

Ecological Monitoring in Hālawā Stream, O‘ahu



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Halawa Stream Biodiversity Surveys

Jan, 2022	Pre-discharge survey
Jan 29, 2022	Started discharge ~ 5 MGD
Feb, 2022	Post-discharge survey #1
May, 2022	Post-discharge survey #2
Aug, 2022	Post-discharge survey #3
Oct, 2022	Post-discharge survey #4
Feb., 2023	Post-discharge survey #5
May, 2023	Post-discharge survey #6
Aug, 2023	Post-discharge survey #7
Oct., 2023	Post-discharge survey #8

Objectives:

How will the GAC water outflow affect stream water quality and aquatic biodiversity?

Hypotheses:

- Increased wetted area
- Attract native migratory species (e.g., 'o'opu).
- Impacts to stream water quality

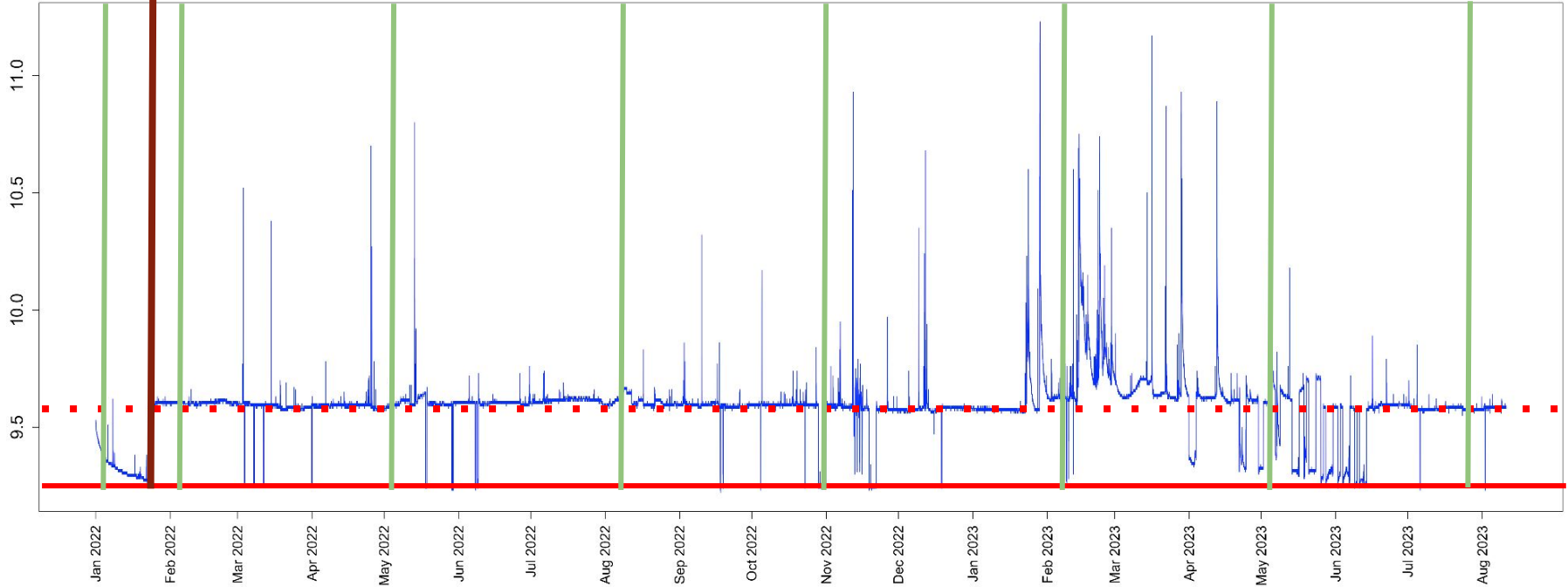


Changes in streamflow (stream water height)

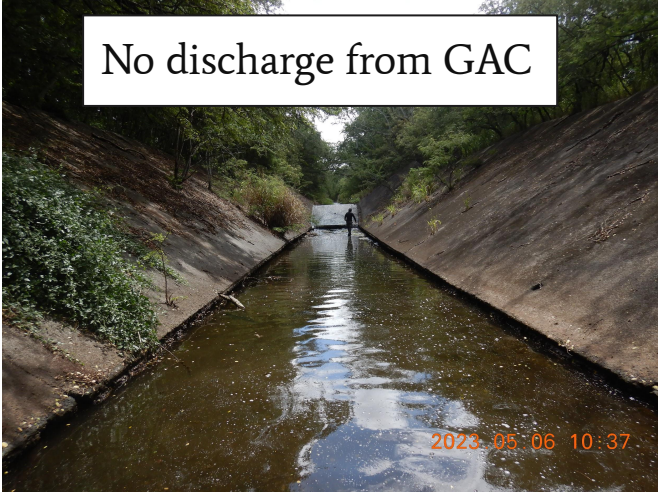
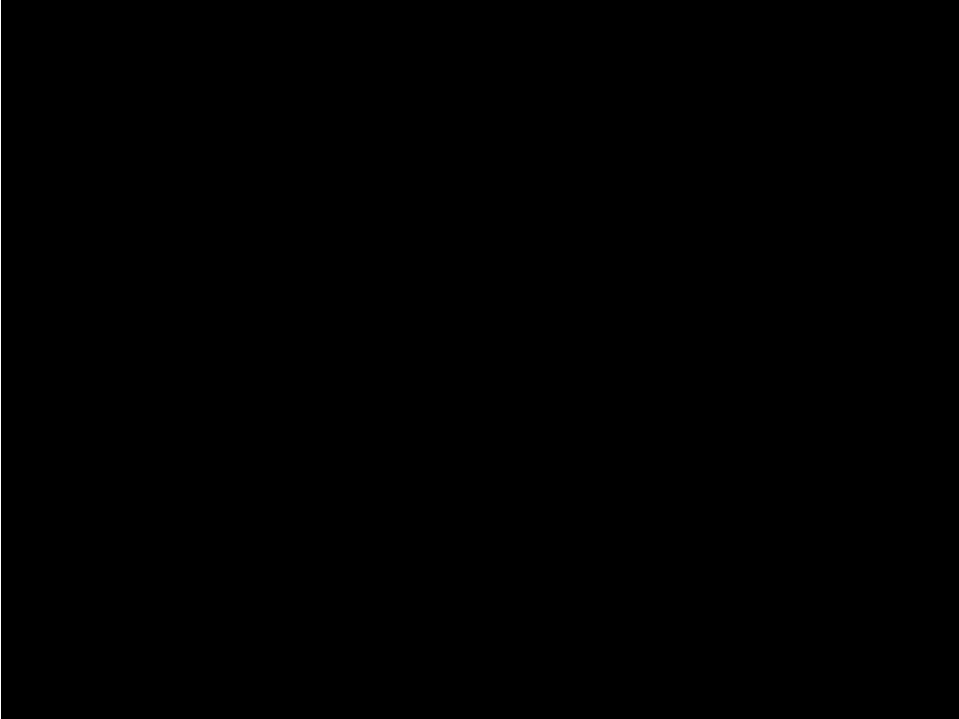
- Water level with discharge from GAC
- Water level without discharge from GAC
- Date of survey

