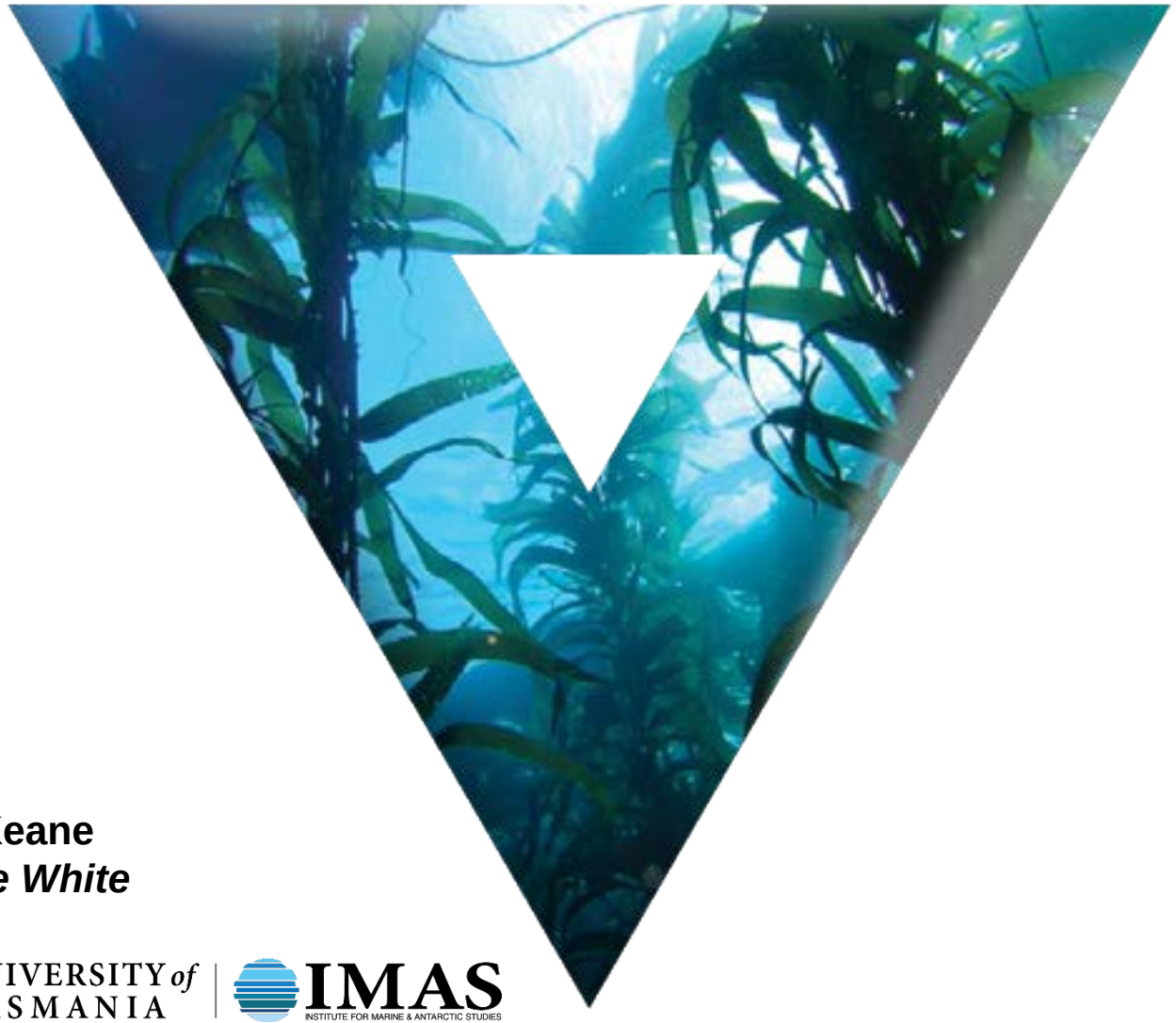
Urchin Research in Tasmania.



