

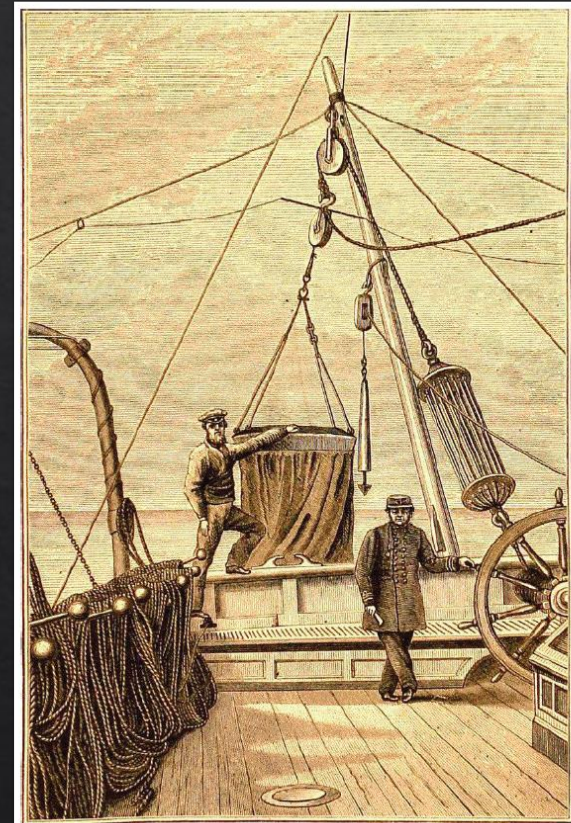
# Abyssal and hadal fishes of the Pacific Ocean: baited lander studies from three hadal trench systems

Thomas Linley

[Thom.linley@ncl.ac.uk](mailto:Thom.linley@ncl.ac.uk)

# The 'era of exploration', the first wave of ultra-deep exploration

- ◆ The H.M.S. *Porcupine* collected the first abyssal samples in 1869
- ◆ First hadal fish in 1901
  - ◆ Princess-Alice
  - ◆ Ophidiid (cusk-eel)
    - ◆ *Holcomycteronus profundissimus*
- ◆ Widely spaced trawling and dredging stations
- ◆ Until the middle of the 20<sup>th</sup> Century, geographically wide expeditions collected samples from abyssal and hadal depths



1)



# The 2<sup>nd</sup> wave of ultra-deep exploration

- ◇ From the middle of the 20<sup>th</sup> Century until now, the data collected are predominantly visual
- ◇ 1<sup>st</sup> wave
  - ◇ Physical samples
    - ◇ Potentially damaged
  - ◇ Doubt as to point of origin
- ◇ 2<sup>nd</sup> wave
  - ◇ None or few physical samples
  - ◇ Confidence in location
  - ◇ Natural appearance and behaviour