Started discharge ~ 5 MGD

Gage height (ft) at S. Halawa USGS

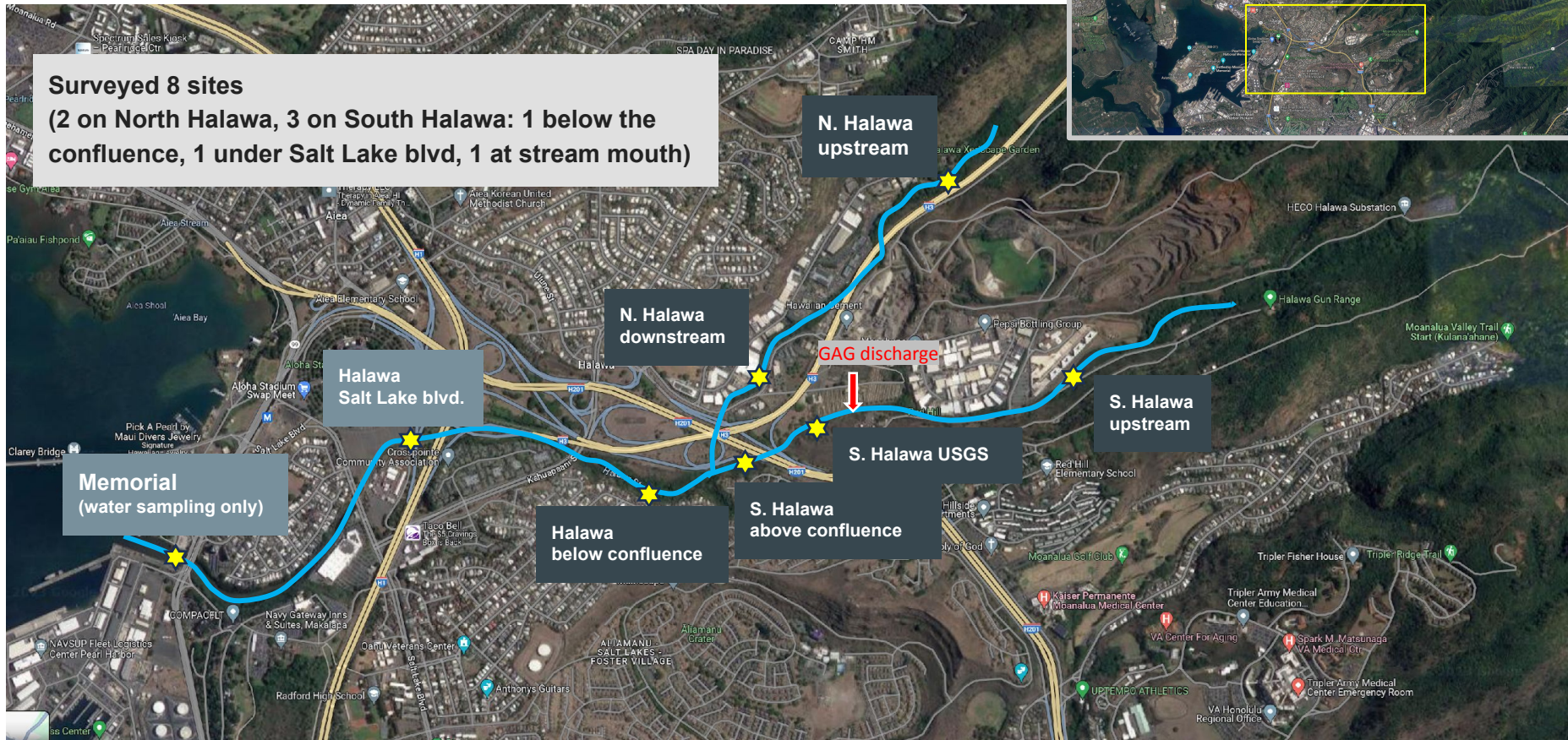


Pre- vs. post- GAC discharge

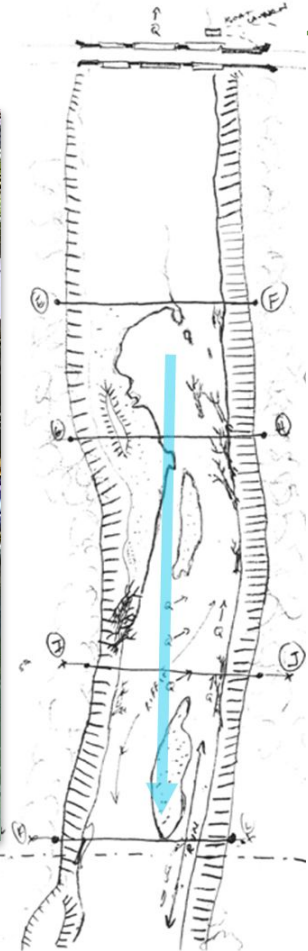


Survey Sites

Surveyed 8 sites
(2 on North Halawa, 3 on South Halawa: 1 below the confluence, 1 under Salt Lake blvd, 1 at stream mouth)



