



# Data for paua stock assessment: past, present and future

1. Data requirements for stock assessment
  - Data requirements for management
2. Inventory of available data
  - Spatial scale
3. Finer scale reporting: PCELR vs CELR
4. Future directions for paua commercial fishery data
  - The need for fine scale data collection
  - Opportunities for industry

## Data requirements for stock assessment/management

- Removals by the fishery
  - Catch weight
  - Catch structure (e.g. size distribution)
  
- Abundance index
  - Surveys (fishery independent)
  - CPUE – commercial catch-effort data (fishery dependent)
  - Hybrid schemes (e.g. fishers collecting survey-like data)
  
- Biological data
  - Population structure (e.g. sex-ratio, size distribution)
  - Growth rates
  - Maturity

## Typical data sources for NZ paua assessments (1)

- Catch data (PAU7: 1974-)
  - QMS harvest returns (fishstock resolution only)
  - Catch-effort returns (estimated catch only)
  - Recreational/Customary/Illegal  
(potentially substantial, but poorly estimated)
  
- Abundance indices
  - Commercial CPUE (PAU7: 1983-)
  - Research diver surveys (PAU7: 1993, 1995, 1996, 1999, 2001, 2003, 2005)

## Typical data sources for NZ paua assessments (2)

- Length frequency data
  - Commercial shed sampling (PAU7: 1990-1994, 1998-)
  - Survey LFs (PAU7: 1990, 1992, ...)
- Growth data
  - Tag-recapture studies (PAU7: 4 datasets – different areas/times, high variability)
- Maturity data
  - Maturity at length (PAU7: 178 paua; seven sites; March, May 1994)

