



Physical Characteristics of Streams Which Increase Ecosystems Resilience To *Salvinia molesta*

Visual surveys and its use
for management

By Dan Lager

Salvinia molesta

- Aquatic fern
- Native to Brazil
- Used in an ornamental plant in ponds and aquariums
- Highly invasive around the world and many negative impacts
- Listed on Federal Noxious Weed list in 1984
- State of Hawai'i Act 085 prohibits import and sale in 2003



S. Molesta impacts in Hawai'i

Lake Wilson

- January 2003 *S. molesta* covered the entire surface of the 325 acre lake
- Nearly two years of State, City & County and Military crews to clear
- Cost over \$1 million to remove



S. molesta project in Kauaʻi

- 2016
 - Community reaches out with concern of expanding population in Kilauea Stream
- 2017
 - AIS team organizes a multi-agency physical removal effort
 - Partners with OI to develop *S. molesta* DNA markers to sample for eDNA, initial testing
- 2018
 - eDNA sampling of all perennial stream mouths on island
 - eDNA sampling of tributaries with known populations
 - Visual surveys of streams with known populations
- 2019
 - Continued visual surveys of Kapaʻa and Kilauea Streams



eDNA

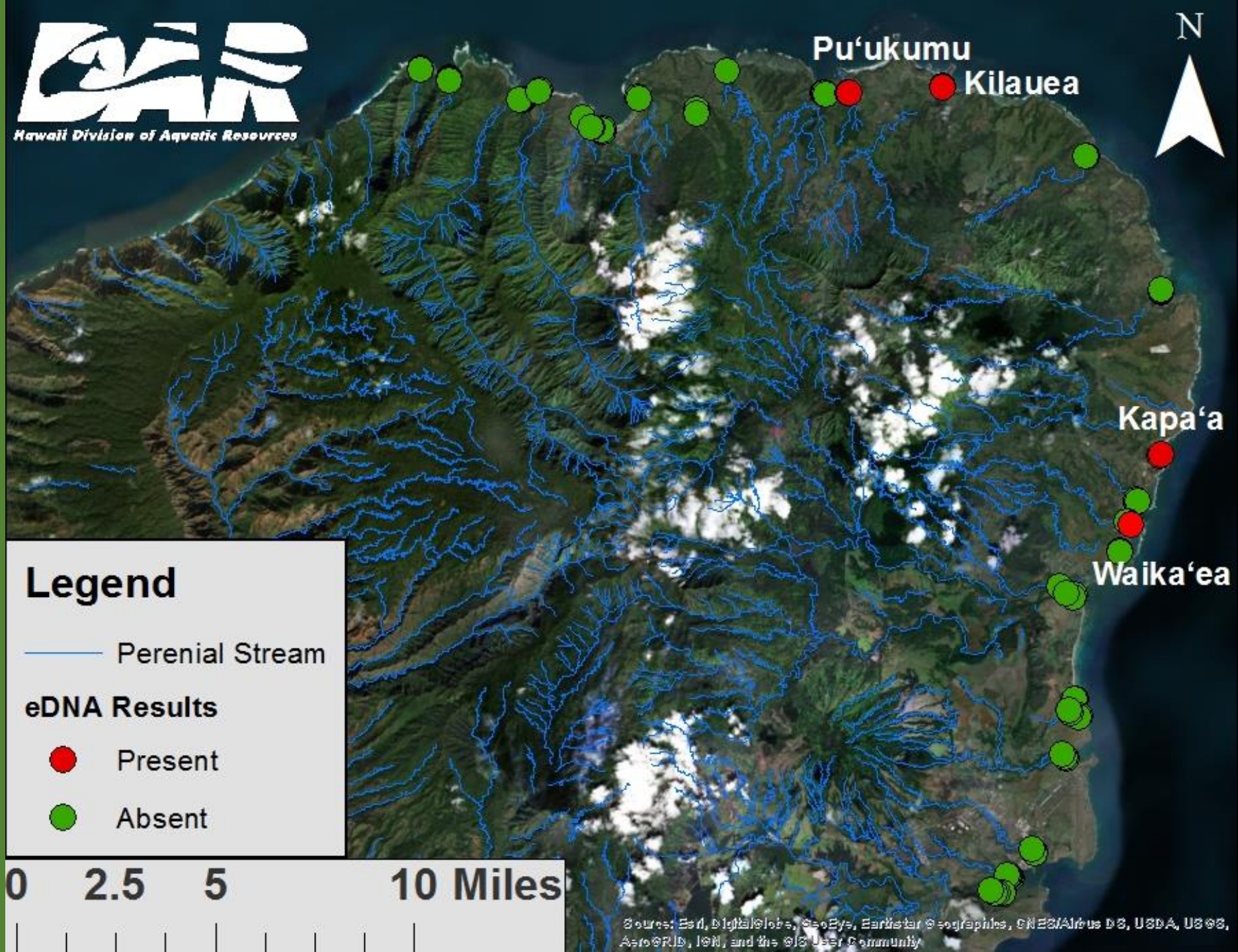
- Strands of free floating DNA from organisms that live within the aquatic ecosystem.
- Once a species specific primer is developed water samples can be processed to detect presence or absence of that species