Survey Methods



1. eDNA and water chemistry sampling



2. Visual species survey



3. Benthic samples

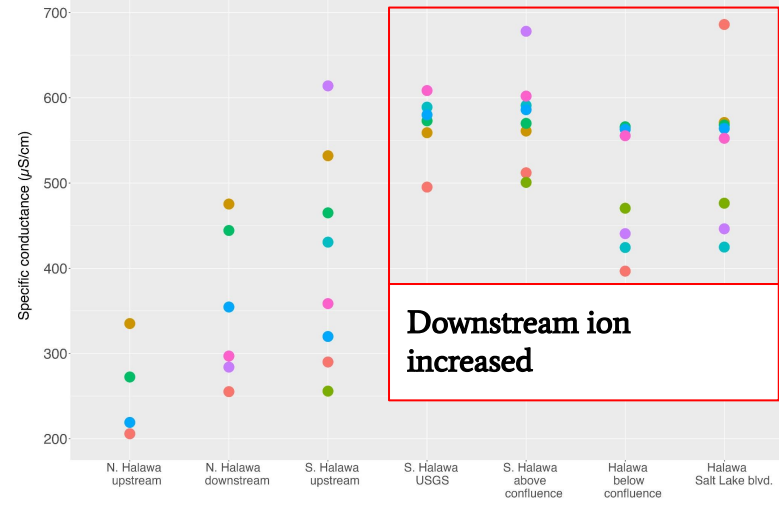
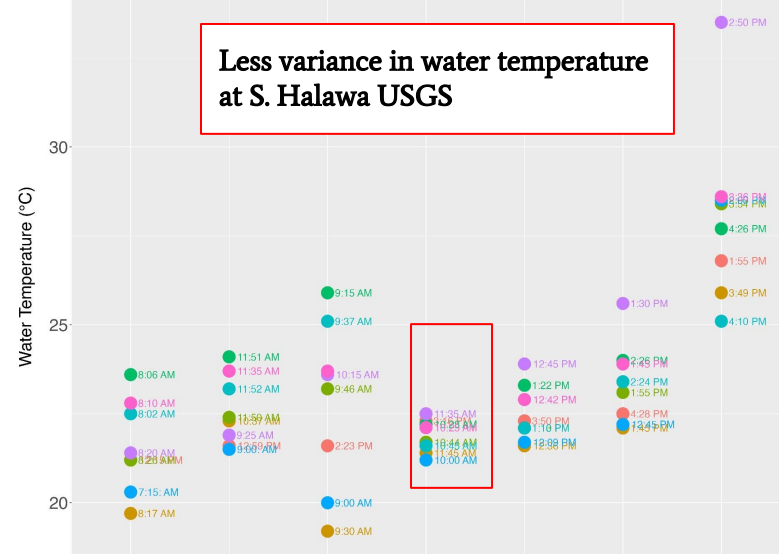
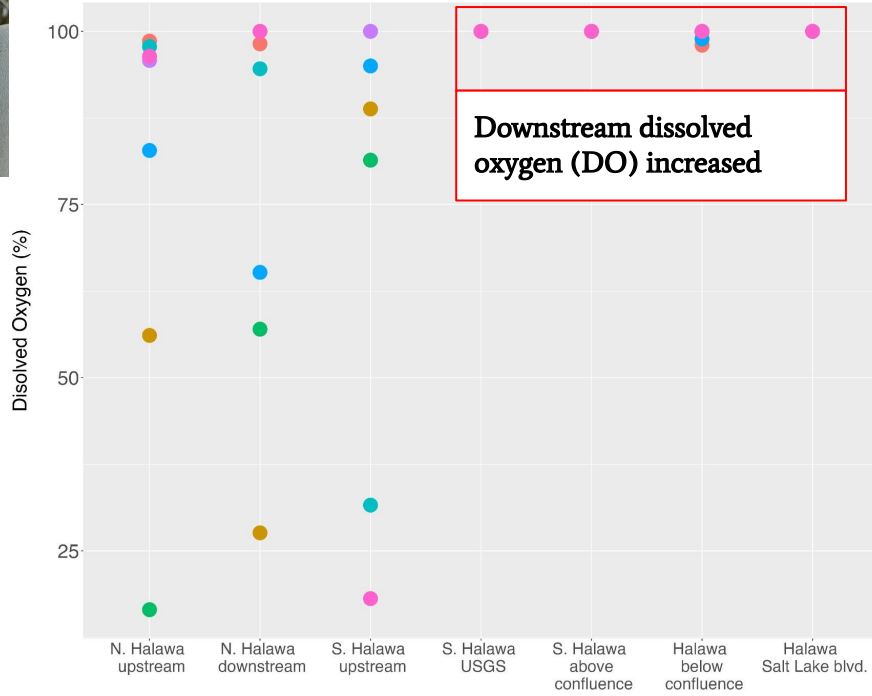
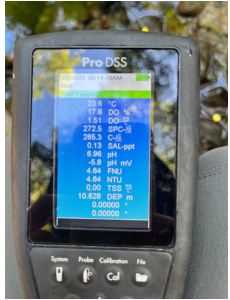


4. habitat monitoring



Changes in water chemistry

- pre-discharge
- post-discharge_01
- post-discharge_02
- post-discharge_03
- post-discharge_04
- post-discharge_05
- post-discharge_06
- post-discharge_07