## Resolution of existing commercial fishery data

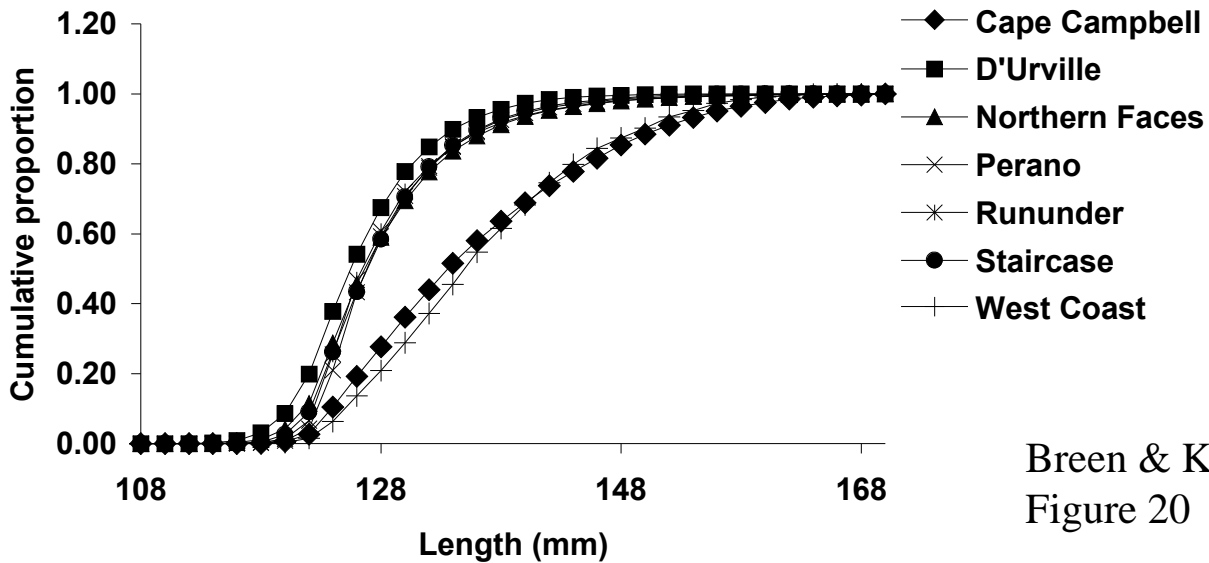
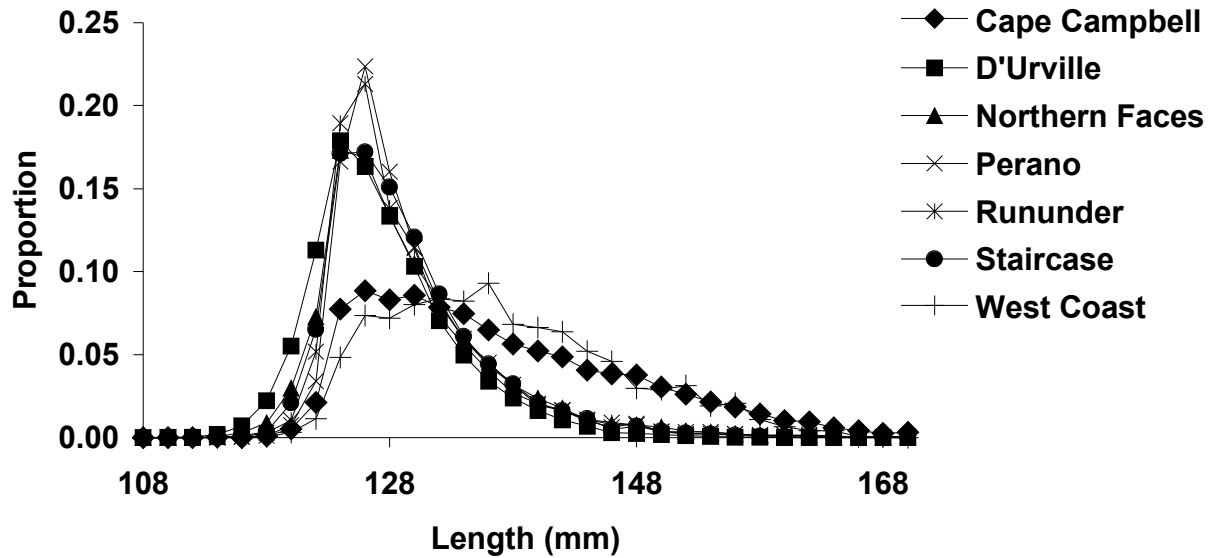
- Harvest returns/Landings data – recorded to fishstock level only
- Catch/Effort data:
  - CELR: general statistical areas, prior to Oct. 2001  
PAU7: 4 - 6 general statistical areas
  - PCELR: paua statistical areas, since Oct. 2001  
PAU7: 97 paua statistical areas
- Commercial length-frequency
  - Difficulties matching shed samples to particular catch locations: some data discarded
  - Aggregated to general statistical area or research strata for analyses in current assessments

## Scale of population processes

- Paua are essentially sedentary
- Short planktonic phase before settlement
  - limited dispersal, local variations in recruitment
- Local variation in growth rate and maximum size reached (e.g. stunted stocks)
- Localised effects of both environment and population density
- Effects of fishery are also localised, not homogeneous across the fishstock

## Effect of data limits on stock assessment

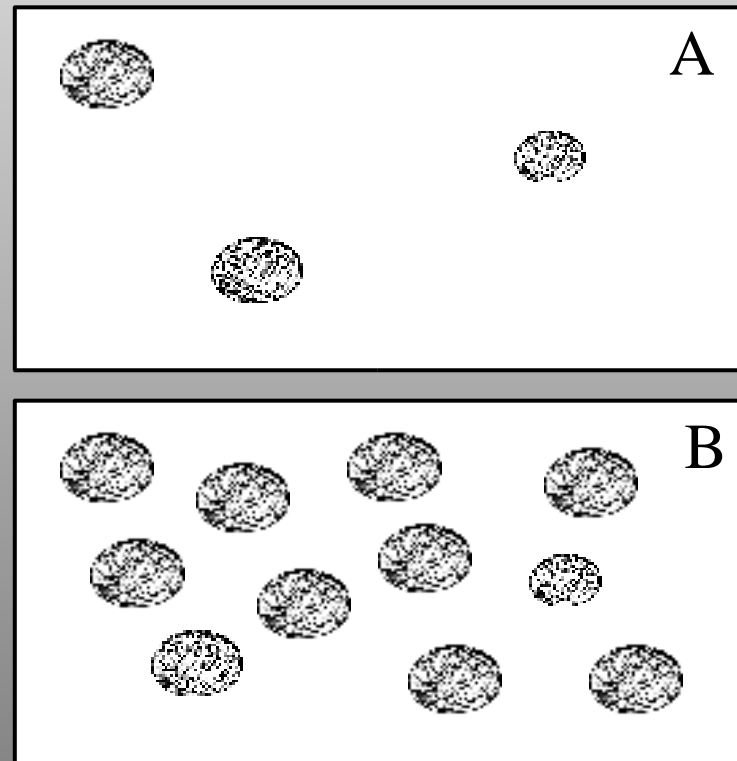
- The assessment model employed is often determined/limited by the available data
  - Type of data (e.g. catch vs. catch-at-age)
  - Resolution of data
- Current NZ paua stock assessments use “state-of-the-art” methodology but a fairly simple population model
- Model is probably wrong
  - No spatial structure, assumes homogeneity/mixing
  - Modelling the “average” process can mask important local dynamics



