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The DIFS,  
Rhodes  
University  
(South Africa)

# Recent advances in abalone IMTA in South Africa – The AquaVitae story

*Cliff Jones*

The DIFS, Rhodes University (South Africa)



*Clifford L. W. Jones, Peter J. Britz, Gercende Courtois de Viçose, Abiodun Falade, Brett M. Macey, Njabulo Madlala, Petronilla Mwangudza, Abigail J. Onomu, Matthew Slater, Niall G. Vine, Dirk Weich, Yu (Ann) Wu*

## Circular economy

Recycling

Reduced environmental impact

Ecosystem services

# What is IMTA?

... turning "waste" into **profit**

# Circular economy of South African MARICULTURE in context...

South African aquaculture industry:

- **Abalone** (2500 tons/annum)
- Mussel
- Oyster
- Trout



# Circular economy of South African MARICULTURE in context...

South African aquaculture industry:

- **Abalone** (2500 tons/annum)

Land-based

Pump-a-shore

Monoculture (mostly)



# Circular economy of South African MARICULTURE in context...

South African aquaculture industry:

- **Abalone** (2500 tons/annum)

Formulated feed





# Circular economy of South African MARICULTURE in context...

South African aquaculture industry:

- **Abalone** (2500 tons/annum)

Formulated feed

Combined with **macro-algae**



# Circular economy of South African MARICULTURE in context...

South African aquaculture industry:

- **Abalone** (2500 tons/annum)

Formulated feed

Combined with **macro-algae**

... **abalone/algae IMTA**



# Low trophic species aquaculture around the Atlantic

SIX AquaVitae  
**HIGH IMPACT**  
results

of potential to developing a  
circular economy

... abalone/algae IMTA



## (1) Optimization of abalone nursery systems

Optimizing use of algae &  
adult mucous in abalone hatcheries:



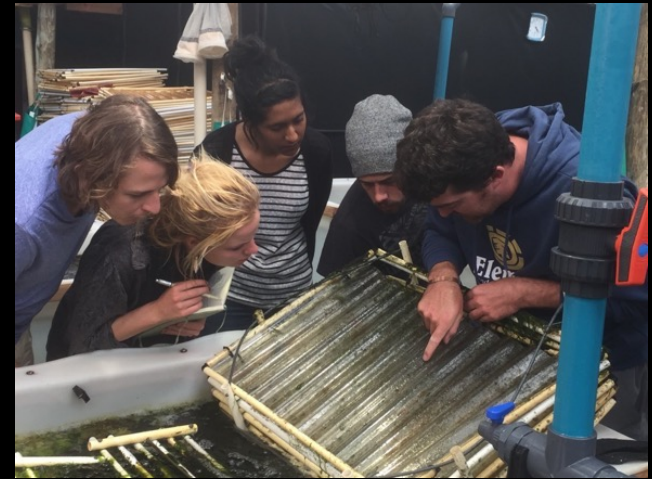
## (1) Optimization of abalone nursery systems

Optimizing use of algae &  
adult mucous in abalone hatcheries:

improved **settlement**

improved **survival**

**organic certification**



**(2) Co-culture of abalone & sea cucumber**

**Sea cucumber cultured under  
abalone baskets removes solid waste:**



## (2) Co-culture of abalone & sea cucumber

Sea cucumber cultured under  
abalone baskets removes solid waste:

reduced **handling**

reduced **labour costs**

**cleaner** tanks

**new product** in sea cucumber



### (3) Life cycle analysis of land based IMTA

Environmental cost/saving:

**flow-through** abalone farming

vs

**ulva/abalone/sea-cucumber IMTA**

vs

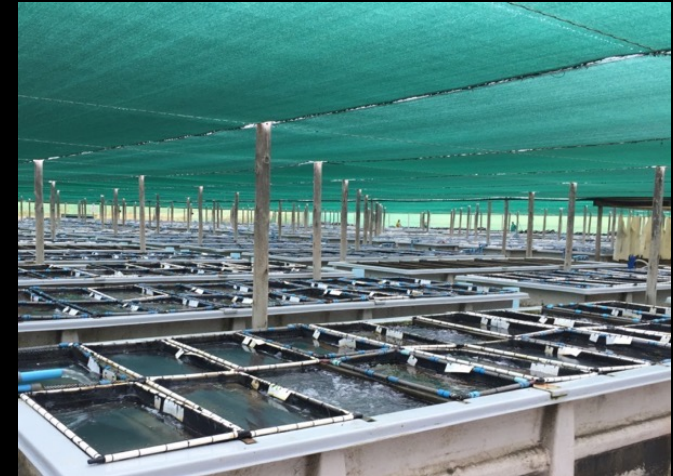
**fishmeal/soya feed** Abfeed®

vs

**ulva supplemented feed** Abfeed®

using carbon, nitrogen and phosphorus flow  
as a measures

# What is the cost/saving?



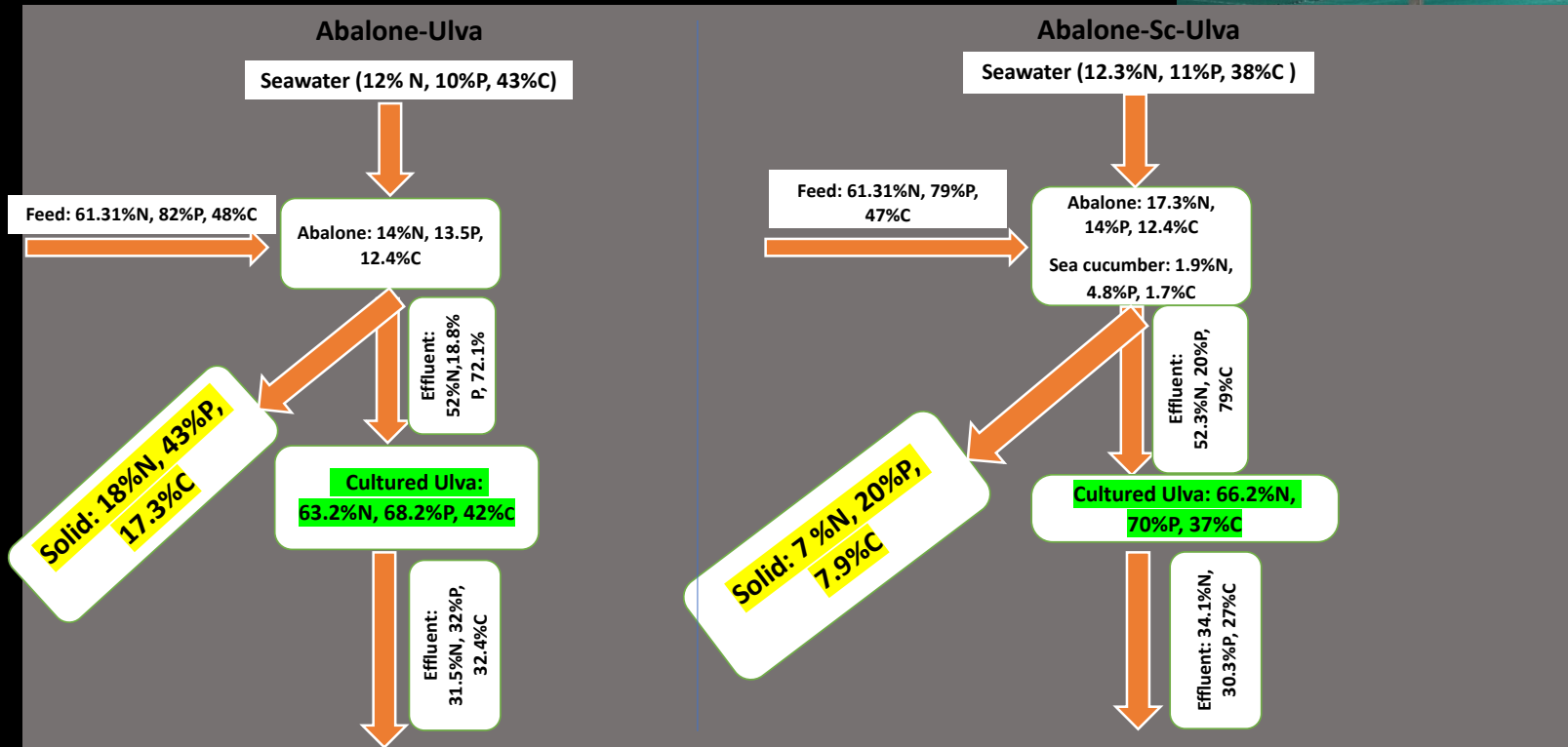


### (3) Life cycle analysis of land based IMTA



LCA data, on commercial-scale: IMTA vs non-IMTA

### (3) Life cycle analysis of land based IMTA



What is the cost/saving?

