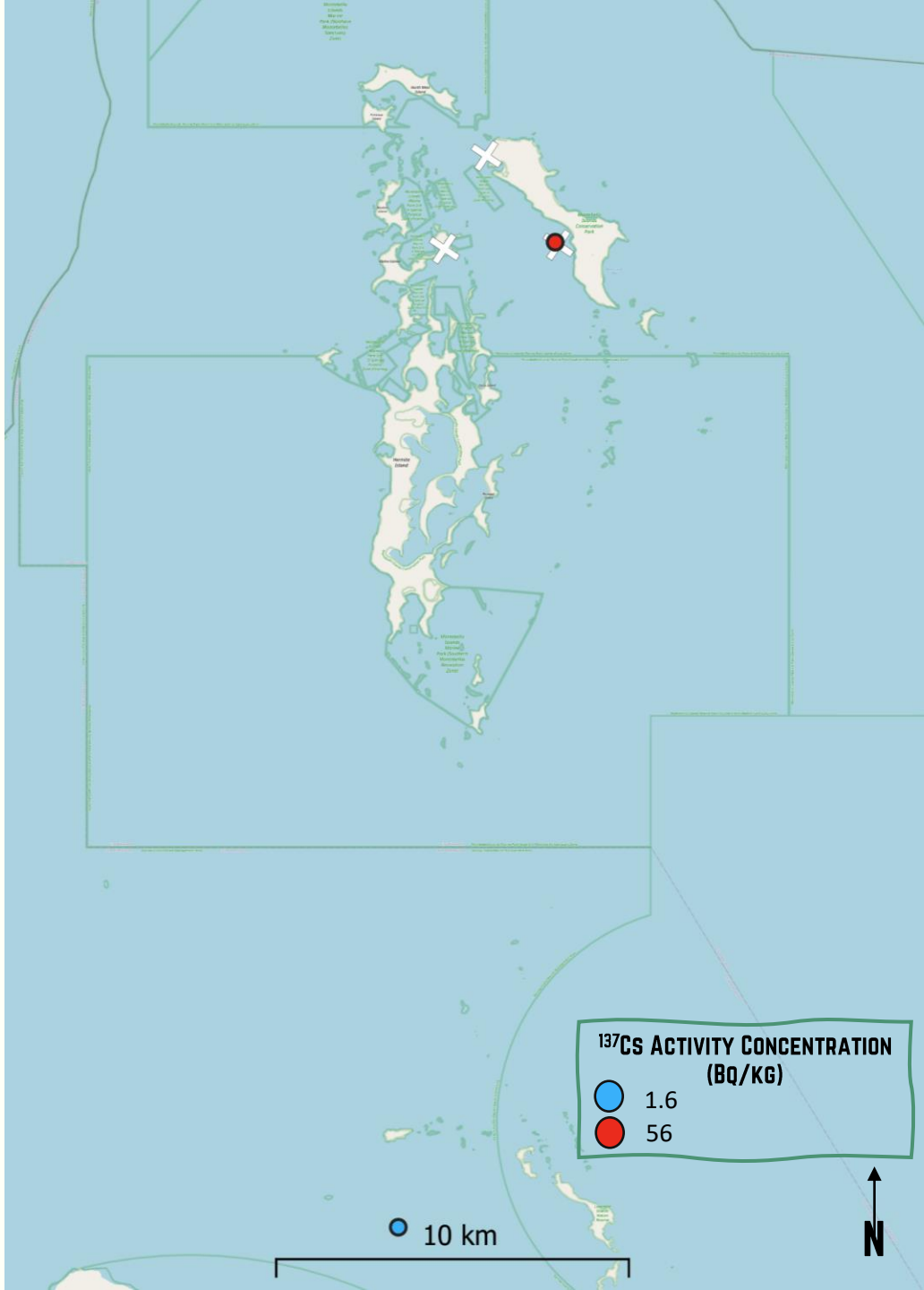




Survey overlay from Moroney, J. & Cooper, M. 1982. Australian Radiation Laboratory, Commonwealth Department of Health

^{137}Cs

- Two locations with quantifiable ^{137}Cs activity concentrations
- Coincides with the locations with the two high ^{241}Am activity concentrations



Future directions

1. What is the spatial distribution of other radionuclides in surface sediment ($^{238, 239,240}$Pu and ^{90}Sr)?

2. Are the surface sediment radionuclide values representative of all sediment in the region?

3. Are the radionuclides being transported around the archipelago now, how have they moved in the past and will they migrate future?

Extent

- Alpha spectrometry for Pu measurement
- Accelerator mass spectrometry (AMS) for delineating samples that have levels too low for other techniques
- ICPMS & Cherenkov counting for ^{90}Sr

Transport

- ^{210}Pb dating for sedimentation rates
- Grain size and composition analysis
- AMS to identify signatures for each detonation: like a forensic fingerprint
- Vertical profiles and inventories of man-made radionuclides in sediment cores

In conclusion

- ^{241}Am and ^{137}Cs are present in the marine sediments of the archipelago 70 years after the initial detonations
- Concentrated near the detonation sites and in the north-west that falls within the original fallout plumes trajectories
- There is also a single location in the southern Lowendal Islands that also shows high ^{241}Am and low ^{137}Cs activity concentrations
- Suggests transport of the radionuclides has occurred at some point

- Quantification of remaining man-made radionuclides hypothesised to be present is necessary
- Identification of transport mechanisms and vertical profiles of radionuclides below surface sediment is necessary

Acknowledgments

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