Breen & Kim (2003)  
Figure 20

## PCELR data: CPUE as an index of abundance

- CPUE = Catch per Unit Effort
- e.g. kilograms per hour of diving
- Measure of relative abundance rather than absolute density.
- Absolute abundance
  - Area A has 200 kg
  - Area B has 1000 kg
- Relative abundance
  - Area A yields 10kg/hr diving
  - Area B yields 50kg/hr diving



## Complications with CPUE indices

- We generally want to use CPUE as an index of abundance over time, but:
  - Abundance varies between areas
  - Catch rate varies between divers
  - Catch rate may vary with weather/sea state
  - Catch rate can vary seasonally (CPUE slide)
  - Dive sites are not randomly selected
  - Fishing patterns may mask changes over time (Serial depletion)
- CPUE *standardisation* is important
  - Uses catch-effort returns

## PCELR: HIGH RESOLUTION PAUA CATCH-EFFORT DATA

- PCELR forms replaced CELR forms in October 2001 for statutory reporting of Paua catch, effort and landings.
- Important information for CPUE standardisation

**Paua Catch Effort Landing Return** Form number **PCE**

1. If this is a NIL return for an entire calendar month, then you only need to provide one PCELR for that month. Otherwise, provide a separate return for each day (in which diving for paua, or landing of paua, or both, occurred).  
**Is this a NIL return for a month?**

Yes  → Enter that month (e.g. "FEB")  and year, **20**  → Go to section 5.

