Effect of different pH on the growth and survival of Sandfish sea cucumber *Holothuria scabra* larvae in the Hatchery

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POHNPEI

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Rationale behind Sea Cucumber Aquaculture

-High-value & non perishable export products - “Beche-de-Mer” dried or processed sea cucumbers for International Markets (Asian) 1 Kg of dried sea cucumbers can fetch US $ 500- 100 depending on the grade

-Products for local consumption to develop domestic businesses- “Siokara” salted guts/gonads, “sashimi” sliced raw meat is a local delicacy in Pohnpei.

COMPLEX LIFE CYCLE

Auricularia

Doliolaria

Fertilized egg

PELAGIC PHASE (2-3 weeks)

Pentactula
(<1mm)

EPIBENTHIC PHASE
(2-5 weeks)

Spawning adult

BENTHIC Burrowing PHASE
(6-8 months)

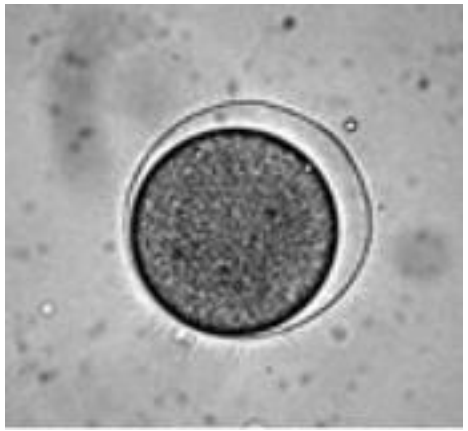
Early visible
juveniles
(<10 mm)

Subadults

Juveniles (>10mm)

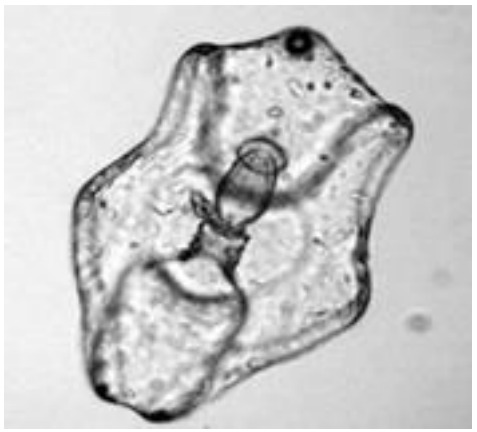
Larval Stages of sandfish sea cucumber

Pelagic stage(2-3 weeks)