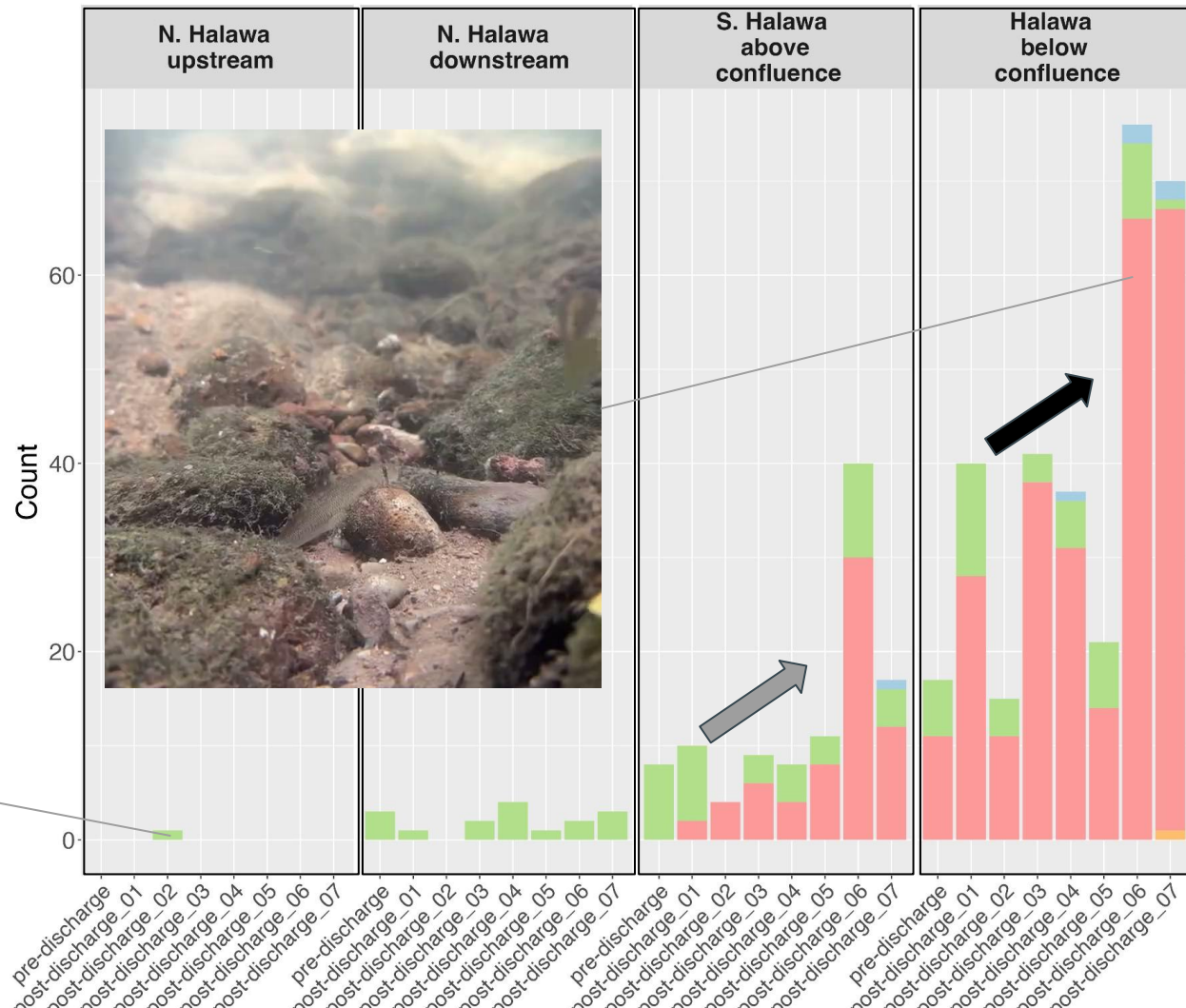
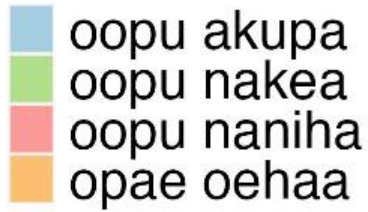
Survey Sites

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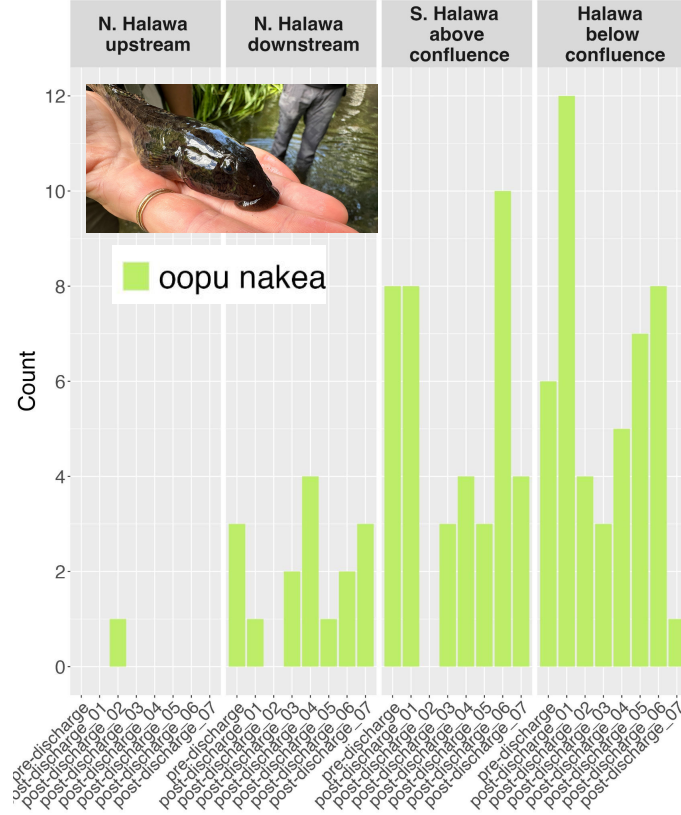
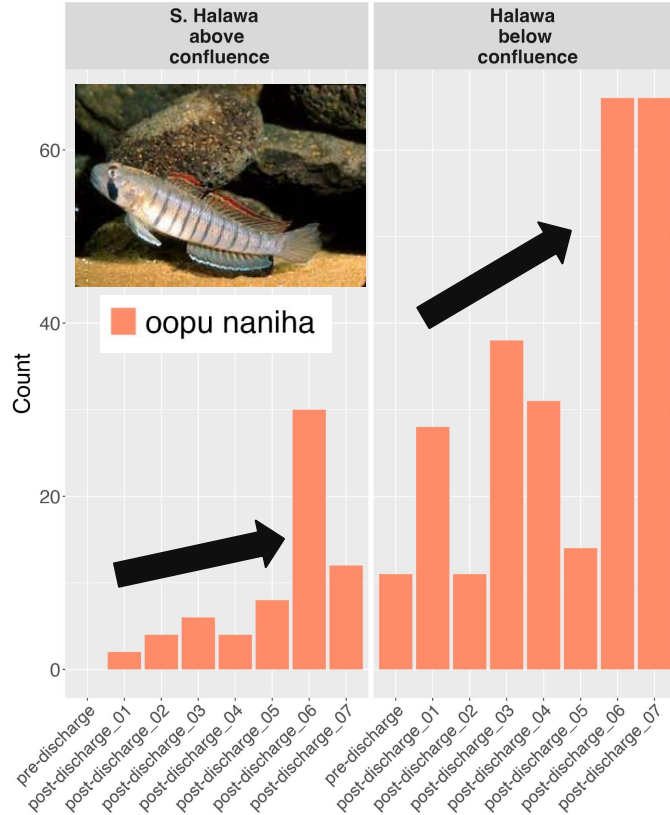
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Freshwater native species increased