No  → Enter the date that this return is for:  /  / **20**

2. Enter the paua quota management area dived. Complete a separate return for each QMA dived. **PAU**

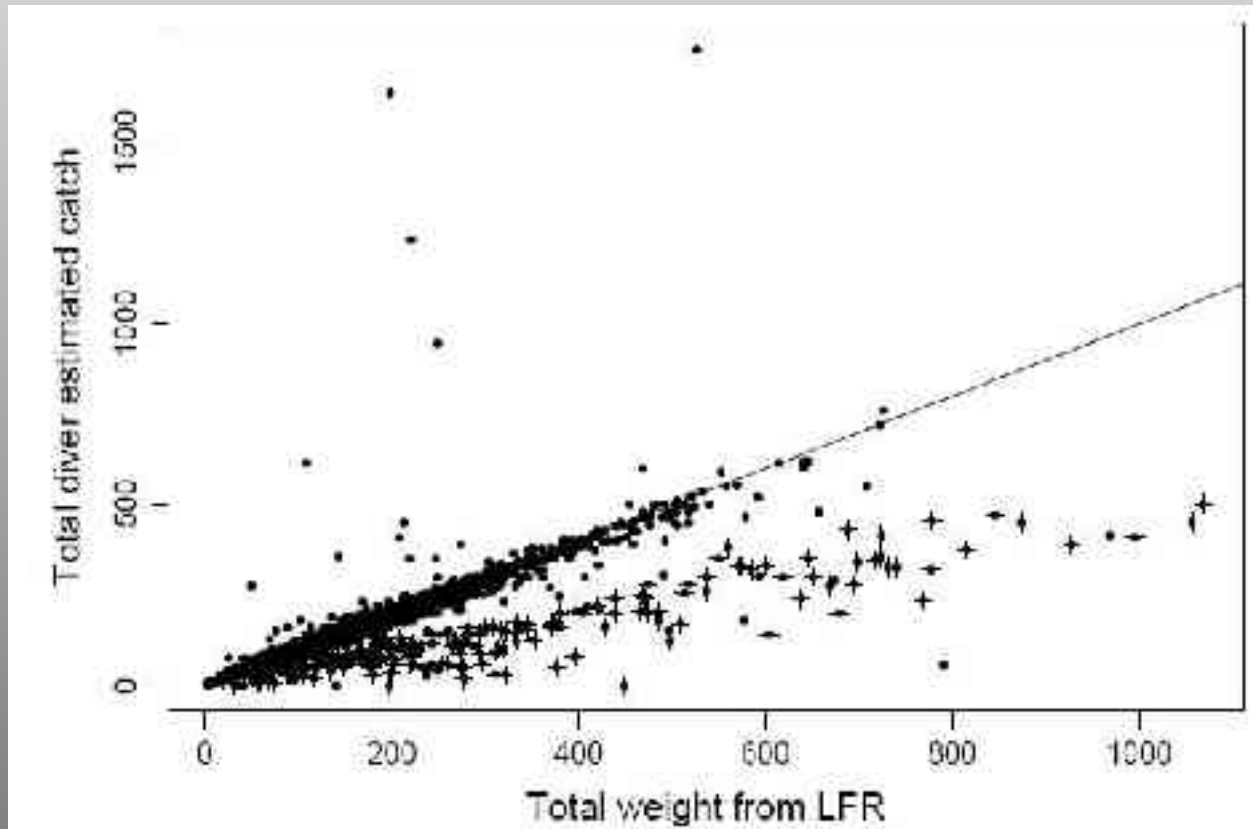
3. Complete a separate line for each diver and each paua statistical area that they dived.

Name of diver <small>first letter of first name, then first four letters of surname</small>	Paua statistical area	Time spent in water (h:mm)	Estimate (by fisher) of catch of blackfoot paua	Estimate (by fisher) of catch of yellowfoot paua	Diving conditions
.			.0kg	.0kg	
.			.0kg	.0kg	
.			.0kg	.0kg	
.			.0kg	.0kg	
.			.0kg	.0kg	
.			.0kg	.0kg	

Use an additional page if you run out of space when recording this day's diving.

## Problems with PCELR data (1): estimated catch

- Catch-effort reporting only requires *estimated* catch total
- Catches need not be weighed until they are landed
- Paua catch estimation is generally accurate



## Problems with PCELR data (2): diver identity

- Divers are identified on PCELR forms by first initial and first four letters of their surname: not necessarily unique (e.g. would not distinguish D. Mills and D. Miller)
- Not always completed with diver's real name: A.DIVE, B.DIVE
- For PAU7:
  - 417 diver IDs used from 2001-2002 to 2003-2004.
  - 207 associated with only one fishing event.
  - 324 diver IDs have less than 10 fishing events in the three years.

## Problems with PCELR data (3): catch splitting

- Aliases may be used when a group of divers do not keep their catch separately and instead split the daily total evenly between divers.
- Frequent occurrence:
  - In PAU7 (2001-2004) catch was evenly split on 818 of 4076 permit holder-days (~20%)
- Diver groupings could be used in CPUE standardisation, but may not be consistent over time:

<i>Fishing Year</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>	<i>I</i>	<i>J</i>
2001-2002	84				75	2				
2002-2003	128	1	17	1			1	1	1	116
2003-2004	117		11						1	116

## Problems with PCELR data (4): null vessel codes

- If no vessel was used in fishing “NONE” should be entered as a vessel code.
- If this is left blank these data are eliminated from the analysis, even if they are otherwise valid data.