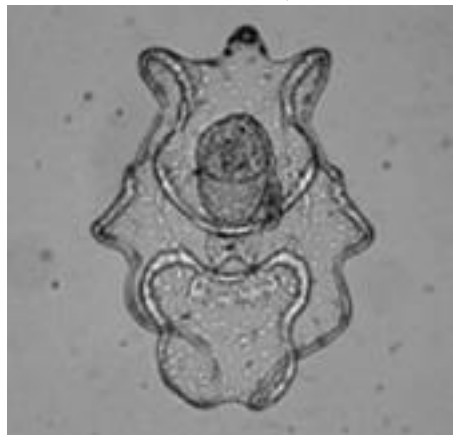


Egg 80-200µm

Gastrula

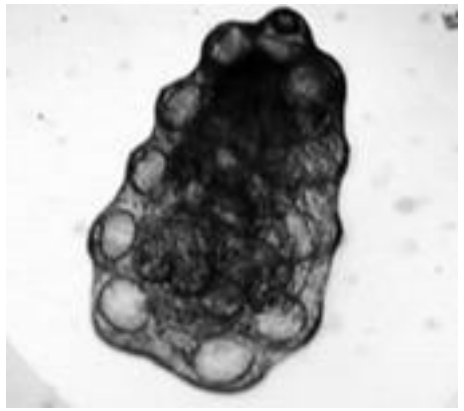


Early Auricularia 430-563µm



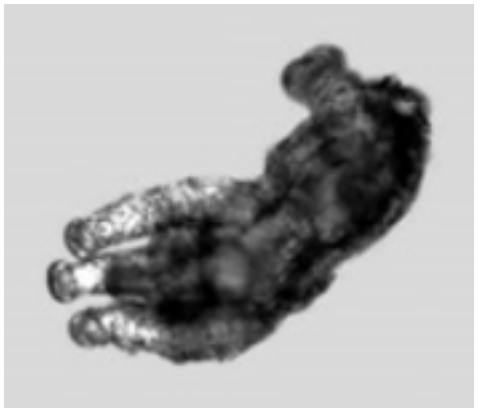
Mid-Auricularia 700-750µm

Late Auricularia



Doliolaria 420-620µm

Transition stage(2-5 weeks)



Pentacula 330-750µm

Benthic stage(6-8 months)