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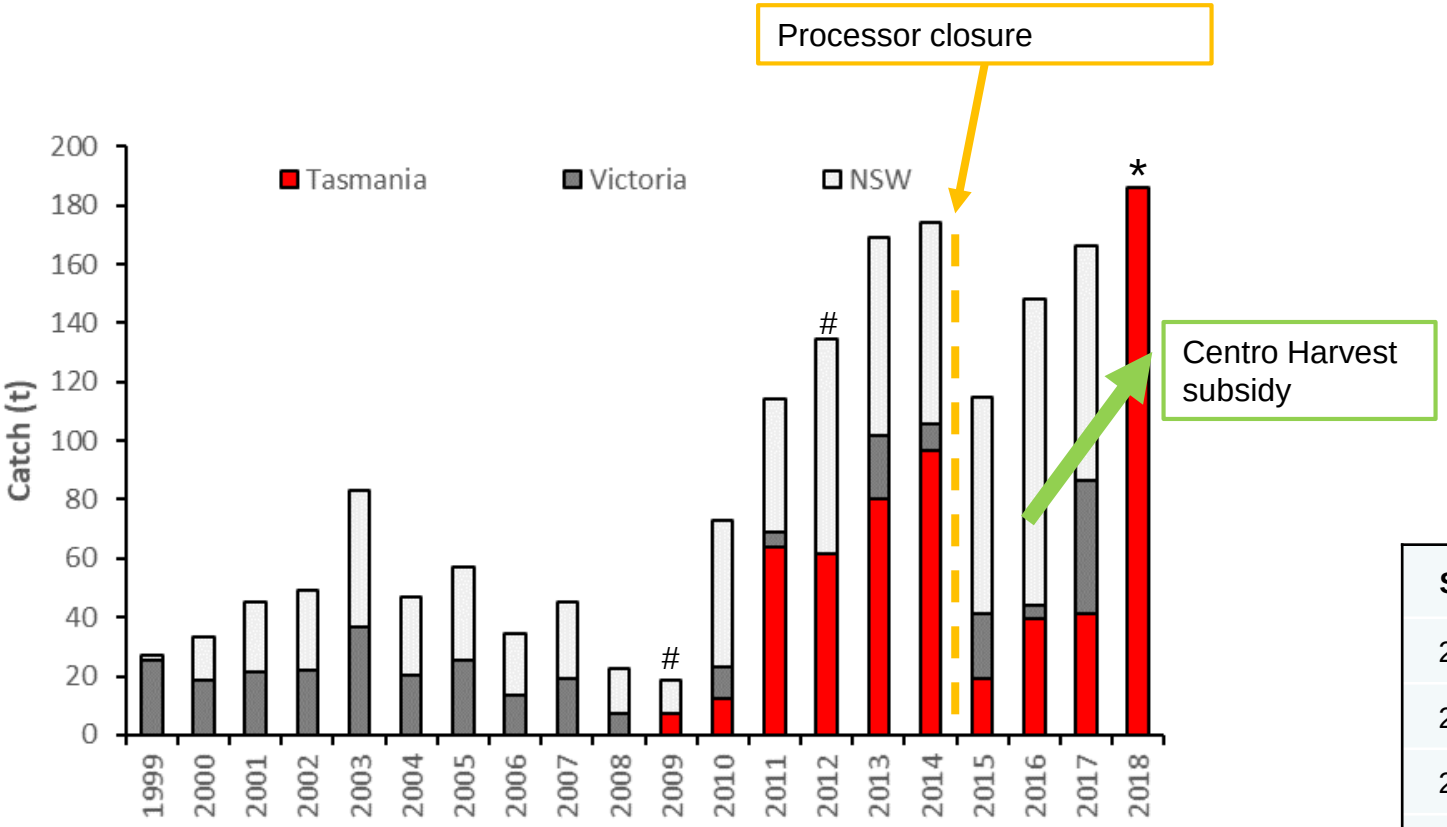
Overview