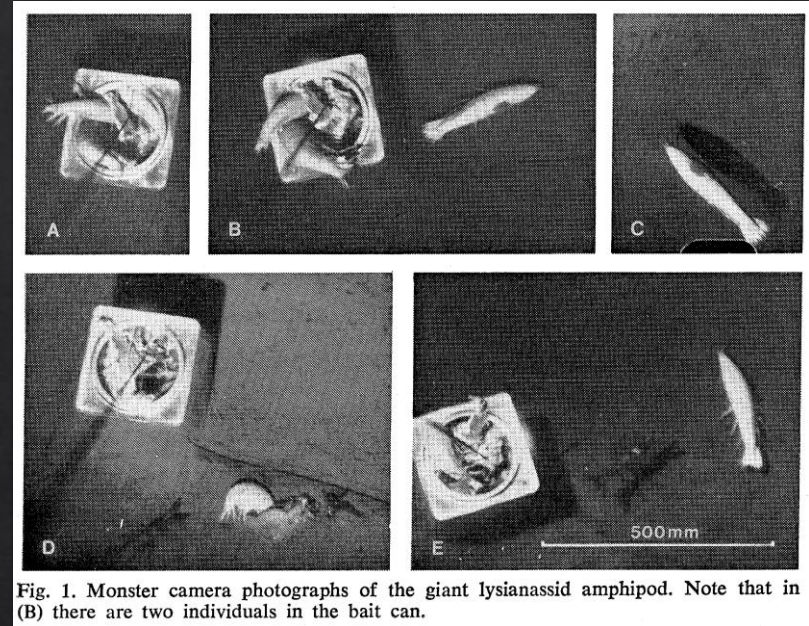
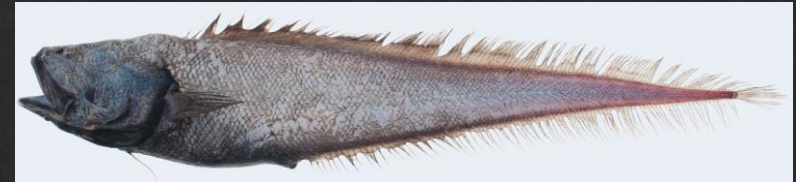
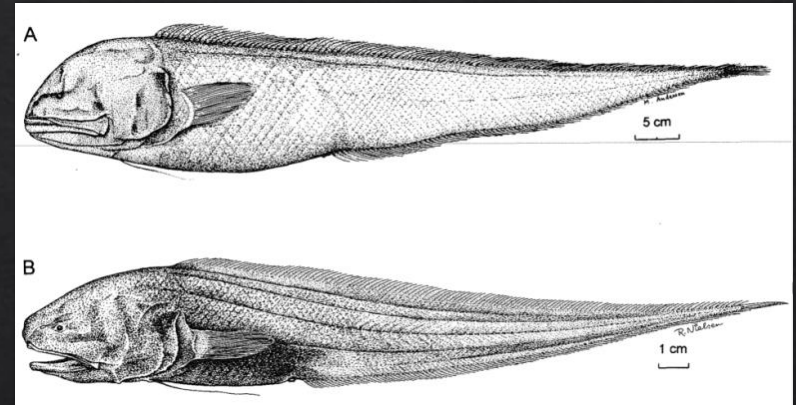


Fig. 1. Monster camera photographs of the giant lysianassid amphipod. Note that in (B) there are two individuals in the bait can.

# Very different data



3)



4)