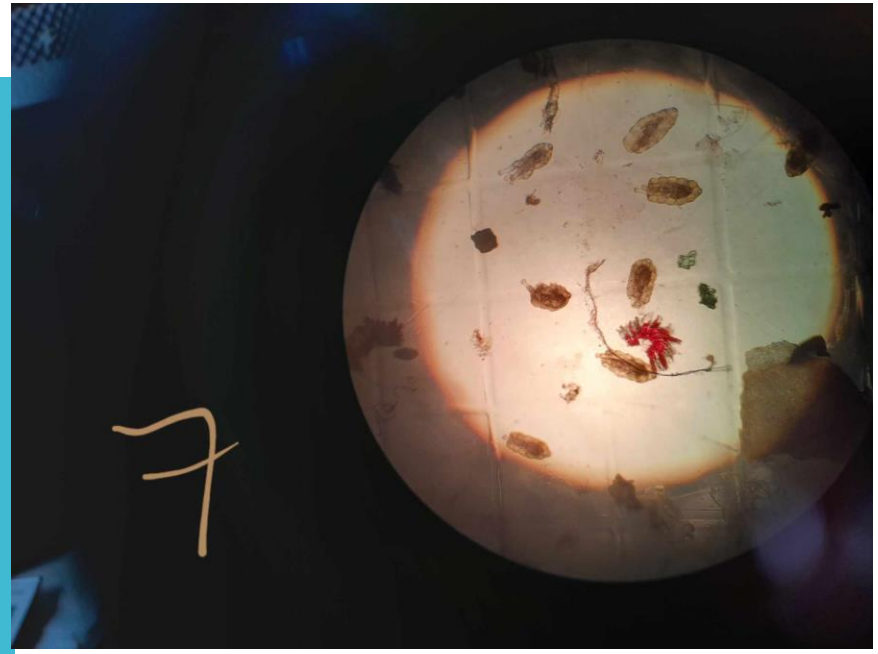
Early juvenile 1mm

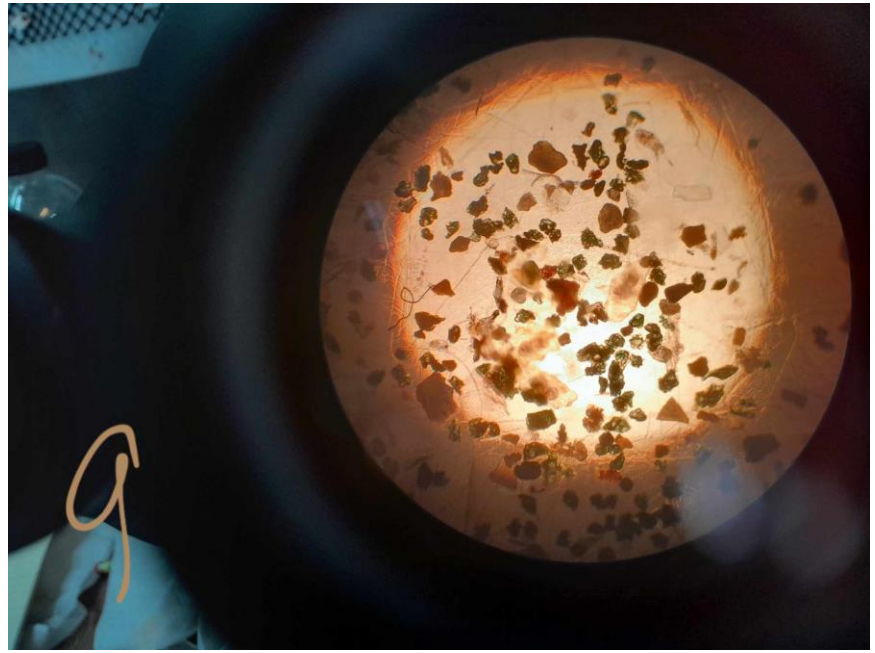
Juvenile to adult life

Place of Work

Hypothesis/Questions

- The effect of pH on sea cucumber larvae
- Which pH is the best for sea cucmber growth and survival
- How long can the larvae last in each pH treatment
- Can the larvae survive in regular sea water after being exposed to different pH





Methodology

Steps

Tools:Acid, bleach, 8 buckets, pH measurement tool, pipette, microscope, tubes, and seeve

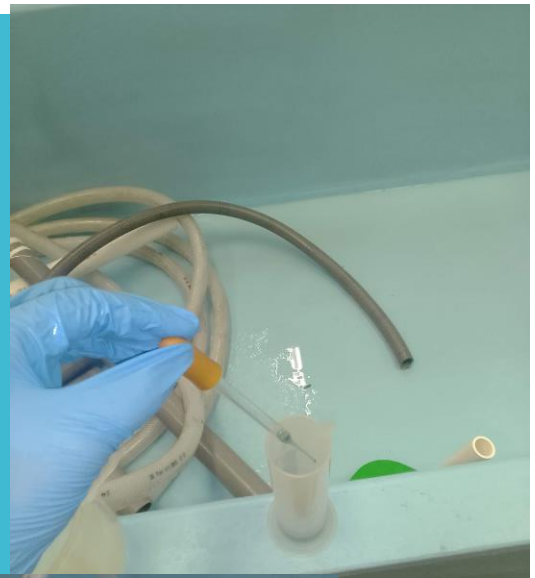
1st test

1) Fill buckets with sea water
2) Use acid to lower the sea water pH to 6 and 7 and bleach to highten the pH to 9
3) Put 10,000 larvae in each bucket and check the condition of the larvae within the first 30 minutes of exposure and another 30 minutes (1 hr) to see how long they can survive

2nd test (requires 8 more buckets(total:16))

The second test had 16 buckets in total, all the steps were the same, but this time, instead of 10,000 we put 5,000 larvae in each bucket and set a timer to 30 mins. And another to 1 hr. When the timer went off, we'd put the larvae back in regular sea water to see if they could still survive