1. **Wild Harvest Fisheries**
   - ***Centro, Helio***
2. ***Heliocidaris* FRDC 2017-033**
   - **Growth, size at maturity**
3. **Roe Enhancement**
4. **Roe Quality**

1. Wild Harvest – *Centrostephanus*



Tasmania
608 tonnes: >1 million urchins

2019: 15-20 Tonnes / week. Target 400-500 Tonnes
Seasonally offset from *Heliocidaris*

Tas Catch

Season	Catch (tonnes)
2008/09	7
2009/10	12
2010/11	64
2011/12	61
2012/13	81
2013/14	97
2014/15	**19**
2015/16	40
2016/17	42
2017/18	**188**

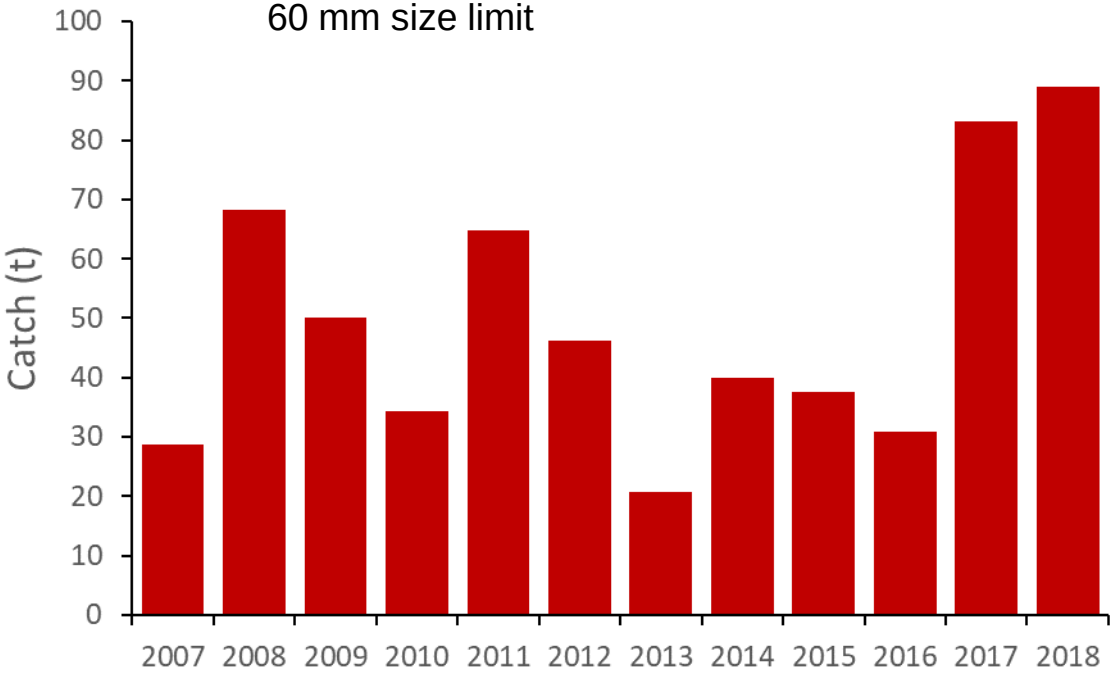
1. Wild Harvest – *Heliocidaris*

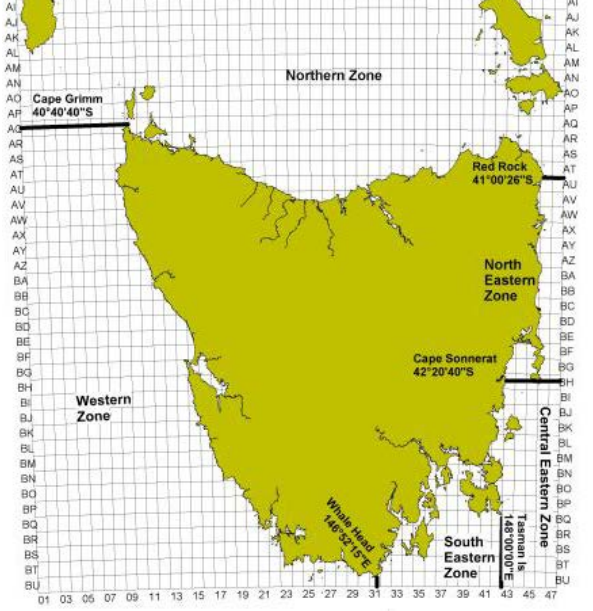
Management controls

TACC of 166 t

55 licences

60 mm size limit





2018/2019*	South Eastern	Central Eastern	North Eastern	Northern	Western	Total