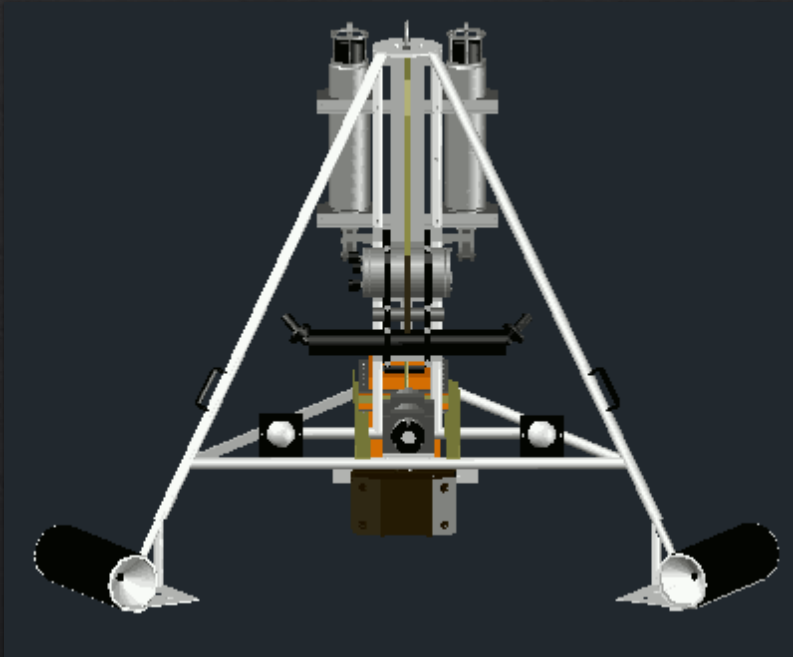


# Freefalling vehicles

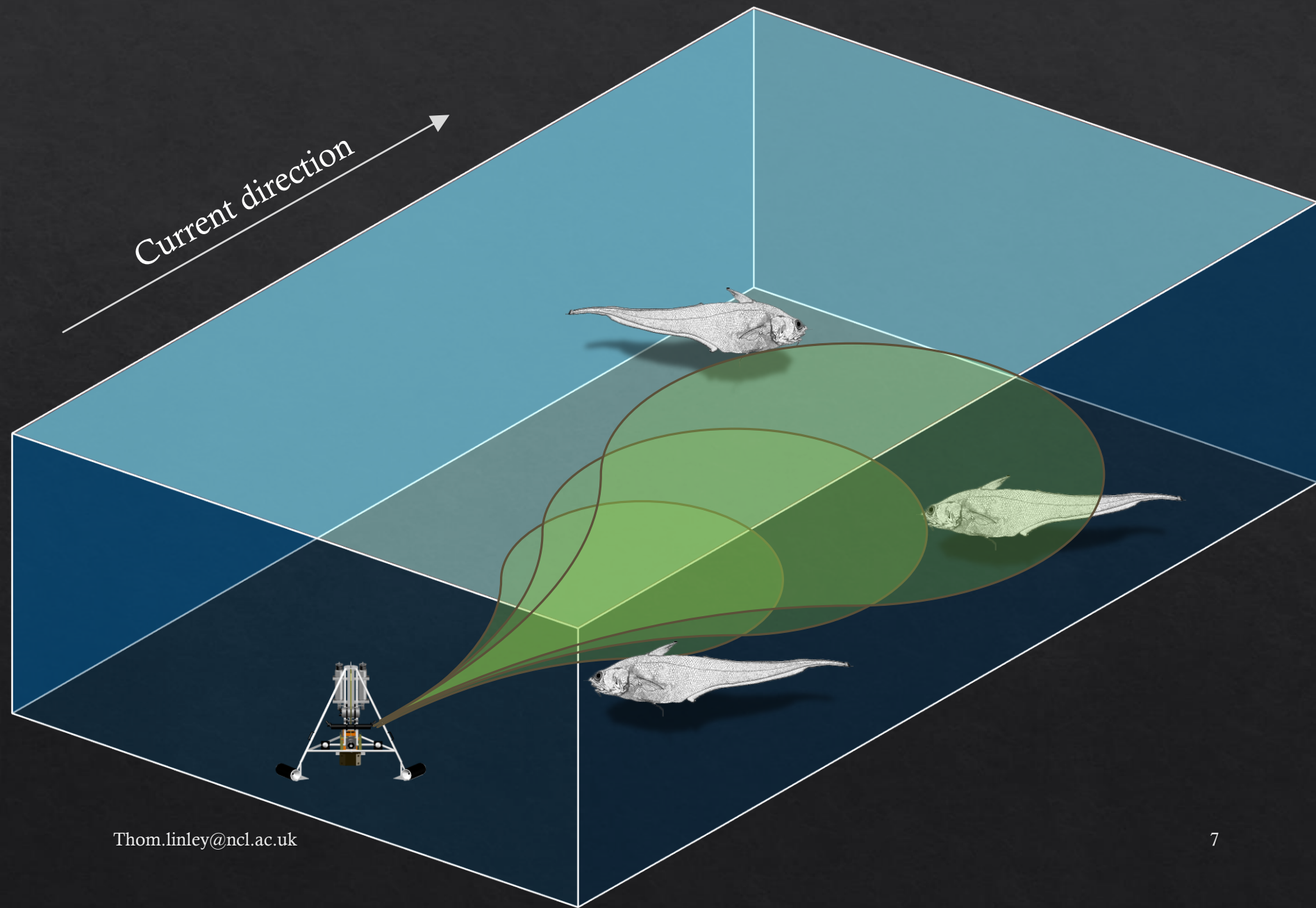
- ◇ With increasing depth, there is increasing cost
  - ◇ Equipment
  - ◇ Size of vessel
  - ◇ Time
  - ◇ Risk
- ◇ Landers less prone to these costs than other methods