## Conclusions

- Current data (catch, biological sampling) is not sufficiently fine scale
  - Limits assessment model
  - Limits management options
- Data collection needs to be at a sufficiently fine scale to:
  - Determine spatial variation in relevant biological processes
  - Support any future fine scale management that takes into account between area variations in productivity
- Assessments require data time series
  - Data collection must plan ahead, e.g. a decade
  - Not simply “what data do we need now?” but “what data might we need in the future?”
  - Prudent to assume fine-scale management likely in the future

## What resolution of reporting is required?

- *Minimum* required is likely scale of future management
- Actual level of biological variation can only be determined after fine scale studies
- Fine-scale data can be easily aggregated – it is much harder (often impossible) to separate coarse scale data
- Thus the ideal resolution would be recording of the lat/lon (i.e. GPS resolution) or each fishing event/biological sample
- NB scale of biological sampling should match scale of catch reporting

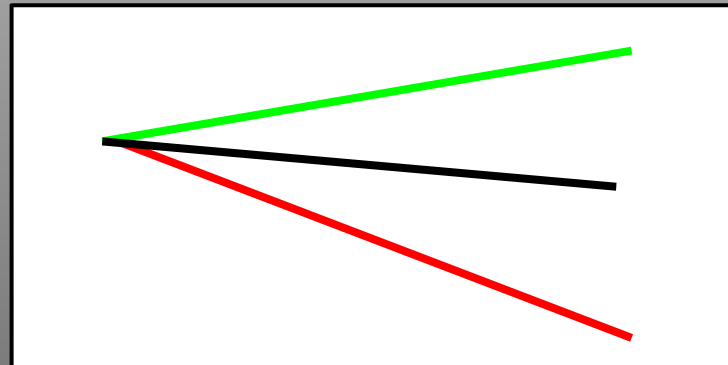
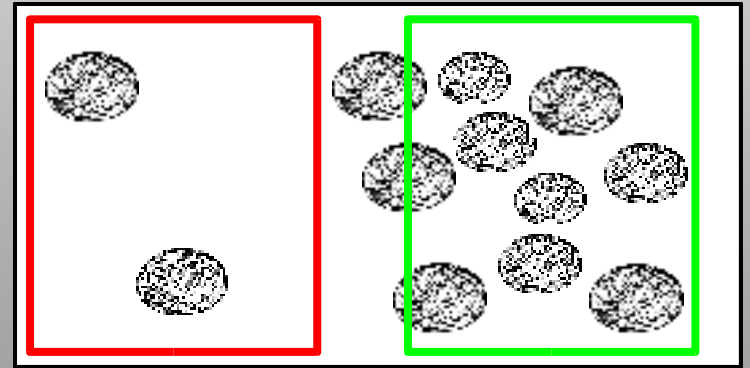
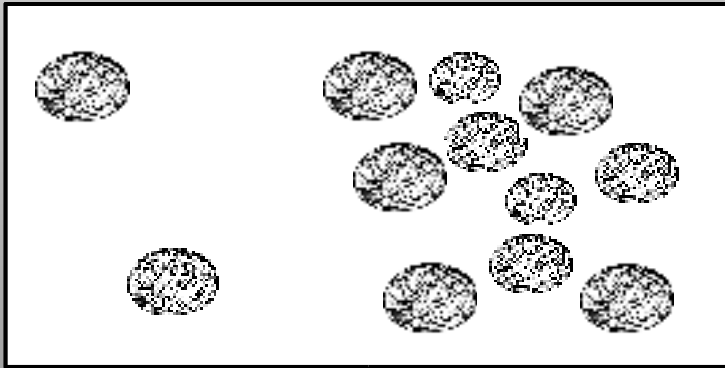
## Industry opportunities (1)

- Improvements are possible within the current data collection system
  - Ensure “estimated” catch is accurate
    - Weighing individual catches
    - Standard estimation procedures
  - Use consistent diver IDs
  - Avoid catch splitting if possible (possibility that PCELR could be adapted to indicate group fishing)
  - Ensure vessel code is completed
  - Work to ensure that shed samples can be identified with the correct catch location