Methodology



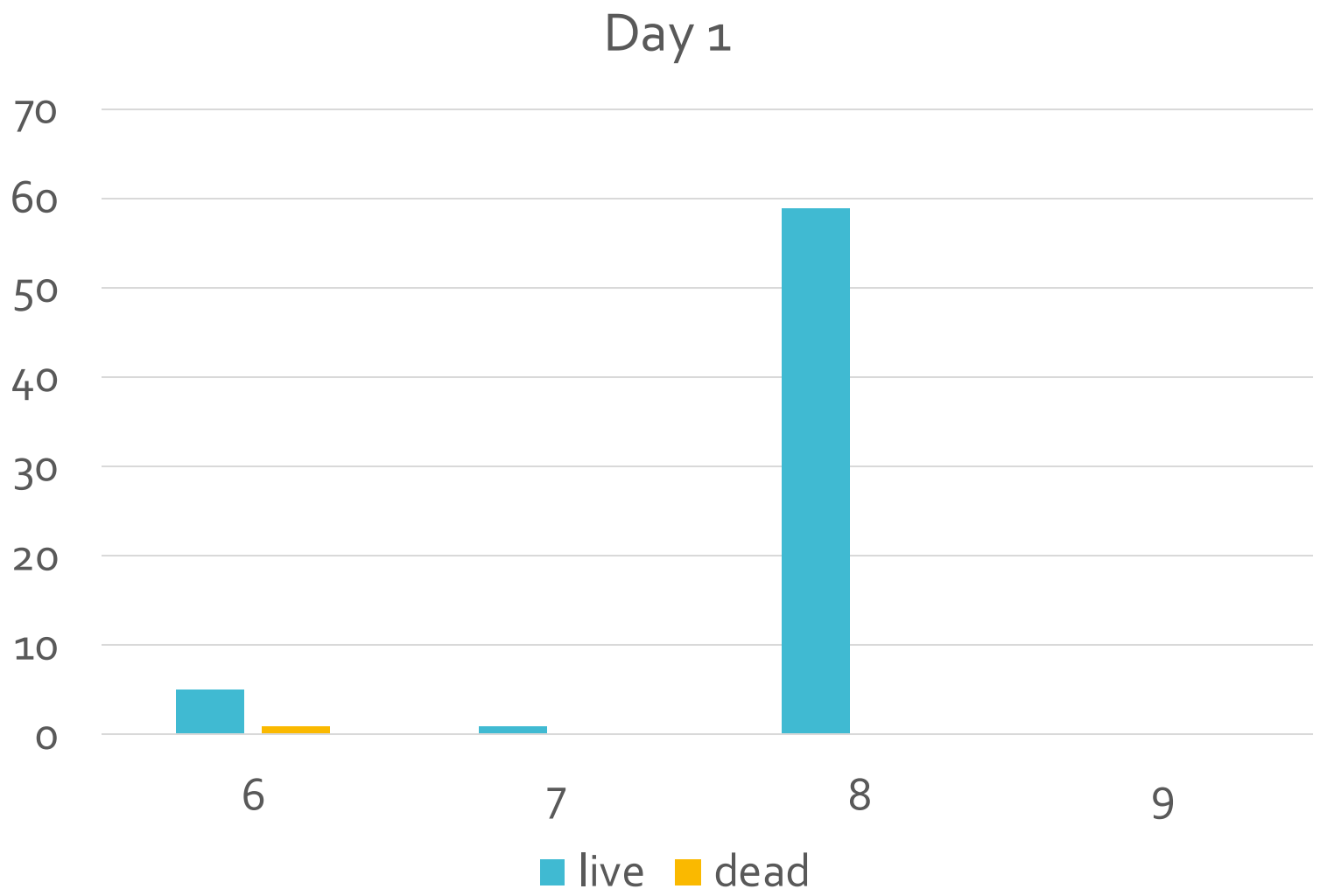
- After exposing the larvae on the first day, we checked on their condition after an hour and found that none had survived the 9 pH treatments, some had survived 6 and 7 pH and almost all the larvae survived 8 pH.
- We remade the same experiment and tested it for another hour, except this time, we kept track of the stages the larvae had reached, the results were the same, but we discovered that more mid-Auricularia survived than early Auricularia in all treatments.

Methodology

- The next test was to test if the larvae could survive in regular ocean water after being exposed to the pH treatments for a set amount of time(30 mins-1 hr.)
- After exposing the larvae to the pH treatments, we brought them back to regular water and waited a few more minutes before checking on them and seeing how they were doing and which stages of larvae would most likely survive.
- We continued the same tests until we were sure of the results.