**(4) Make algae biosecure when introduced  
to an abalone feed**

**ingredient pre-treatment process that  
eliminates pathogens:**

**Biosecurity risk??**

**Seaweed blamed for abalone stock  
loss: Australia/Taiwan**

**IMTA, feeding algae grown in effluent  
back to abalone**



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**(4) Make algae biosecure when introduced to an abalone feed**

**pre-treat ingredients  
eliminates potential pathogens:**

**Bacteria  
Fugus  
Virus**

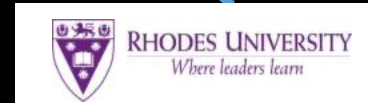


**Samples plated  
DNA isolation, PCR  
Metagenomics**

**Diff. combinations  
Exposure time...  
Develop procedure**

**UV; pH; salinity  
Temperature  
Desiccation  
Iodine, etc.**

**Effect on nutritional quality on  
abalone growth & gut microbiome?**

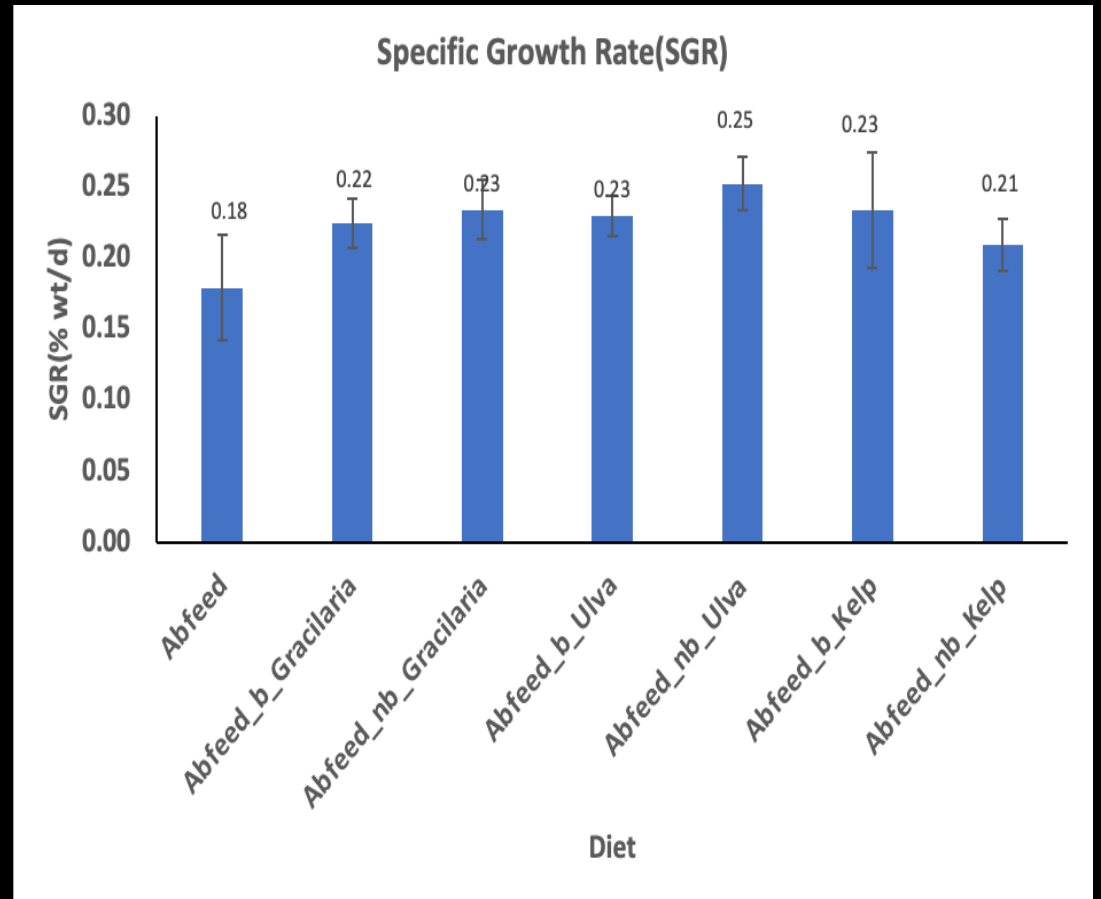


## (4) Make algae biosecure when introduced to an abalone feed



**Growth not compromised**

**Effect on nutritional quality on abalone growth & gut microbiome?**

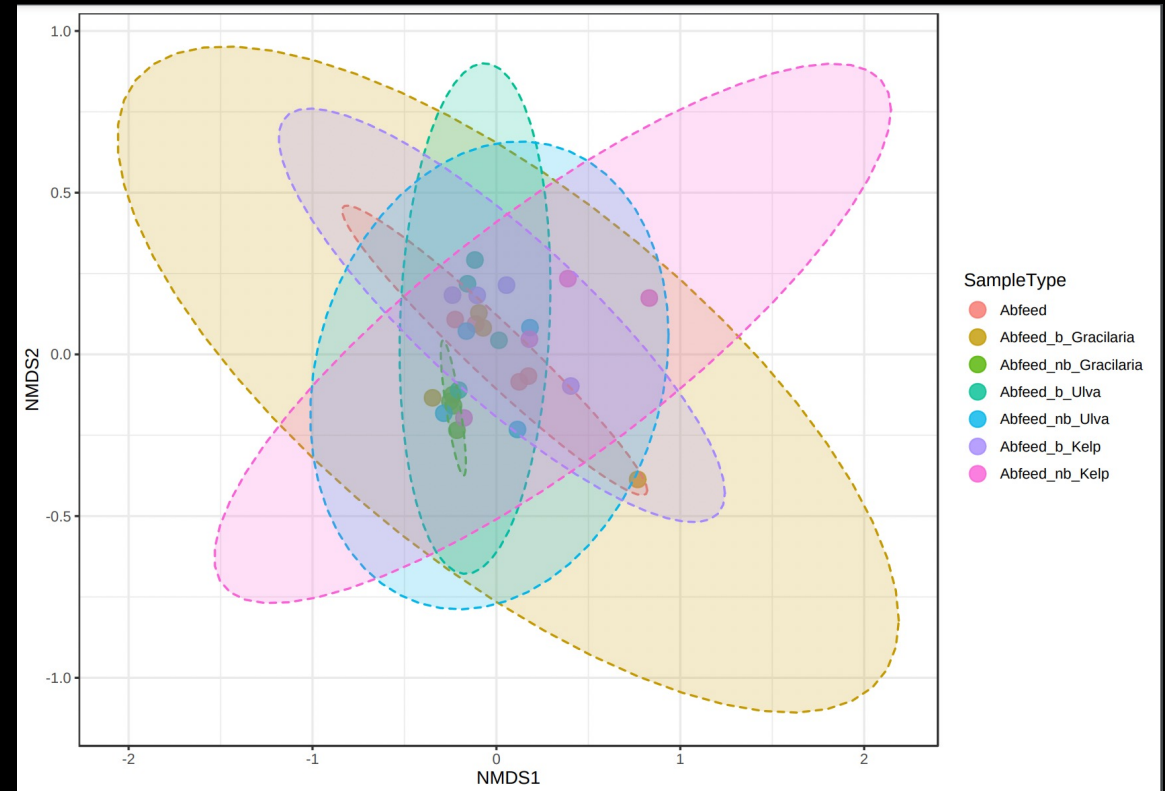


Statistical results:  $p > 0.05$

## (4) Make algae biosecure when introduced to an abalone feed

Microbiome community structure:  
**NOT NEGATIVELY INFLUENCED**  
by disinfection process

Effect on nutritional quality on  
abalone growth & gut microbiome?