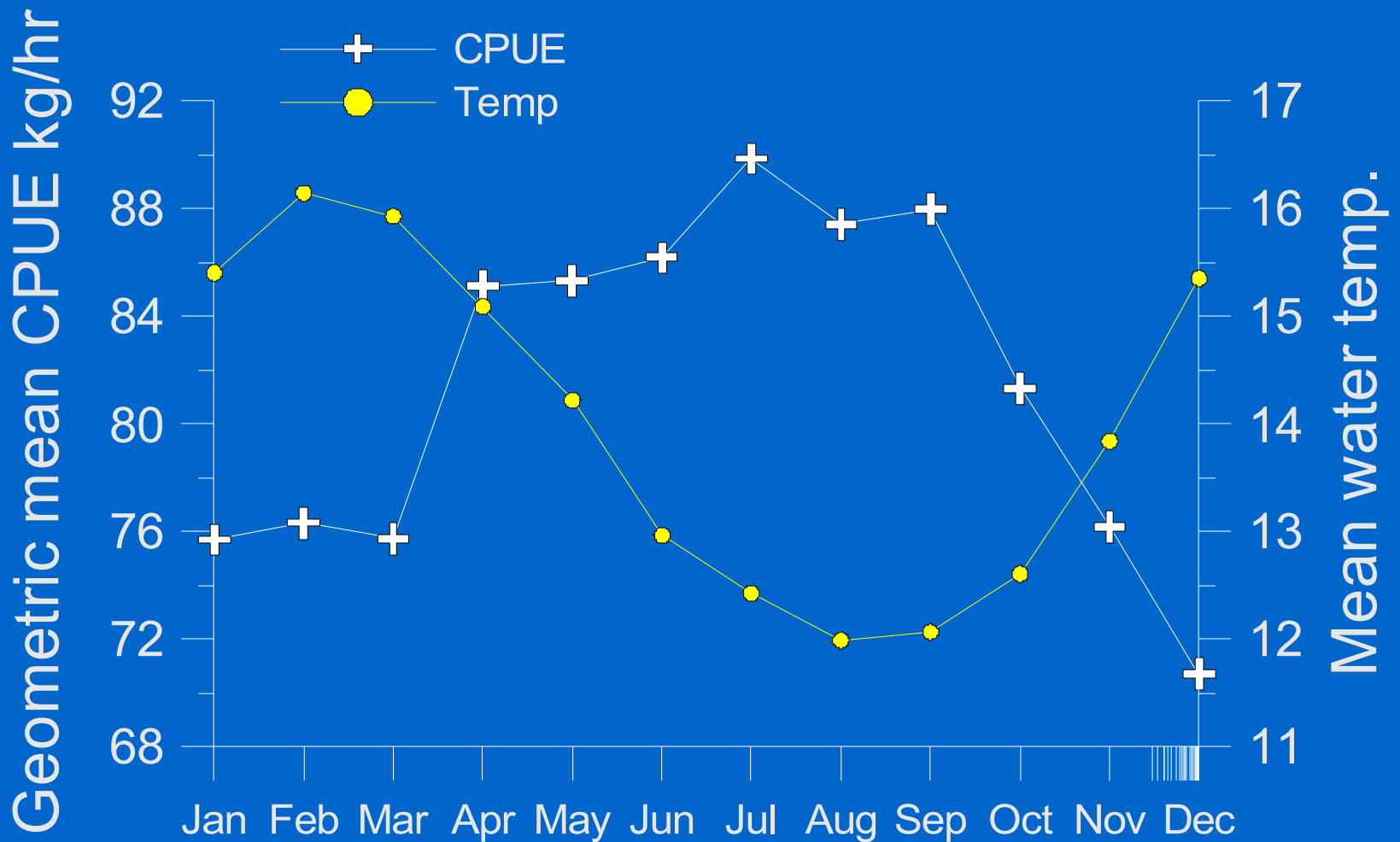
## Industry opportunities (2)

- Ensure catch reporting is at an appropriate scale
  - Are paua statistical areas sufficiently fine scale?
  - Is lat/lon reporting possible?
  - Fine scale reporting can be an industry (e.g. PAUMAC) initiative – do not have to wait for MFish lead.
- Fine scale, representative biological sampling
  - Clear opportunities for fishers to sample individual dive locations
  - Biological sampling by fishers has been very successful in NZ rock lobster fishery
  - Requires good management, and incentives to ensure samplign effort does not wane

# Serial depletion



(back)



Linked to - reproductive activity, seasonal flush in algae (decreased visibility/loss of space), day length, seasonality in arrival of new recruits, stock depletion

Thanks to Craig Mundy MRL University of Tasmania (back)