Freshwater native species increased



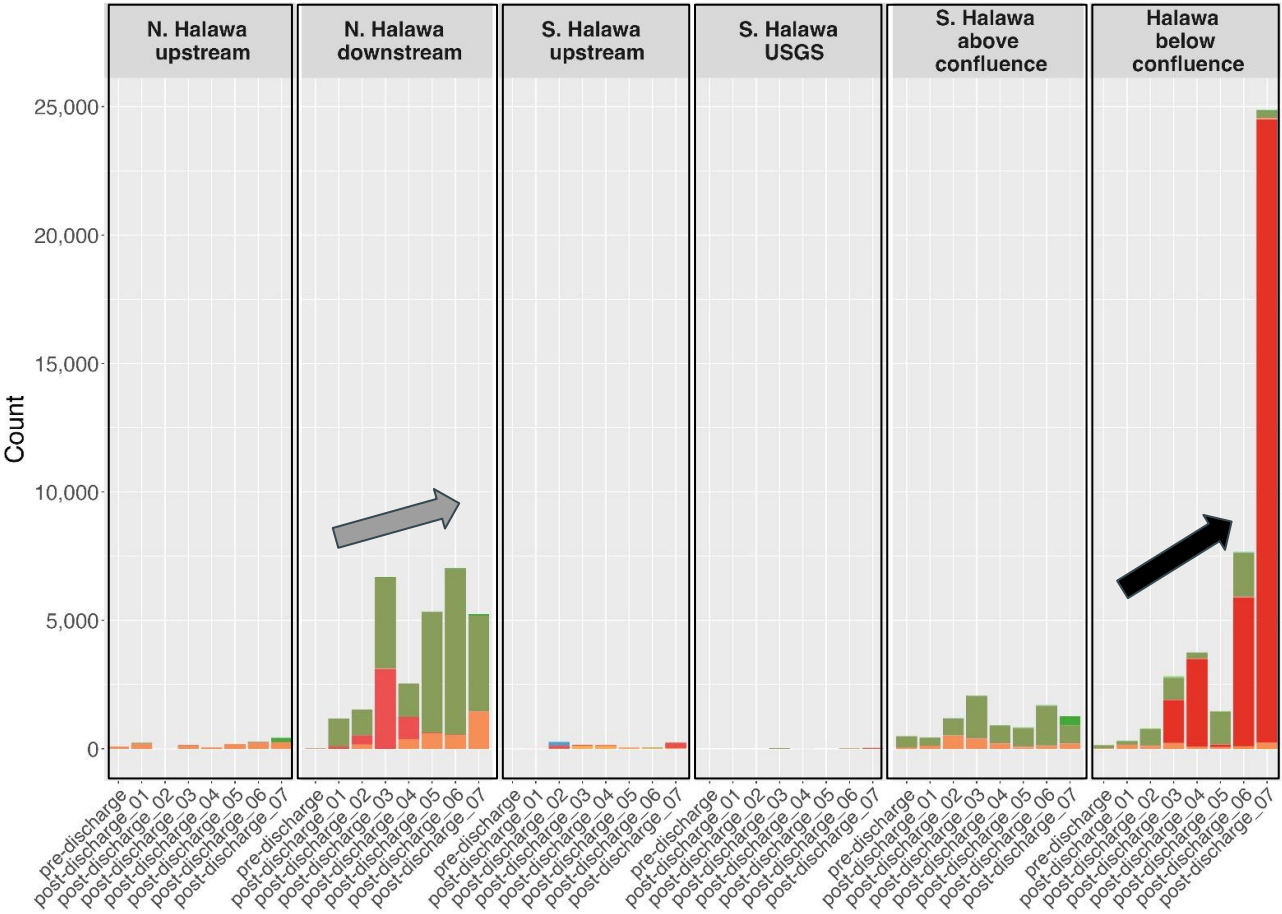
Survey Sites

Surveyed 8 sites

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Freshwater non-native species increased

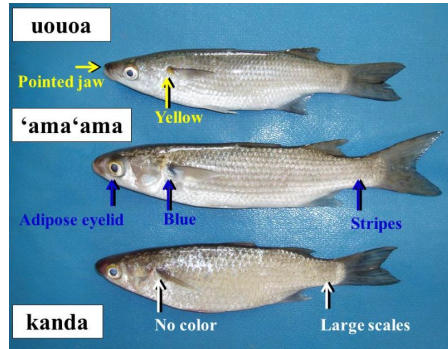


Survey Sites

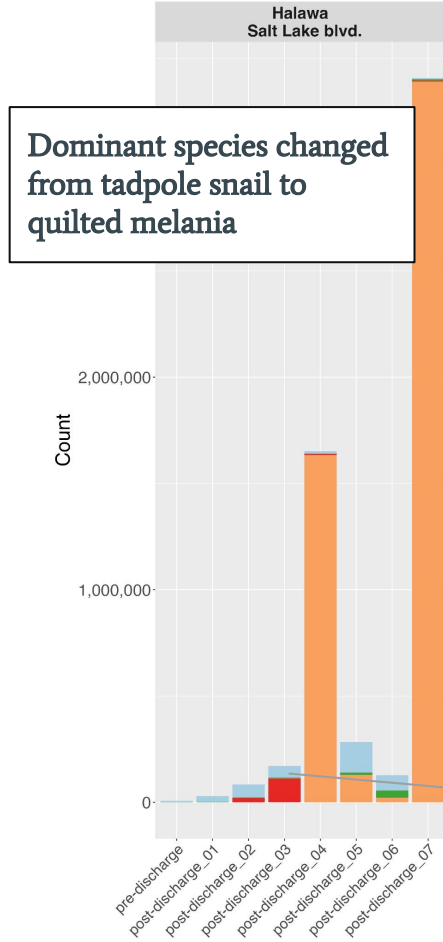
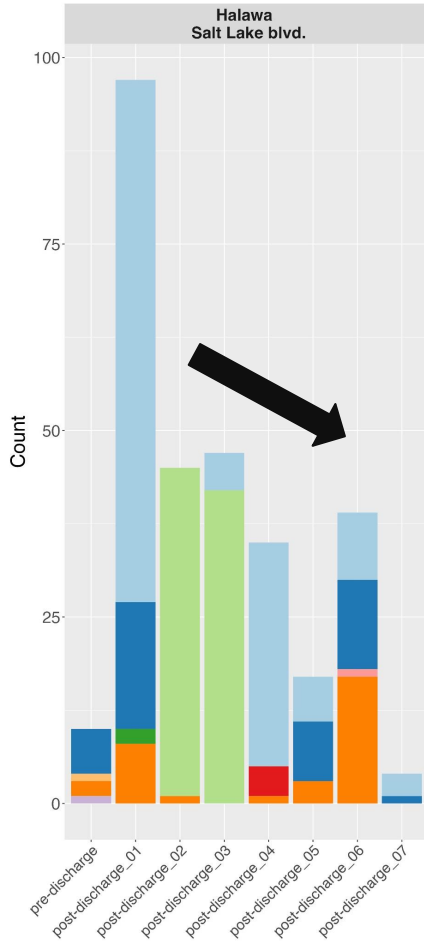
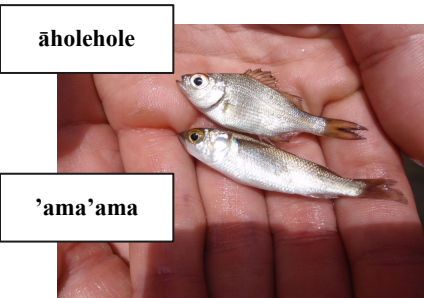
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Brackish species population