TACs	44	39	43	30	10	**166**
Catch	32	20	37	1	0	**89**
%	**73%**	**51%**	**86%**	2	0	**54%**

**Incomplete season*

Season	Catch (tonnes)
2008/09	68
2009/10	50
2010/11	34
2011/12	65
2012/13	46
2013/14	21
2014/15	40
2015/16	38
2016/17	31
2017/18	**83**
2018/19	**89***

2. *Heliocidaris* FRDC 2017-033

Need

- Policy not set on solid science
- Improve management and economic performance

Objectives

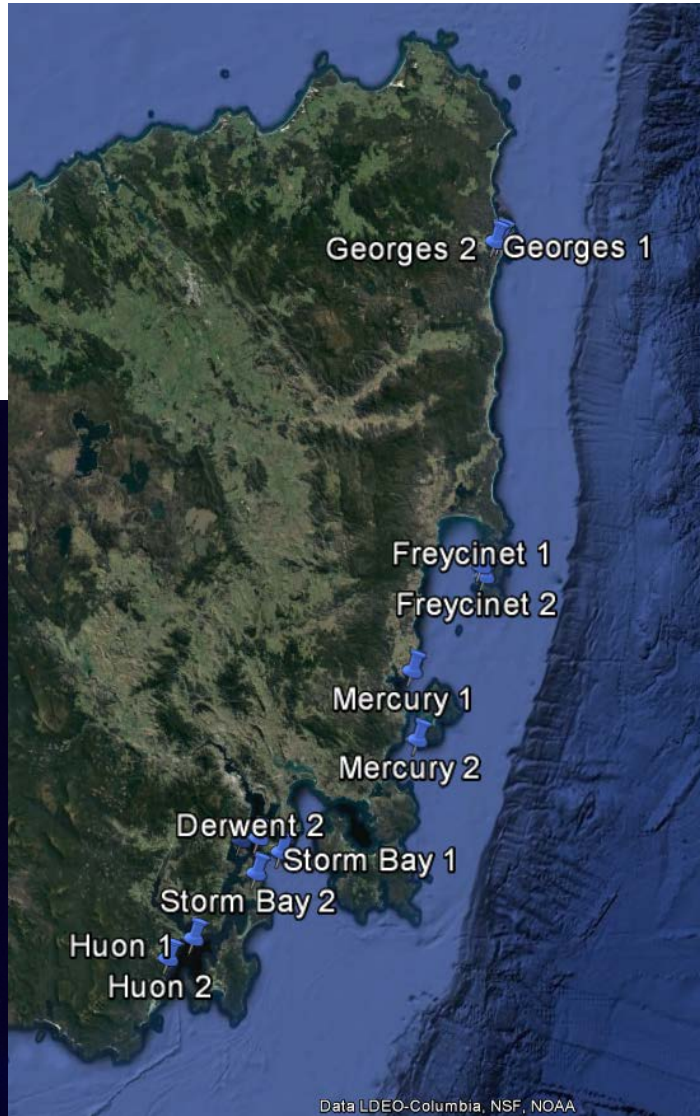
- Fisher perceptions of stock status and management
- Growth, size at maturity, size limits
- Roe quality, roe enhancement

Ongoing project – VERY preliminary data

2. *Heliocidaris* FRDC 2017-033

Growth and Size at Maturity

- 12 sites (6 regions)
- > 300 tagged tetracycline
- 20% PIT tagged
- Juveniles for histology



