In Search of the Source: Oil Fingerprinting in African Penguins (*Spheniscus demersus)*

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Environment Canada Environnement Canada

SANCCOB
Southern African Foundation for the Conservation of Coastal Birds

Agenda

- Purpose of the Study
- Background
- Materials & Methods
- Results & Discussion
- Challenges to Oil Analysis
- Conclusion

Purpose

- Answer unresolved questions
- Oil fingerprinting as a valuable tool:
  - Support enforcement
  - Determine source
  - More than one spill?
  - Type of oil to narrow vessel search
  - Veterinary Medicine & rehabilitation:
    - Type of oil: treatment, triage
    - Proper collection & storage

Background

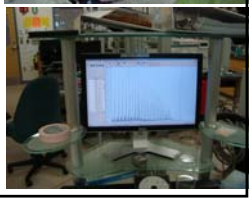
- African Penguin (*Spheniscus demersus)*
  - Predation, vulnerability, threats
- IUCN Red List → Vulnerable
- Definitions:
  - Heavy fuel oil (HFO)= bunker + diesel
  - Bilge oil = HFO + lubricating oil
  - Weathering

Materials & Methods

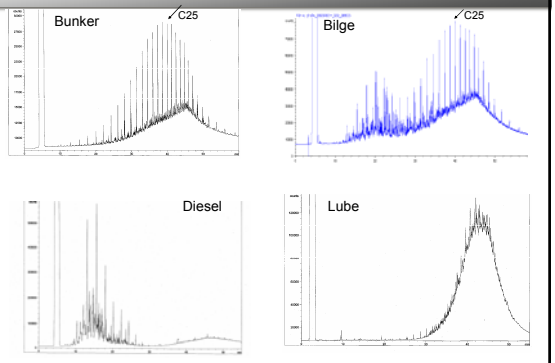
- Oil extraction by SANCCOB
- Gas Chromatography
  - flame ionization detection (GC-FID):
    - overall picture, screening
  - mass spectrometry (GC-MS) :
    - molecular weight, ratio, comparison
- Diagnostic ratio analysis: looking at biomarkers
  - Stable constituents, biomarkers

Results & Discussion

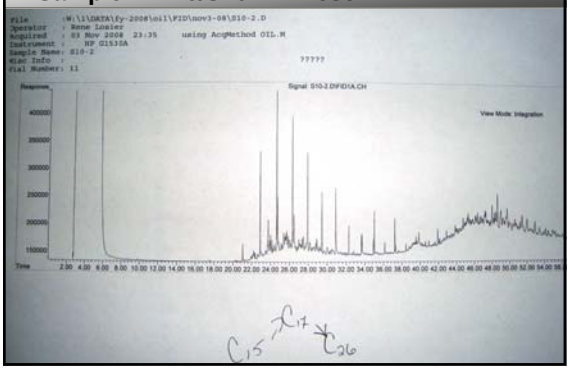
- 170/171 samples:
  - Weathered bunker
  - Weathered Crude, or
  - Weathered Heavy Fuel Oil
- 1/171 samples:
  - Diesel
- May – October (Winter)
  - Currents, foraging, ships
- Chromatogram examples



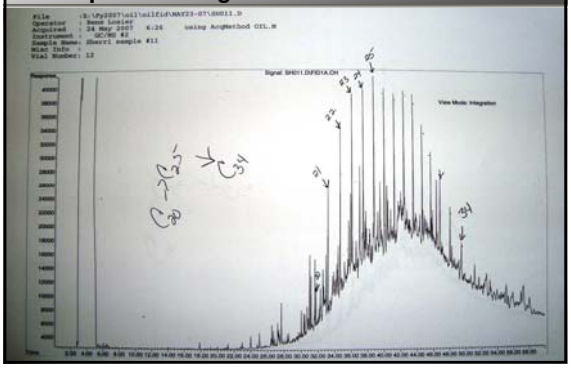
Results & Discussion
Chromatogram: Overview of GC/FID Profile



