

**A Prospective Poly-culture of Abalone and  
Japanese Sea Cucumber (*Apostichopus japonicus*):  
a study of Diurnal Water-Quality in Abalone Tanks**

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# Japanese Sea Cucumber (*Apostichopus japonicus*)



- Grow in **12-21°C** range
  - Optimal temperature: 15-18°C (Yu and Song, 1999; Asha and Muthiah, 2005)
- DO (Dissolved Oxygen) **above 5 mg/L**
- Salinity tolerance: **26-33 ppt** (parts per thousand)
  - Optimal: 31.6 ppt
- pH range: **7.5-8.2** (optimal 7.8)

# Intro: Why *Apostichopus japonicas* at BIAC?

- Aquaculture business + standard of living in Hawaii  
= Expensive
- Poly-culture improves profit margins
- Has been SUCCESSFULLY co-cultured with abalone since 2003 (Ho et al., 2003)
- High-end gourmet food item in Asia
- Established market in China
- Are detritivores—abalone waste as *A. japonicas* feed.

# Experimental Objective



- To determine whether or not the diurnal (daytime) water quality in the abalone tanks is suitable for Japanese Sea Cucumber to thrive in—so as to implement BIAC’s much-desired plan to co-culture the prospective species with abalone.

# Working Hypothesis

- Abalone and *A. japonicas* successfully co-cultured in past
- Water conditions already *seem* ideal
- *Therefore:*
  - $H_A$ : water quality in abalone tanks is suitable for the growth and co-culture of *A. japonicus*

# Methods

- 3 abalone grow-out sections: juvenile (JGO), young (YGO), and mature (MGO)
- Instruments used to measure water quality of *incoming*, *basket*, *bottom*, and *outgoing* tank water
- 10 mL water sample from each tank for ammonia testing (*basket* and *bottom* only)
- Collection of abalone excrement (one-time) for nutrient analysis
- Example of raw data for 2 tanks in one grow-out section

Water Quality Testing								
Date	Tank#	Time	Temp (°C)	Ammonia NH <sub>3</sub> -N (mg/L)	DO (mg/L)	%SAT	pH	Salinity
6/20/2013	M4 (In)	11:18	26.6	-	6.38	96.0	8.10	35.0
	M4(Bask)	11:31	17.6	0.03	6.77	86.7	7.84	35.0
	M4 (Bott)	11:39	17.6	0.09	6.82	87.3	7.81	35.5
	M4 (Out)	11:45	17.8	-	6.82	87.6	7.72	35.5
	M16 (In)	12:22	27.1	-	6.53	99.5	8.07	35.0
	M16 (Bask)	12:32	17.8	0.14	6.75	86.8	7.89	35.0
	M16 (Bott)	12:40	17.9	0.03	6.77	87.2	7.85	35.0
	M16 (Out)	12:45	18.1	-	6.17	79.7	7.76	35.0

**Juvenile Grow-out**



**Young Grow-out**



**Mature Grow-out**



MON	TUES	WED	THUR	FRI
<i>JGO (dirty)</i>	<i>JGO (post-art.)</i>			<i>JGO (no feed)</i>
<i>YGO (dirty)</i>	<i>YGO (post-alg.)</i>			<i>YGO (post-art.)</i>
	<i>MGO</i>		<i>MGO</i>	<i>MGO</i>

**Tank Testing Schedule**



**pH Electrode**



**Refractometer**



**Nitrogen Ammonia Reagent Kit**



**DO meter**





## Ammonia Colorimeter Kit

- Ammonium Salicylate
- Ammonium Cyanurate



**Abalone Excrement for Nutrient Analysis: protein, fat, moisture, ash**

# Results and Trends

Basket						
Tank#	Temp (°C)	Ammonia NH3-N (mg/L)	DO (mg/L)	%SAT	pH	Salinity
J50	17.5-18.7	0.00-0.09	7.10-7.54	91.9-97.6	7.97-8.09	35.0-36.0
J132	17.8-18.4	0.00-0.05	6.68-7.26	86.8-94.3	7.93-8.08	35.5-36.5
Y42	18.8-19.5	0.00-0.07	7.21-7.53	95.4-98.7	7.94-8.14	35.5-36.5
Y113	18.8-19.4	0.00-0.11	7.12-7.46	93.7-98.0	7.94-8.12	36.0-36.0
M4	15.8-17.6	0.00-0.12	6.77-7.52	86.6-93.1	7.75-7.93	35.0-36.0
M16	15.7-17.8	0.00-0.14	6.75-7.79	86.8-95.8	7.89-7.99	35.0-35.5

Bottom						
Tank#	Temp (°C)	Ammonia NH3-N (mg/L)	DO (mg/L)	%SAT	pH	Salinity
J50	17.5-18.7	0.00-0.14	7.29-7.76	94.3-100.5	7.99-8.10	35.5-36.0
J132	17.9-18.5	0.00-0.19	7.05-7.40	91.2-95.3	7.87-8.08	35.5-36.5
Y42	18.9-19.5	0.00-0.06	7.20-7.61	94.6-99.2	7.90-8.14	36.0-36.5
Y113	18.8-19.4	0.00-0.09	7.12-7.44	93.1-98.2	7.88-8.12	36.0-36.5
M4	15.8-17.6	0.00-0.10	6.82-7.52	87.3-93.2	7.64-7.94	35.0-36.0
M16	15.8-17.9	0.00-0.14	6.77-7.71	87.2-95.2	7.85-8.02	35.0-36.0

- Temp., DO, and pH for ALL TANKS good range for *A. Japonicas*
- Salinity for ALL TANKS **high**
- Analyses to run: Analysis of Variance (ANOVA) and Chi-square

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# Conclusion

- Analyses have yet to be run
- However, past successful operations indicate that co-culturing this species seems to be very possible, given that the water quality shows adequate living conditions for Japanese Sea Cucumber.
- Salinity

# Mahalo, everyone!



Mentor: Cecilia Viljoen



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