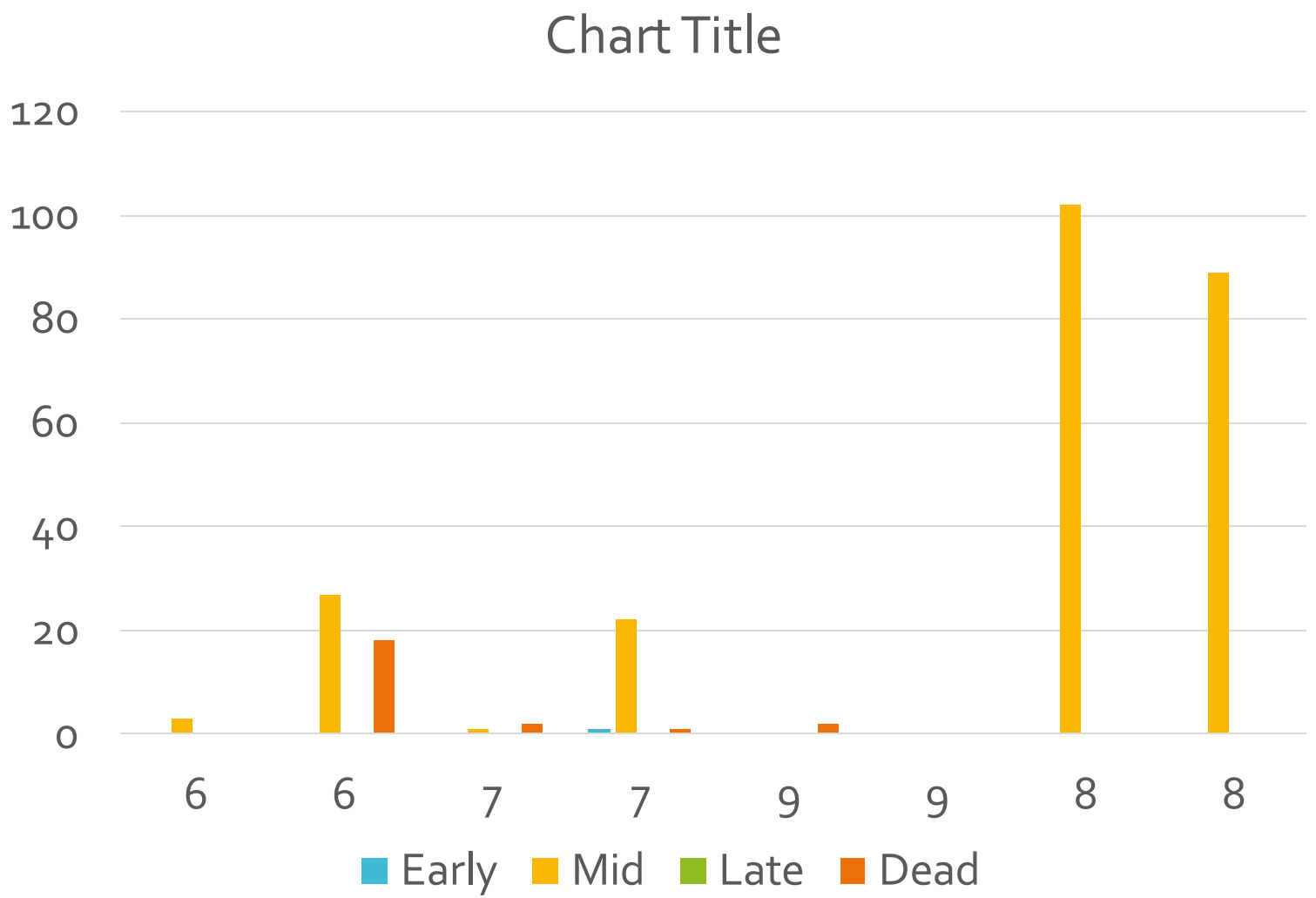
Results

date: 07/08/2023



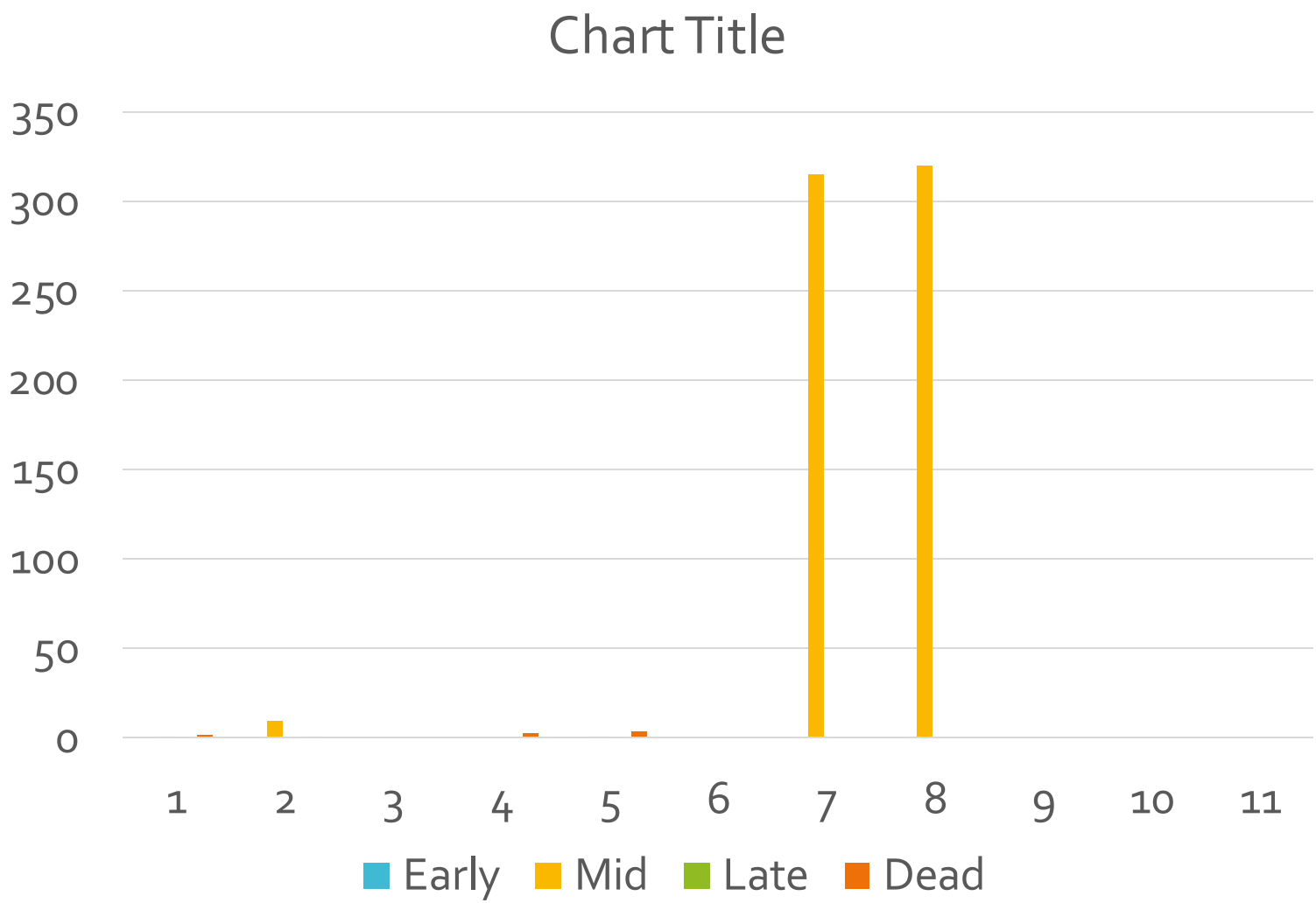
Results

date: 07/11/2023



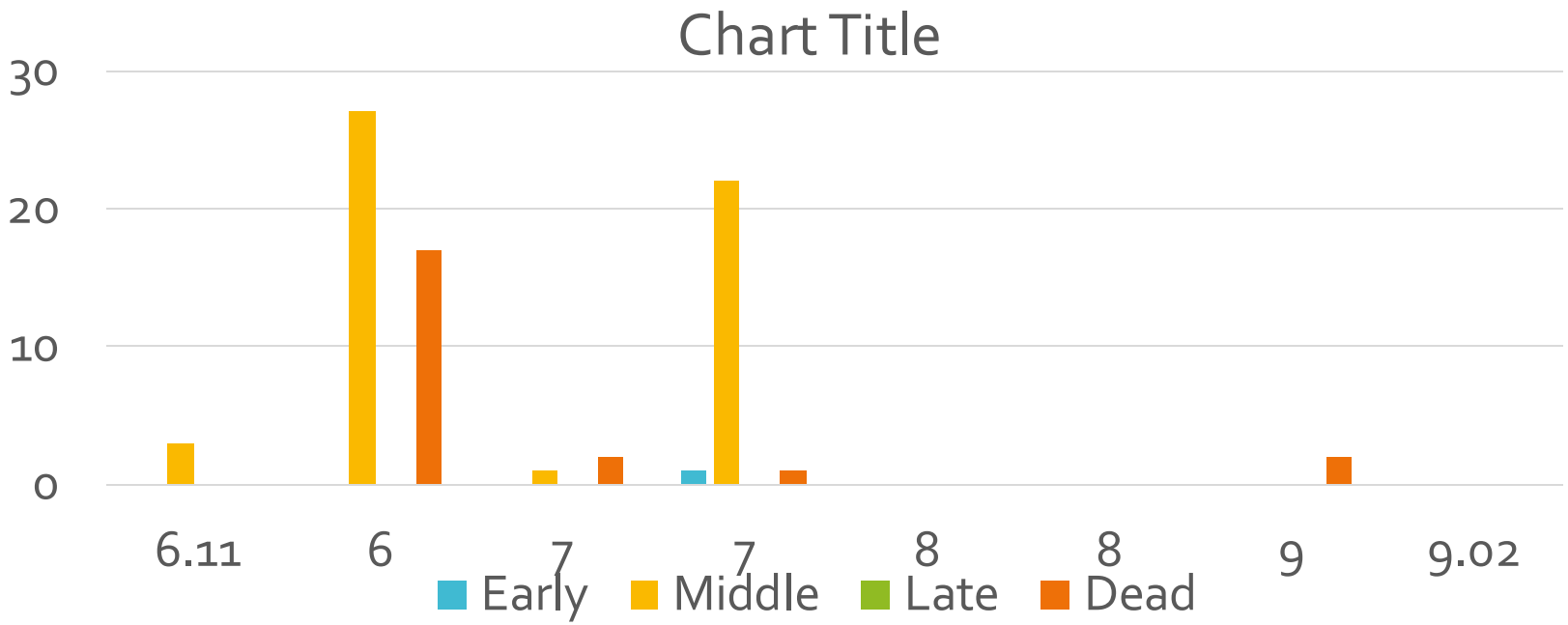
Results

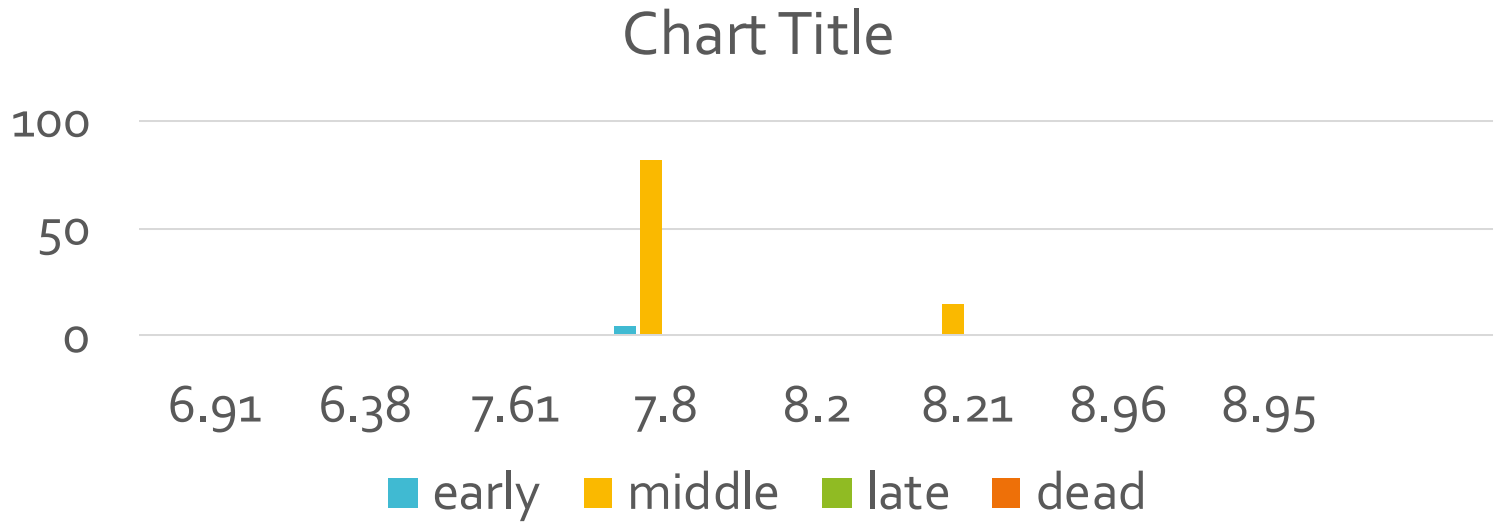
date: 07/12/2023



date:

07/13/23
morning result
&
afternoon
feeding result





date:
07/14/23

After 1 Hour	pH level	Description
	6	o animals (ALL DEAD, NONE FOUND)
	7	Found many, shows spheres on head
	8	Found many, shows spheres on head
	9	Found dead no live

date:
07/17/23

Bucket #		Early	Middle	Late	Dead	total		
1	6	0	0	0	0	0		
2	6	0	0	0	0	0		
3	7	0	0	0	0	0		
4	7	0	0	0	0	0		
5	8	0	5	0	0	15,000		
6	8	0	1	0	0	3,000		
7	9	0	0	0	0	0		
8	9	0	0	0	0	0		