# Scientific payload



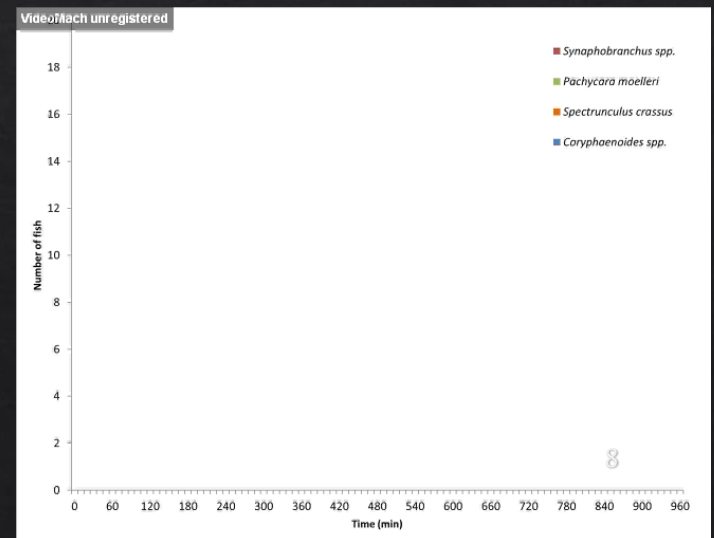
- ◇ Sensors
  - ◇ CTD
  - ◇ RCM
- ◇ Water samples
- ◇ Traps
- ◇ *In situ* experiments
- ◇ Camera systems
  - ◇ Commonly baited



# Baited lander data

- ◇ As the odour plume disperses fish are gathered from an increasing area
- ◇ They are seen to increase in numbers, feed and then disperse as the bait is consumed
- ◇ While possible, calculating population density can be difficult
- ◇ Proxies for local fish density are often used
  - ◇ The maximum number reached
  - ◇ The time taken for the first fish to arrive
  - ◇ The rate of arrival
  - ◇ The % of frames

Thom.linley@ncl.ac.uk





# Future direction

- ◆ Lander systems settle on the seabed
  - ◆ Omitting the far larger pelagic habitat above
- ◆ Baited systems only gather 'bait-attending' species
  - ◆ Omitting the larger non-attending community
- ◆ Short term
  - ◆ Providing only a snapshot
- ◆ Potential future development lies in:
  - ◆ Pelagic
  - ◆ Long term
  - ◆ Intelligent

# References

1. Thompson, W., Wyville), C. W. (Charles, Carpenter, F., Jeffreys, J. G., Thomson, C. W. and Carpenter, W. B. (1873) 'The depths of the sea: an account of the general results of the dredging cruises of H.M.S.S. "Porcupine" and "Lightning" during the summers of 1868, 1869, and 1870, under the scientific direction of Dr. Carpenter, F.R.S., J. Gwyn Jeffreys, F.R.S., and Dr.' New York; London: Macmillan and co., pp. 1–626.
2. Hessler, R. R., Isaacs, J. D. and Mills, E. L. (1972) 'Giant amphipod from the abyssal Pacific Ocean', *Science (New York, N.Y.)*, 175(4022), pp. 636–637.
3. Dianne J. Bray, *Bassozetus robustus* in Fishes of Australia, accessed 16 Nov 2016, <http://fishesofaustralia.net.au/home/species/3012>
4. Nielsen, J. G. and Merrett, N. R. (2000) 'Revision of the cosmopolitan deep-sea genus *Bassozetus* (Pisces: Ophidiidae) with two new species', *Galathea Report*, 18, pp. 7–56.
5. Eagderi, S., Christiaens, J., Boone, M., Jacobs, P. and Adriaens, D. (2016) 'Functional morphology of the feeding apparatus in *Simenchelys parasitica* (Simenchelyinae: Synphobranchidae), an alleged parasitic eel', *Copeia*, 104(2), pp. 421–439.
6. Dunn, M. R., Griggs, L., Forman, J. and Horn, P. (2010) 'Feeding habits and niche separation among the deep-sea chimaeroid fishes *Harriotta raleighana*, *Hydrolagus bemisi* and *Hydrolagus novaezealandiae*', *Marine Ecology Progress Series*, 407(May), pp. 209–225.

# Thank you

- ◊ Thanks to:
  - ◊ HADEEP and HADES projects
  - ◊ MASTS
    - ◊ PhD funding
    - ◊ Post Doctoral and Early Career Researcher Exchanges Fellowship
  - ◊ Schmidt Ocean Institute
    - ◊ And the crew of the RV *Falkor*
  - ◊ NSF
    - ◊ And the crew of the RV *Thomas G. Thompson*
  - ◊ NIWA and Te Papa
    - ◊ And the crew of the RV *Kaharoa*