[PERMANOVA] F-value: 1.4772; p-value: 0.291

[ANOSIM] R: 0.13542; p-value < 0.239

**(4) Make algae biosecure when introduced  
to an abalone feed**

**ingredient pre-treatment process that  
eliminates pathogens:**

**bacteria & fungi & viruses**

**macroalgae-born pathogens**

**NO ENTRY!!**

**into abalone systems via the feed**



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## (5) Gracilaria/mussel IMTA

Better use of existing mussel farm  
Additional product - seaweed





## (5) Gracilaria/mussel IMTA

Better use of existing mussel farm

Additional product - seaweed

Vertical lines ✓

“windward” side ✓

**It works!!**



(6) Abalone feed containing IMTA produced macro-algae

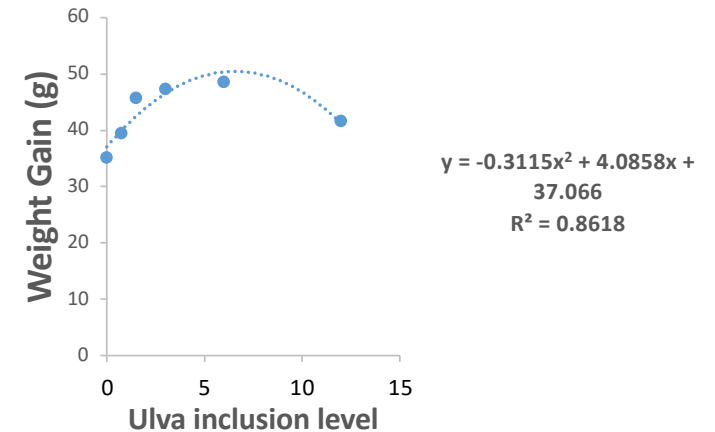
Ulva and/or Gracilaria into Abfeed:



(6) Abalone feed containing IMTA produced  
macro-algae

Ulva and/or Gracilaria into Abfeed:  
improved **growth**

Weight Gain of abalone fed graded levels of ulva in  
formulated feed

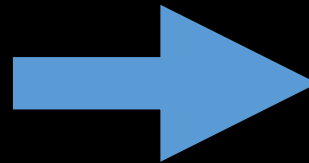


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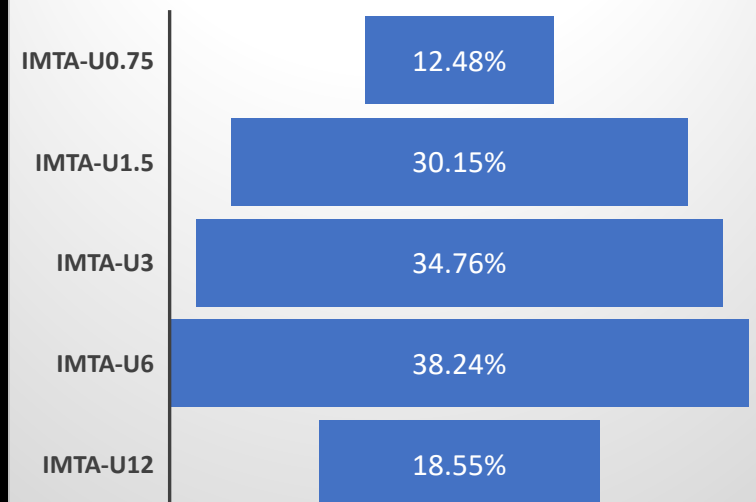
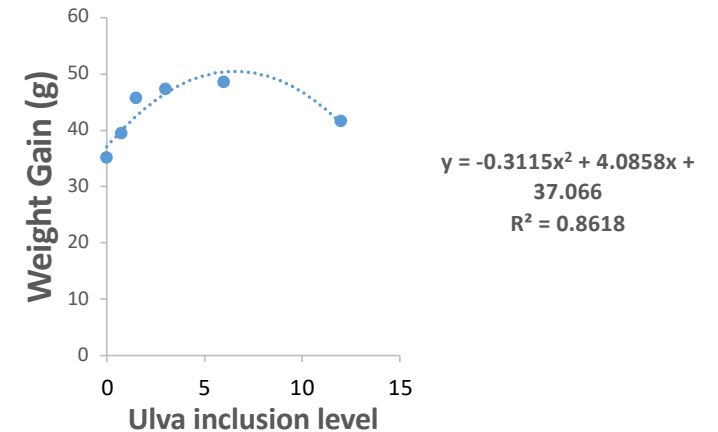