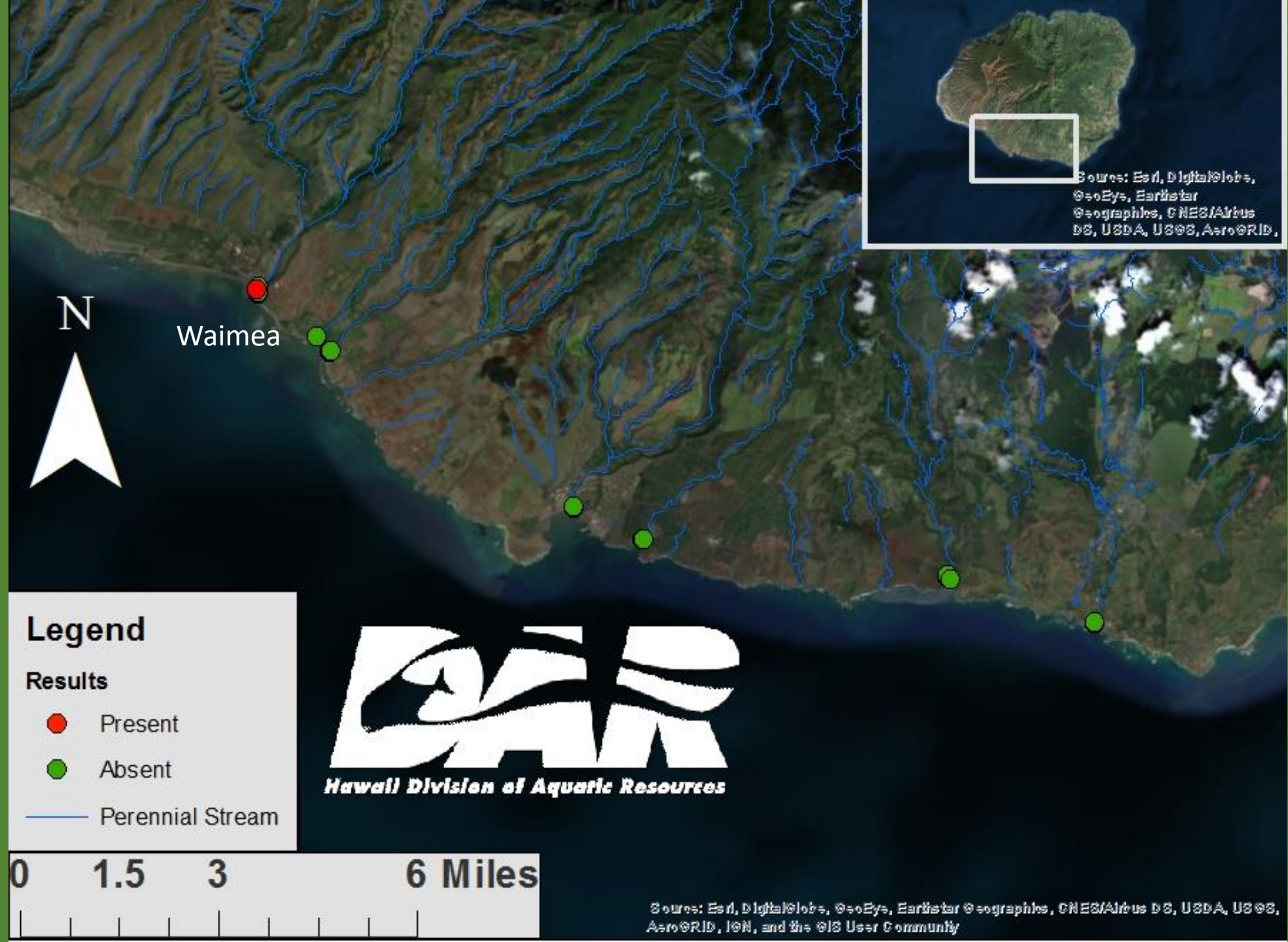
Sample Filtering



Northeast Stream eDNA results



Southwest Stream eDNA Results



Visual Survey

Conducted on all stream with positive eDNA results which were accessible via kayak