					CONCLUSION:	18,000	9,000	10% LOSS in pH 8 buckets

MONITER BUCKETS date: 07/17/23

pH Level	Early	Middle	Late
6	0	0	0
7	0	0	0
9	0	0	0
			Conclusion: none survived monitor buckets

date:
07/19/23

pH Treatment to Regular pH (salt water, pH 8)					
After 30 mins					
Bucket #	pH level	Result	types		
1	6	dead	late and dolo		
3	7	late:dead/dolo:dying, not fully dead	late and dolo		
5	8	alive and active	mid,late, and dolo		
8	9	dead	late and dolo		
After 1 hour					
Bucket #	pH level	Result	types		
1	6	late:partially dissolved/dolo:dead	late and dolo		
3	7	late:dead/dolo:dying	late and dolo		
5	8	alive and active	mid, late, and dolo		
7	9	dissolved	none		

date: 07/20/23

Main Buckets			
Bucket #	pH level	Result	Types
1	6	L&M: dead/Dolo:dead	Late, Middle, & Dolo
2	6	Dead	Late and Dolo
3	7	Dead; one dolo alive	Late and Dolo
4	7	Some dead, some alive	Late, Middle, & Dolo
5	8	Alive	Middle, Late, &Dolo
6	8	5 dead, 6 alive	Late and Dolo
7	9	Late:dead/Dolo:alive not active	Late and Dolo
8	9	Late:dead/Dolo:alive not active	Late and Dolo

Conclusion/Result

After all the experiments were done, I came to the conclusion that sandfish sea cucumber larvae are unable to survive in both 6 and 9 pH. They have a chance at surviving in 7 pH, but are best suited for 8 pH, which is the control or regular sea water pH.

They are also unable to survive in regular salt water after being exposed to the pH treatments for 30 mins-1hr.

To put it briefly, sandfish sea cucumber larvae are very fragile and are unable to survive in both acidic and alkaline conditions. They have a very small survival range and the best way for these larvae to survive is by not polluting the ocean.

Discussion

Why is it important to research on the survival of Sandfish sea cucumber?

What is the significance of my research?

1)Because they are of high value among the islanders(locals) as a delicacy, and Asian markets(international) as exporting product.

2)Because of pollution, our ocean grows more acidic each day, this research is necessary for these creatures survival so that we may know which pH they can survive and die in.

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