2. *Heliocidaris* FRDC 2017-033

Preliminary results

Incomplete/unvalidated data pooled across sites

Size at maturity ~ 50 mm

Age at maturity ~ 3.5 years

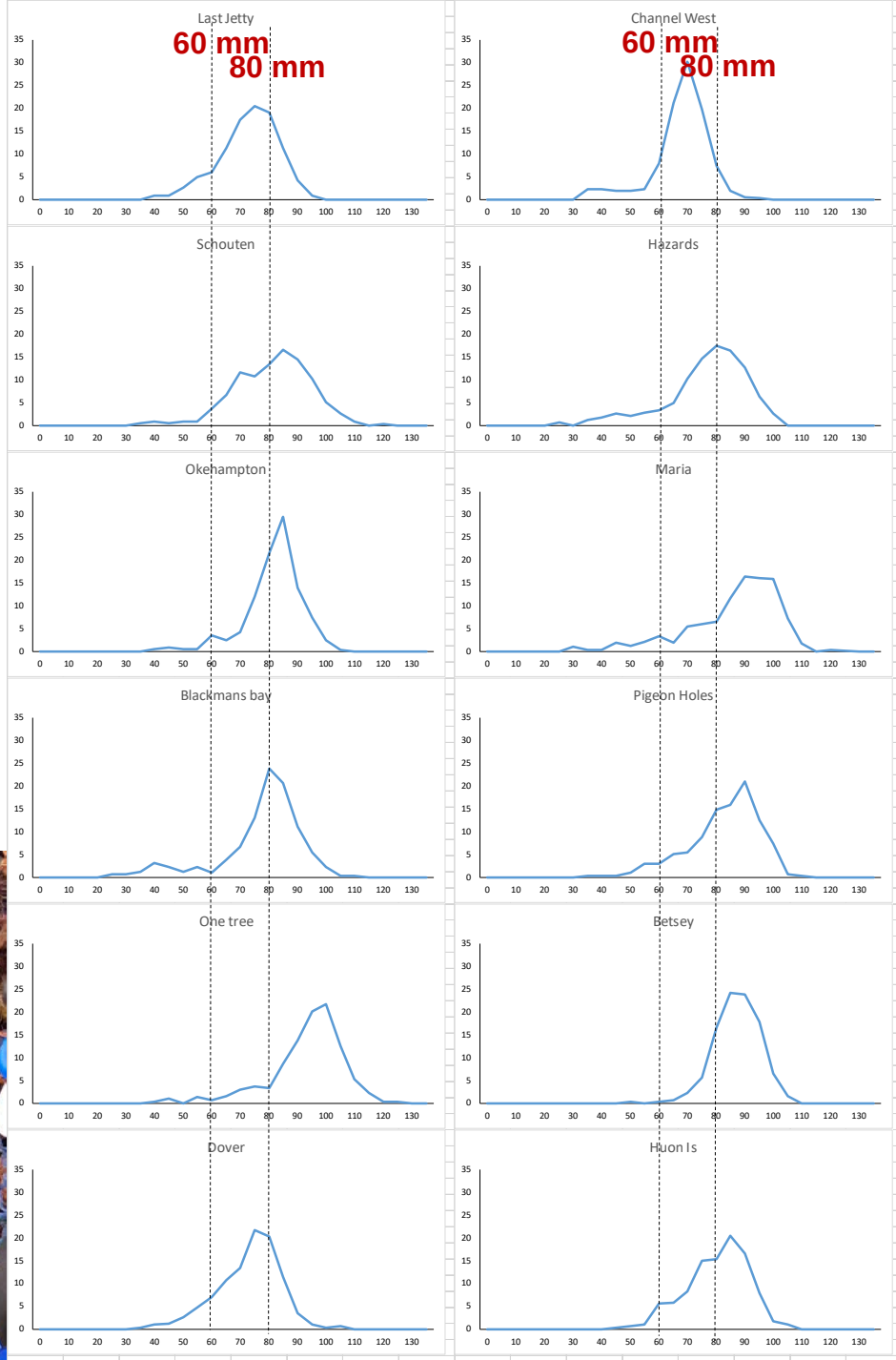
Fishery targeting individuals 6 years+

Expect high variation between sites due to varied habitats (food availability) and temperature regimes.