(Kilauea, Kapaʻa, Waikaʻea, Puʻukumu and Waimea)

Map *S. molesta* density along banks

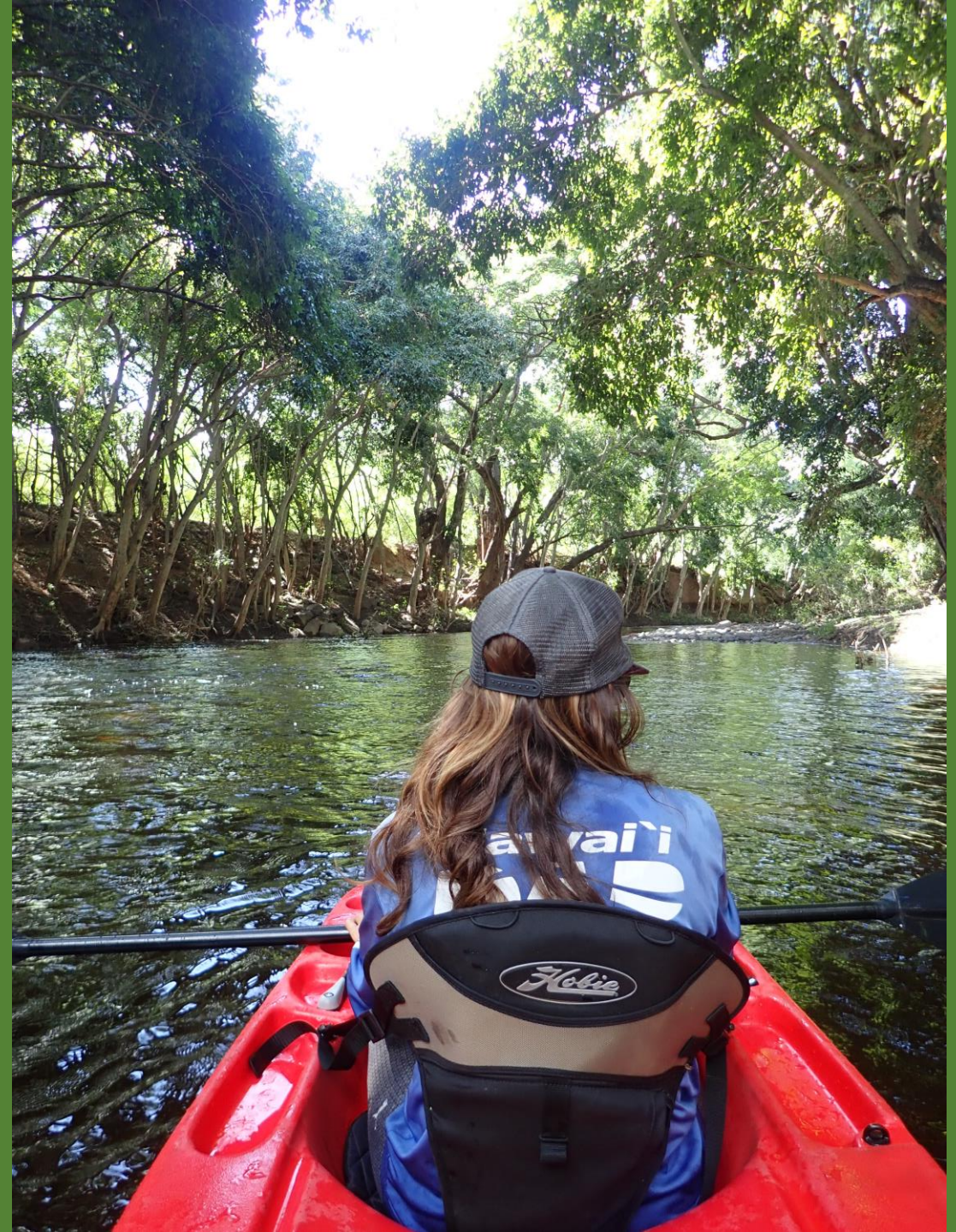
Monitor changes over time

Density categories:

- Absent
- Sparse (small patches no gap <5m)
- 1-2m
- 2-3m
- >3m

GPS points taken to indicate change in density

Mapped in ArcGIS to calculate meters of stream bank for each category



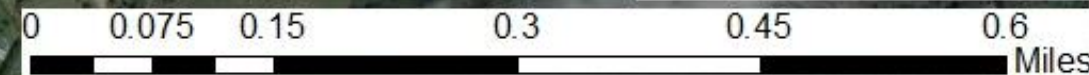
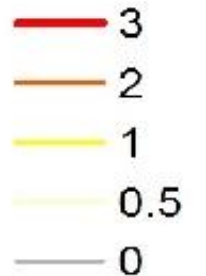
1. Large initial population
2. Significant Decrease
3. Slow regrowth

Kilauea Stream Visual Survey April 2018



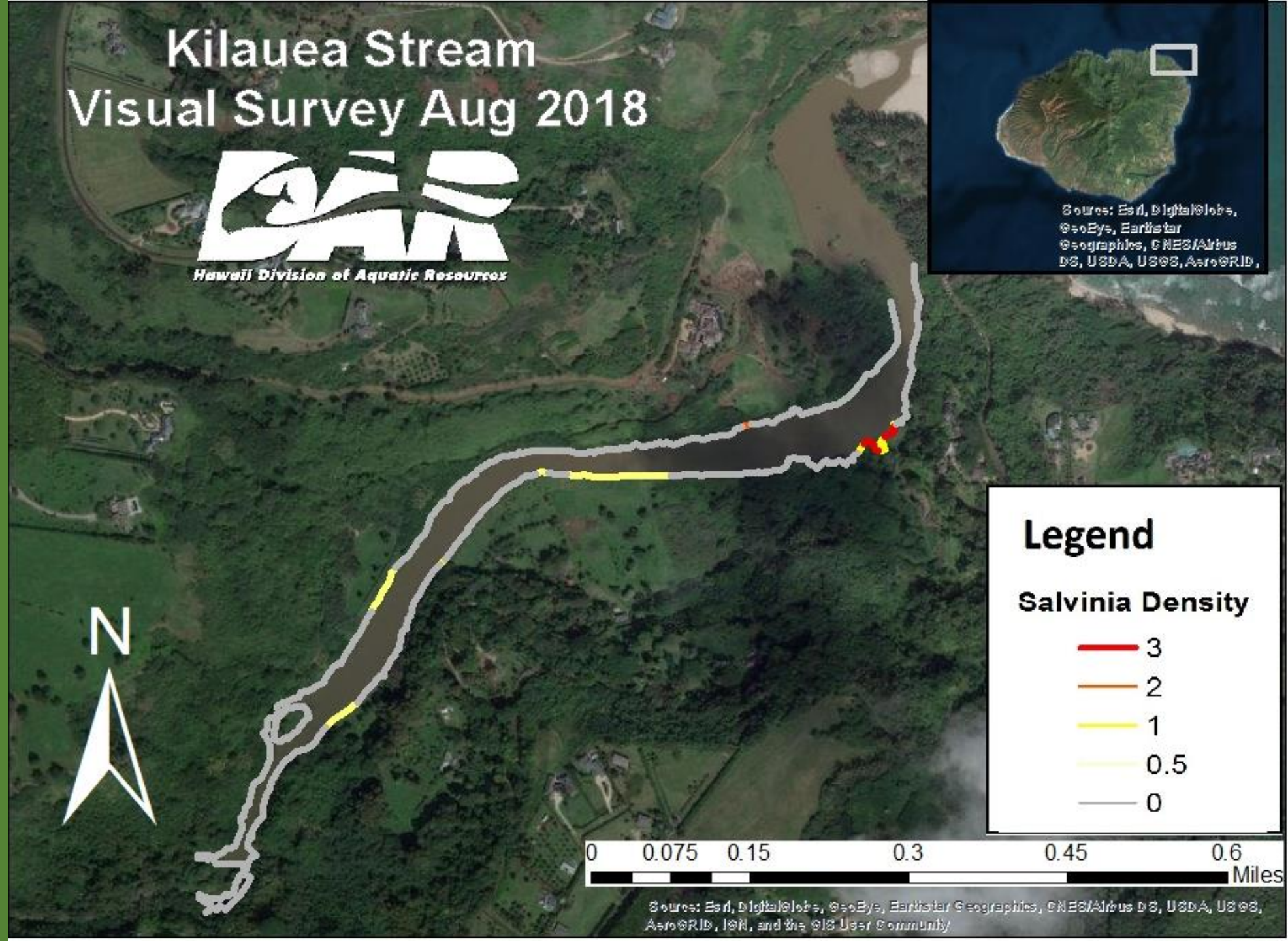
Legend

Salvinia Density

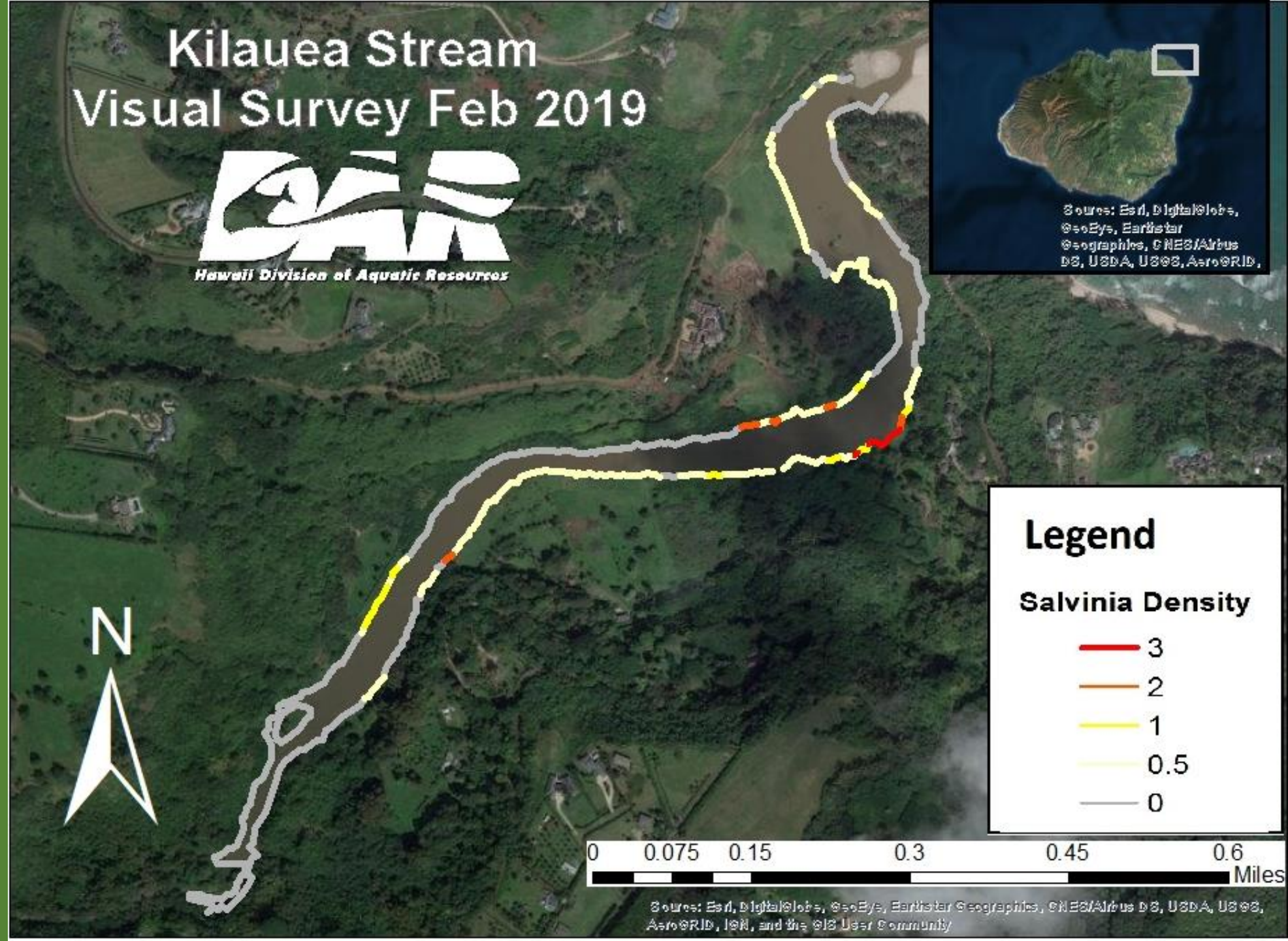


Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

1. Large initial population
2. Significant Decrease