- aholehole
- amaama
- amaama (poss mixed with kanda)
- iao
- kaku / great barracuda
- oopu akupa
- oopu nakea
- oopu naniha
- polychaete worm

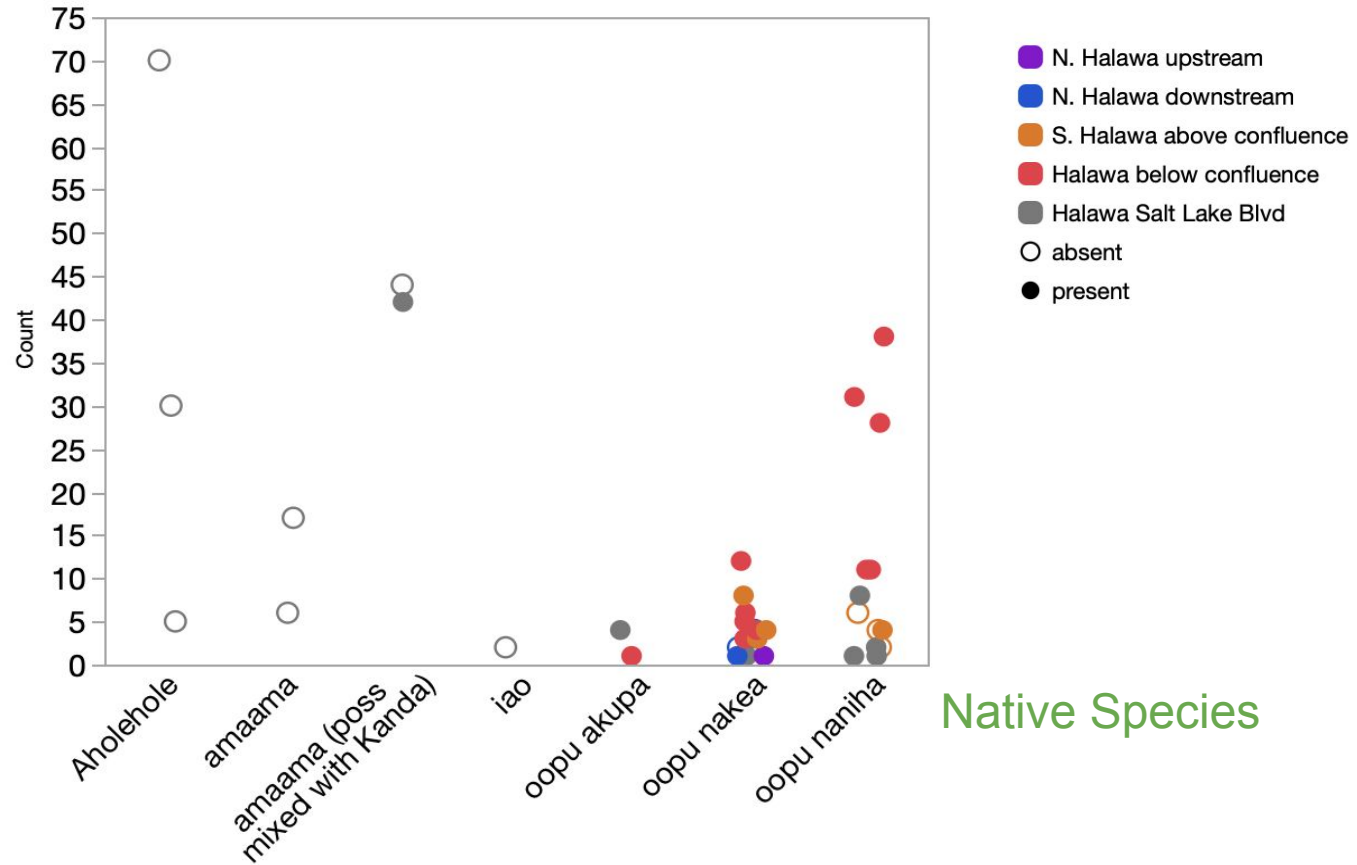


Dominant species changed from tadpole snail to quilted melania

- blackchinned tilapia
- kanda mullet
- kanda mullet (mixed with amaama)
- malaysian trumpet snail
- mexican molly
- mosquitofish
- mozambique tilapia (poss nile tilapia)
- pouch / tadpole snail
- quilted melania
- rainbow guppy
- samoan crab
- tahitian prawn