(6) Abalone feed containing IMTA produced macro-algae

Ulva and/or Gracilaria into Abfeed:  
improved growth



Weight Gain of abalone fed graded levels of ulva in formulated feed



(6) Abalone feed containing IMTA produced macro-algae

Ulva and/or Gracilaria into Abfeed:

improved **growth**

improved **FCR**

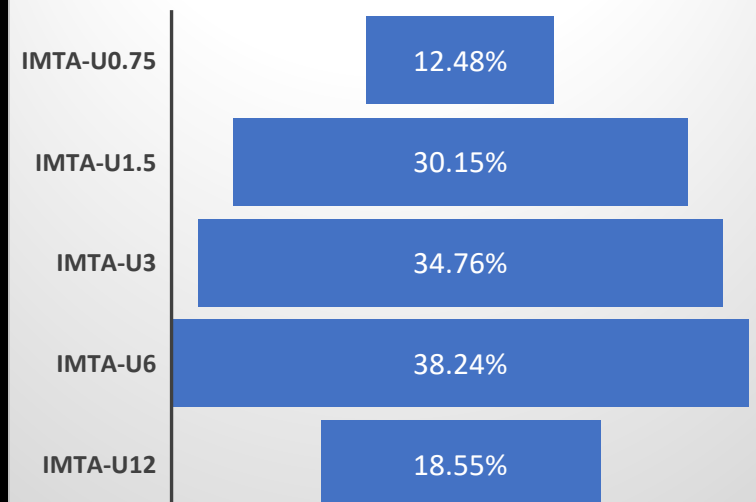
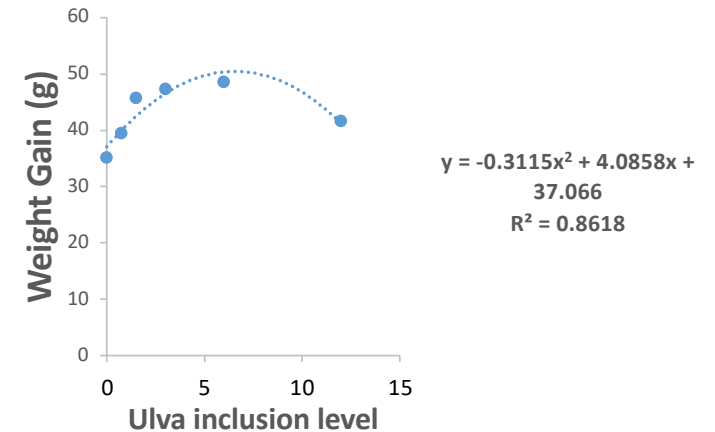
stable **gut microbiome**

cleaner production and

reduced environmental impact

... by developing the circular economy

Weight Gain of abalone fed graded levels of ulva in formulated feed



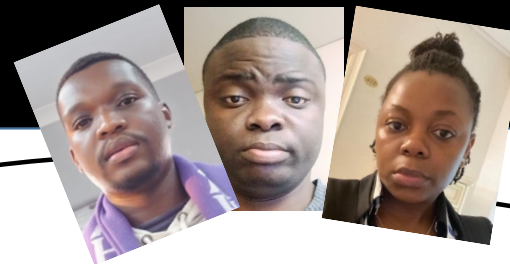
Low trophic species aquaculture: using a **circular economy**

An example of collaboration

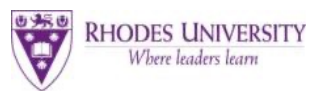
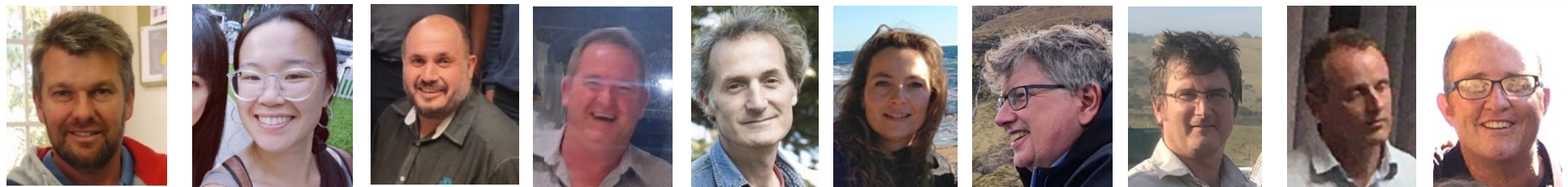


Low trophic species aquaculture: using a **circular economy**

# An example of collaboration



Collaborative research: South Africa, France, Spain, Germany and Faroe Islands:



University of Fort Hare  
Together in Excellence

# Low trophic species aquaculture: using a circular economy