Ship of Opportunity Sampling of Lower Trophic Levels

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In this presentation:

• Traditional CPR sampling

• Pros and cons of SoOp sampling & the CPR approach

• Adding value to the CPR
  • Additional variables
  • The CPR as a platform

• Operational biological oceanography?
What is a CPR?

• A robust device for collecting surface plankton over large spatial scales

• capable of operating at high speeds (>20 knots)

• needs a minimum of attention

• designed for ships of opportunity
Designed by Alister Hardy in the 1920’s
An internal cassette fits into the towing body

Pre-loaded with filtering mesh and wire on a fusee to drive the uptake spool
The CPR Survey today
CPR surveys, 1931 to 2011; ~ 1 million samples
Pros and Cons: (note that limitations of the methodology won’t be discussed here, too big a topic, but see literature)

+ Cheap!
  + particularly important for remote ocean regions
  + can tailor analysis to match funding.
+ Reliable
+ Internally consistent
+ Other instrumentation can be added (see later)
+ Sample archive for future studies

- Sample analysis is labour intensive
- Lack of control over timing and location
- Liaising with ships
  - low on their priority list
  - discrepancies with info.
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Examples of route consistency

Pacific survey, north-south transect.
53 separate transects, 2004-2012
High repeatability

Pacific survey, east-west transect.
33 separate transects, 2000-2012
Lower repeatability
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Example of Ship’s log conflict

CPR with a temperature sensor fitted deployed in N Atlantic. Arrows mark ship’s log times of shoot and haul – first 2 agree with temperature record, but 4 hour discrepancy with 2nd shoot. What to do?
The CPR as a platform – adding instrumentation

Temperature loggers (most basic)
CTD-F (more expensive)
Temperature distributions of two example taxa

Sub-arctic, *Eucalanus bungi*

Warm water, *Clausocalanus sp.*
Cumulative abundance of warm-water copepods each year, south to north, Mar-Sept, for oceanic region

Updated from Batten & Walne (2011), Journal of Plankton Research
Chlorophyll from the CTD

June 2005

Transect through 2 eddies
Bird/mammal observers

- logistically more complex (e.g. diversion insurance, port of departure/arrival)
- more expensive
Macro-ecology of plankton–seabird associations in the North Pacific Ocean

Zooplankton Abundance (all taxa)

Seabird Density (all taxa)
Water and Microplankton Sampler (WaMS). Aimed at smaller size-fraction (nano and pico) plankton community. Flow cytometry, Molecular probes and barcoding, Harmful Algal Bloom microarrays.
WaMS results

Samples have been analysed for HAB species

Diversity of taxa (partial 18S-ribosomal marker) from WaMS: Feb-May 2011

- Acantheria
- Amoebozoa
- Apicomplexa
- Apuzozoa
- Archaea
- Cercozoa
- Chlorophyta
- Choanoflagellata
- Ciliophora
- Cryptophyta
- Dinophyceae
- Fungi
- Haptophyceae
- Ichthyosporea
- Katablepharidophyta
- Metazoa
- Polycystinea
- Rhodophyta
- Stramenopiles
- Streptophyta
- Telonema
- Environmental
Can we get to operational biological oceanography?

Two approaches:

1. Pacific – process a subset quickly (25%)
   - Preliminary data (not QC’d) available within 2 months

2. Atlantic – process a single transect quickly
   - Analysis of a short transect completed within 16 days (but needed someone to push it along).
Comparison between subsample and final result

Mesozooplankton Biomass

For a large area and a summary index, the result is very good
The capabilities for a multi-disciplinary, cost-effective sampling program exist.
Further information can be found at:

[www.globalcpr.org](http://www.globalcpr.org) (GACS)

[www.sahfos.org](http://www.sahfos.org) (CPR parent organisation)

[www.pices.int/projects/tcprsotnp/default.aspx](http://www.pices.int/projects/tcprsotnp/default.aspx) (N Pacific survey and CTD data)