eDNA accuracy depends on site structure and sampling design



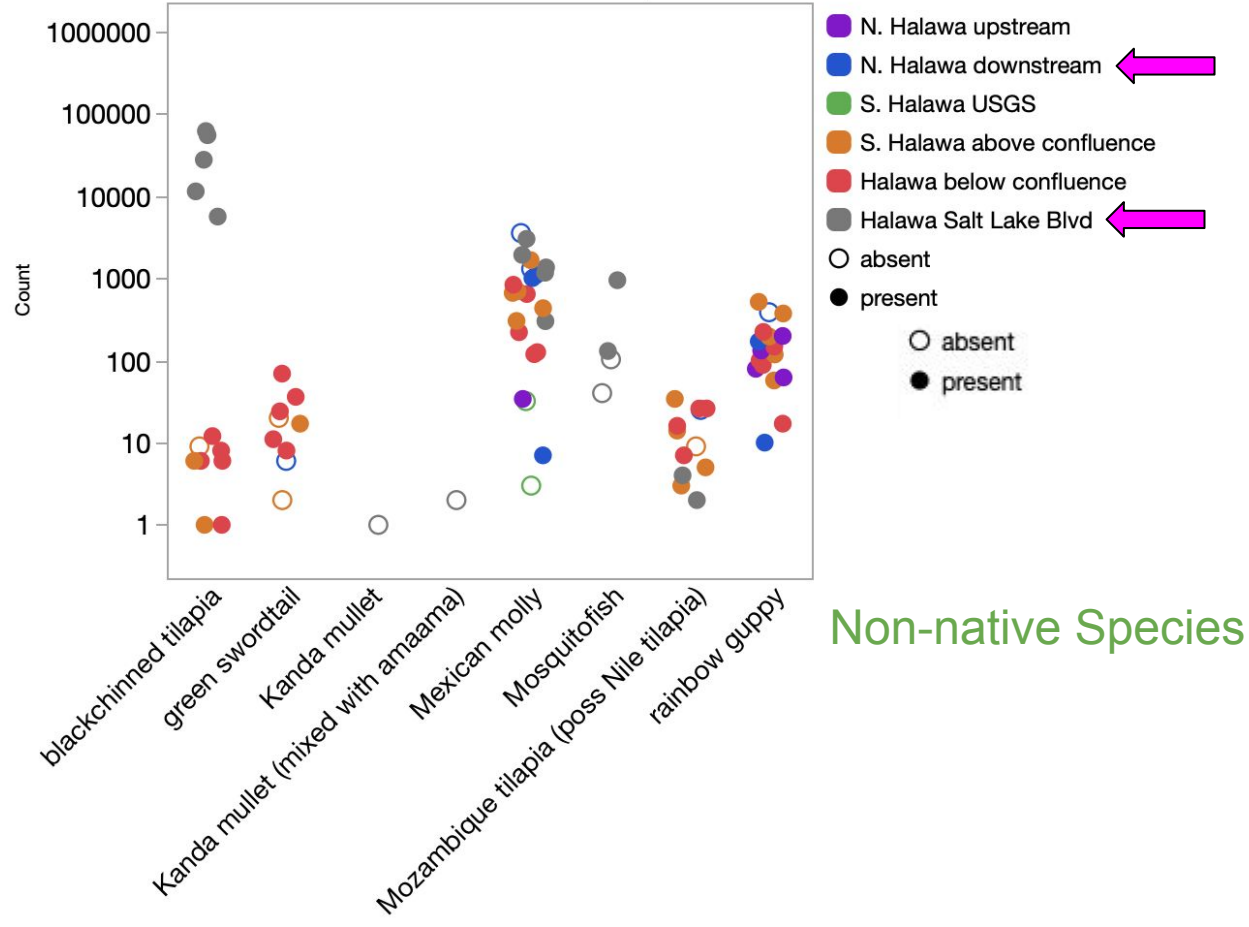
eDNA accuracy depends on site structure and sampling design

Advantages

- Systematic
- Detects cryptic species
- Can survey inaccessible habitats

Caveats

- Taxonomist/biologist input is important
- Dependent on reference database



eDNA helps with hard-to-survey sites and hidden species

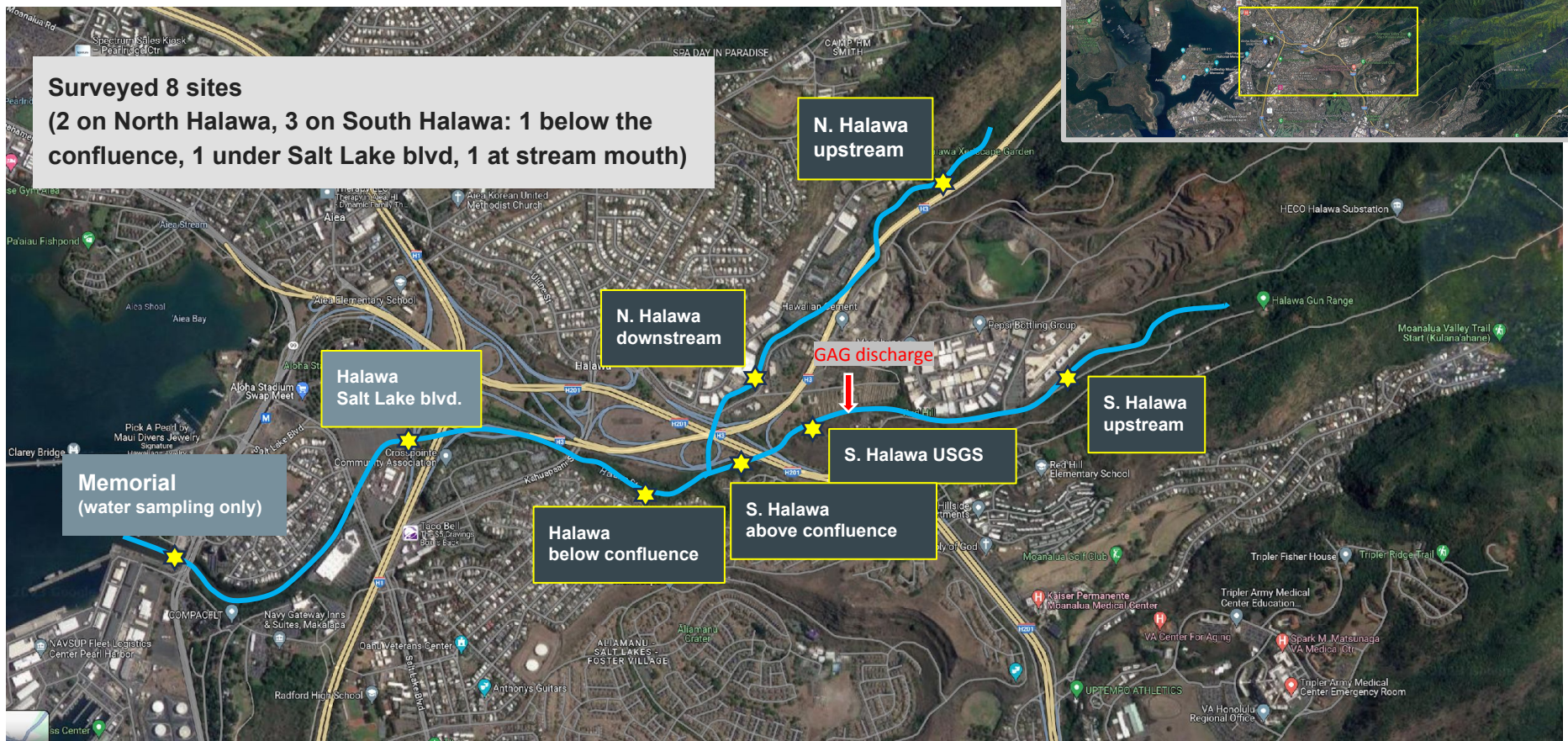
	Species	Sampling Event				
		pre-discharge	post-discharge_01	post-discharge_02	post-discharge_03	post-discharge_04
native	weed cardinalfish	●	●	●	●	●
	ulua (giant trevally)	●	●	●	●	●
	Thompson's surgeonfish	●	●	●	●	●
	spwartail goby	●	●	●	●	●
	omilu (Bluefin jack)	●	●	●	●	●
	o'io (roundjaw bonefish)	●	●	●	●	●
	Lai, double-spotted queenfish	●	●	●	●	●
	flathead grey mullet	●	●	●	●	●
	bigeye scad	●	●	●	●	●
	āholehole	●	●	●	●	●
	'O'opu nopili	●	●	●	●	●
	'O'opu naniha	●	●	●	●	●
	'O'opu nakea	●	●	●	●	●
introduced	roundhead blenny	●	●	●	●	●
	o'opu ohune (cocos frillgoby)	●	●	●	●	●
	Nile tilapia	●	●	●	●	●
	Nebulous lizardfish	●	●	●	●	●
	mangrove goby	●	●	●	●	●
	longfin tilapia	●	●	●	●	●
	Kanda (Australian mullet)	●	●	●	●	●
	Hongkong catfish; Chinese catfish	●	●	●	●	●
	green swordtail	●	●	●	●	●
	Goldspot herring	●	●	●	●	●
	Golden trevally	●	●	●	●	●
	Buccaneer anchovy	●	●	●	●	●
	bristlenose catfish	●	●	●	●	●
bigeye tuna	●	●	●	●	●	
awa (milkfish)	●	●	●	●	●	