2. *Heliocidaris* FRDC 2017-033

Length frequency

- Modes often > 80 mm



3. *Heliocidaris:* Roe enhancement

Nofima

URCHINOMICS
From research trials to commercialization

Feed

Developed over 20 years

Kelp and plant based feed

Less than 10% fishmeal

Heat treated and rendered inert

No antibiotics, hormones or controversial ingredients

Holding Systems

10 to 15kg holding capacity

Neutral buoyancy

Hung off oyster, mussel, scallop or kelp lines

Specially designed for urchins

Designed in parallel with feed

Concept: stable food, weekly feeding

Opportunistic visit to Japan 2016

Trial on *Heliocidaris*

3. *Heliocidaris: R*oe enhancement

Trials were not successful
- No significant yield increases
- Decrease in food consumption
- Why?

1. Cages
   - Stress: no obvious indicators
   - Survival was high

2. Environment
   - Temperature – winter water temps may be sub optimal
   - Waterflow through cages

3. Individuals
   - Too old?

4. Feed
   - ‘Recipe’ unsuitable for *Heliocidaris*

Gonadal biochemical composition of wild sea urchin species

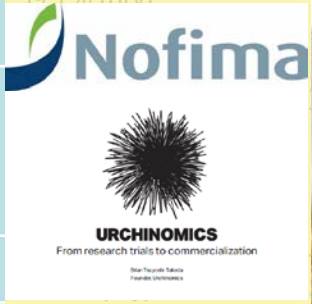
Species (planktotrophic (P) or lecithotrophic (L))	Protein	Lipid	Carbohydrate	Habitat and feeding preference	References
H. erythrogramma (L)	38% - ripe ovaries 48% - testes	50% - ripe ovaries 26% - testes	8% - ripe ovaries 11% - testes	Moderate energy, open rocky shores to estuaries Omnivorous	Byrne et al., 1999 Emlet and Hoegh-Guldburg, 1997 Keesing, 2013 Lawrence and Byrne, 1994
H. tuburculata (P)	54% - F 44%	27% - F	12% - F	Subtidal, reef flat, sublittoral	Byrne et al., 1999 Lawrence and Byrne, 1994
T. gratilla (P)*	11.7% (wet) 60.1% (dry)	2.8% (wet) 14.5% (dry)	2% (wet) 10.4% (dry)	Shallow water Seagrass and macroalgae	Chen et al., 2013 Cyrus et al., 2014
Arbacia dufresnii (P)	57.1% - F 46.7% - M	17% - F 7.3% - M	1.6% - F 1.8% - M	Shallow seagrass beds Omnivorous	Rubilar et al., 2016
Lytechinus variegatus (P)	55.2% – initial 34.5% - F(a) 33.4% - M(a)	22.9% - F(a)	23.4% – initial	Omnivorous	Arafa et al., 2012
P. lividus (P)*	12.03% (wet) 59.1% (dry)				
E. chloroticus (P)					
S. variolaris (P)*					
S. droebachiensis (P)*	7.4% - (wet) 29.3% - (dry)				