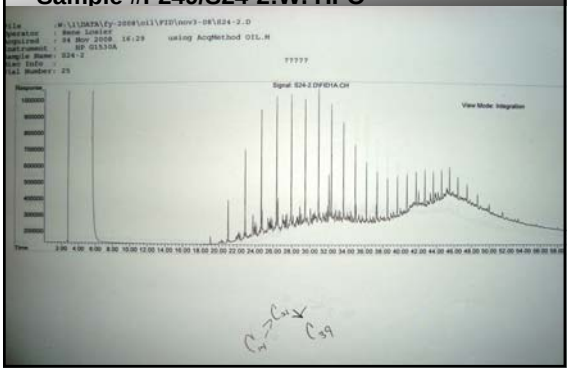
Results & Discussion
Sample #F246/S10-2: Diesel



Results & Discussion
Sample #11: Bilge

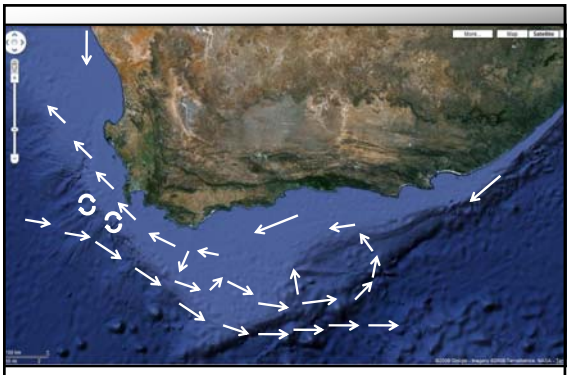


Results & Discussion
Sample #F249/S24-2:W. HFO



Results & Discussion

- Samples submitted: 171
- Samples screened: 171
- Samples compared: 79
- Unique oil samples identified: 25
  - Unique source, no temporal distribution 21
  - Same source, different time (groups 1-4) 4



20 samples → Identical
Time : Jun/Jul 2003; Jan 2007; Sept 2007
Location: majority (12): Boulder's Beach & Betty's Bay
Weathered bunker, crude, HFO

Group 1

13 samples → Identical
Time (winter) : July 2003, Aug 2005, Aug 2006, Aug 2007
Location: majority (9): Dyer Island & Betty's Bay
HFO confirmed (1), Weathered bunker, crude, HFO

Group 2

7 samples → Identical
Time : Jun 2003, Aug 2007
Location: majority (4): Dyer Island
Weathered bunker, crude, HFO

Group 3

6 samples → Identical
Time : June 2005, Mar 2006, Aug/Sept 2006
Location: majority (5): Port Elizabeth, Bird Island
HFO confirmed (5). Weathered bunker, crude, HFO

Group 4

Remaining **21 Unique Sources**
(note: 5 unique sources have more than 1 location)
No temporal distribution
Red dot = 1 sample, 1 location
Other colour dots = Multiple samples, multiple locations, same oil
Weathered bunker, crude, HFO (20): Diesel (1)

Results & Discussion: International Comparison

- South America: Magellanic penguins
  - 50% coastal vessels
  - 50% oceanic vessels*

- Canada: Seabirds
  - Almost all oceanic vessels*

* *Profile of African Penguin oil analysis*

Challenges to Oil Analysis

- ✓ Cost
- ✓ Reactive vs proactive
- ✓ Few labs
- ✓ Unrecovered samples

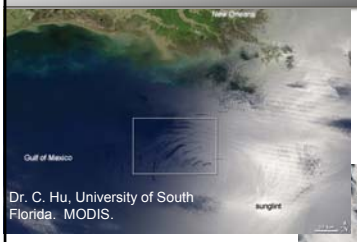
- ✓ Adequate quantity
- ✓ Interference from bird
- ✓ More than one source
- ✓ Time & weather

Conclusion

Sources of Oil

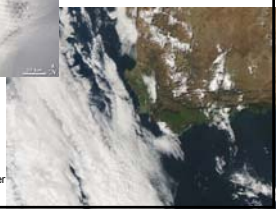
- 20 / 25 → Ocean-going vessel: Bilge?
- 1 / 25 → Ferry / Fishing vessel
- 4 / 25 → Natural Seep, Sunken vessel, Platform spill?

Conclusions



Dr. C. Hu, University of South Florida. MODIS.

- Investigate into known wrecks, seeps, geological data
- MODIS: Sunglint



Moderate Resolution Imaging Spectroradiometer (MODIS). Aug 6/09. South Africa.

Thank you

Environment Canada / Environnement Canada

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Southern African Foundation for the Conservation of Coastal Birds
Getting our birds back on their feet

Art Cook
René Loisier

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Nola Parsons