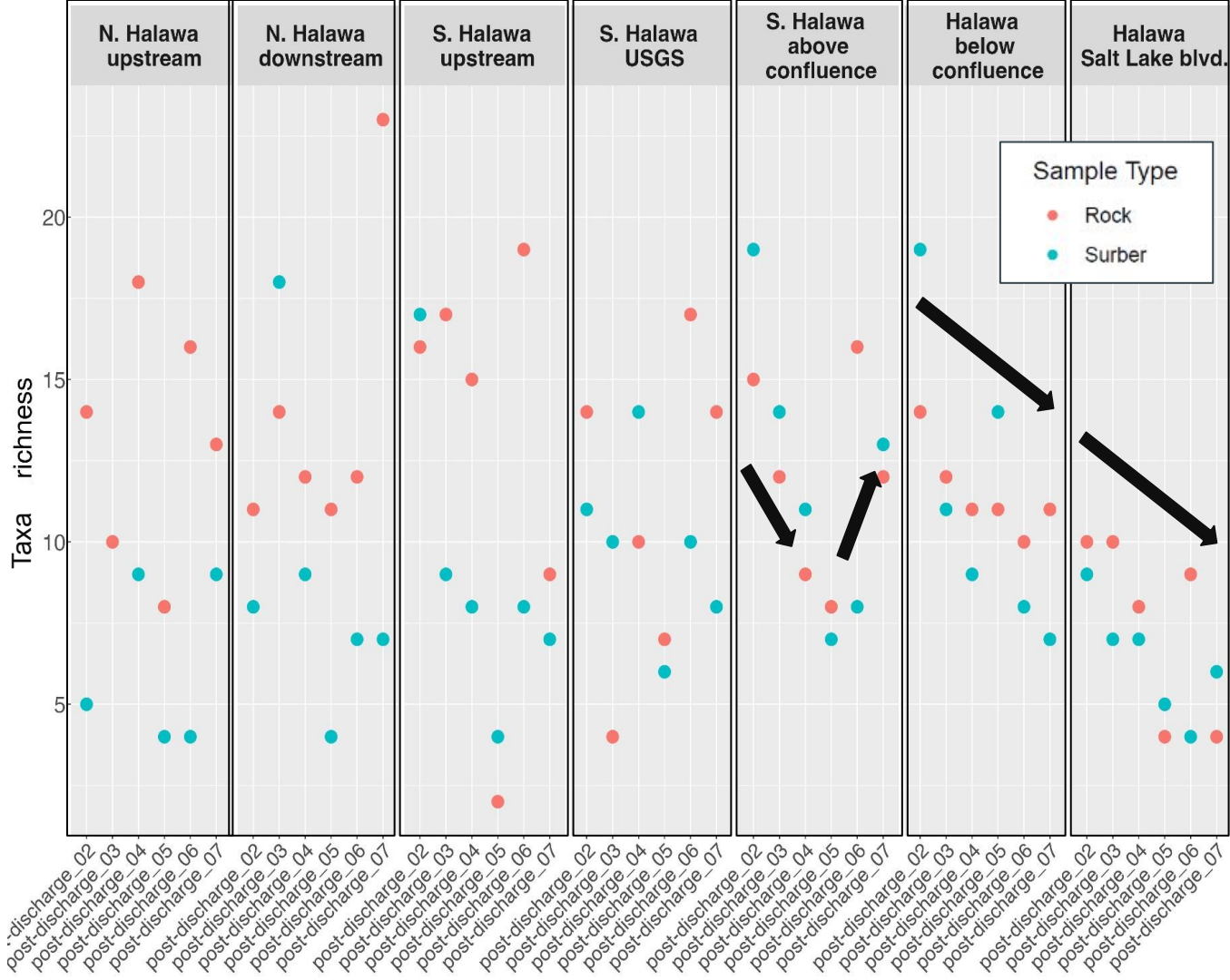
● freshwater species
● marine species

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Benthic taxa richness varied



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