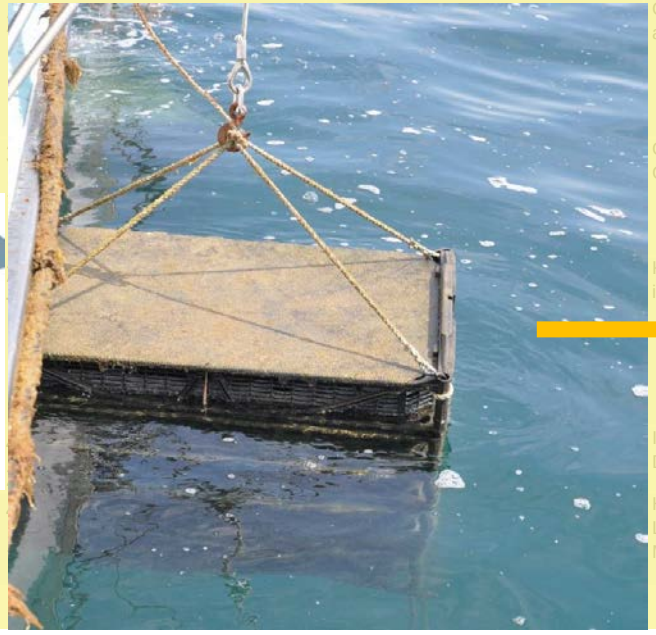
Large variation in proximal composition between species

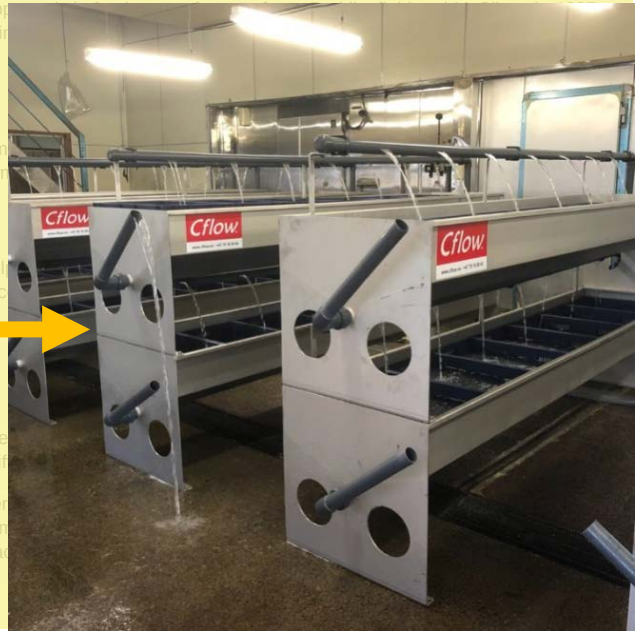
***Heliocidaris* reproductive strategy – <u>Lecithotrophic</u> – differing to all other commercial urchin species**

Does feed for a feed tailored to a species? Or at least *Heliocidaris*

Stop/Go point







4. Heliocidaris FRDC 2017-033 Roe Quality

Natural drivers of roe variability

- *> 1200 samples taken to assess roe quality*
- *Seasonally: 6 sites monthly*
- *Spatially: 18 sites snap shot*

- *Algal assessment at each collection*
- *Environmental variables (Temp)*
- *Estimated age*

- *Algal feeding trial*
  - *6 treatments (algal taxa)*
  - *2 reps (15 urchins each)*

4. Heliocidaris FRDC 2017-033 Roe Quality

Roe quality samples

- *Quantitative colour assessment (CIE L*a*b*)*
- *Histological sample (reproductive stage)*
- *Frozen sample (biochemistry)*

Konica Minolta CR-400

4. Heliocidaris FRDC 2017-033 Roe Quality

Next steps

- *Biochemistry and NIRS (*Near-infrared spectroscopy)
  - *Carbohydrates*
  - *Proteins*
  - *Lipids*
  - *Amino acids*
  - *Carotenoids*
  - *Stable isotopes*

Selective / subsample biochemistry (n=1200)

Model with NIRS

What data would be most beneficial from an aquaculture, feed development perspective?

Concluding thoughts for discussion Tasmania

1. Roe enhancement options
   - ‘young’ urchins vs stable old barrens
     - High biomass of large (old?) urchins among wild stocks
   - Limed resource / competition with wild harvest sector

2. Full aquaculture
   - Growth rates, temperature – water may need to be heated for optimal production.
   - Cost of production