3. Slow regrowth

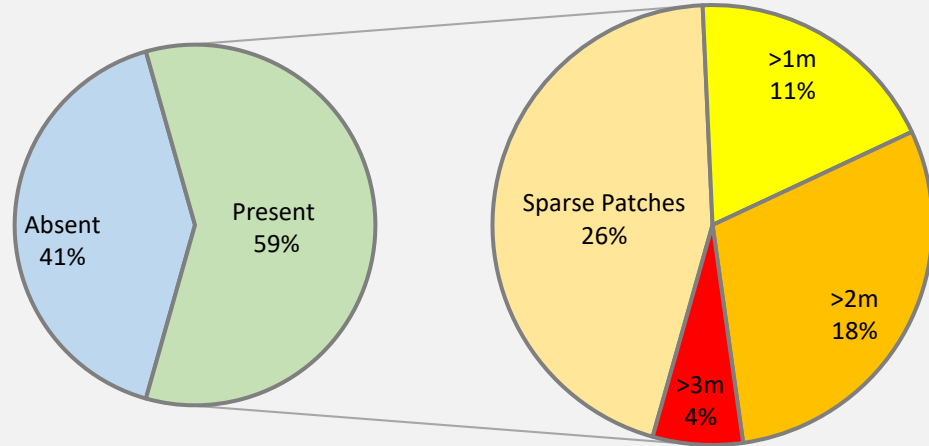


1. Large initial population
2. Significant Decrease
3. Slow regrowth

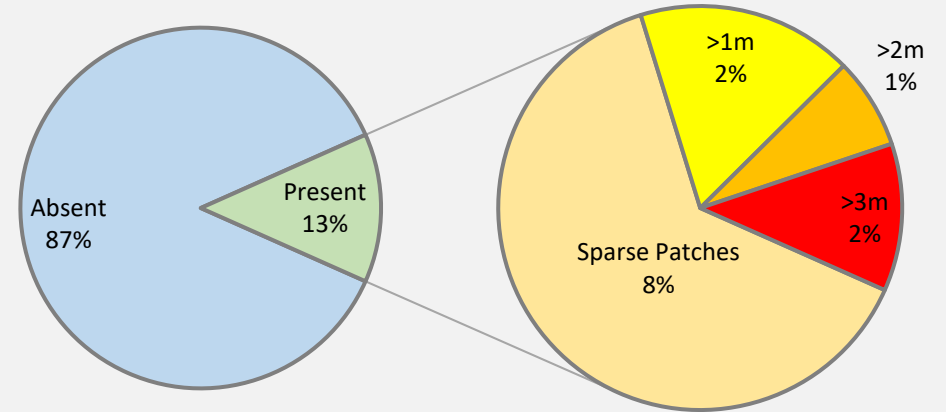


Kilauea Density Composition Graphs

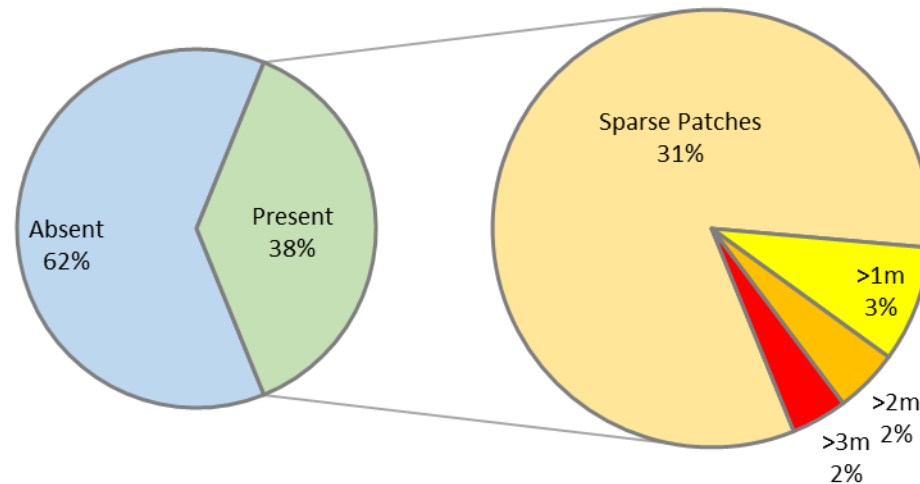
Kilauea River Bank Density April 2018



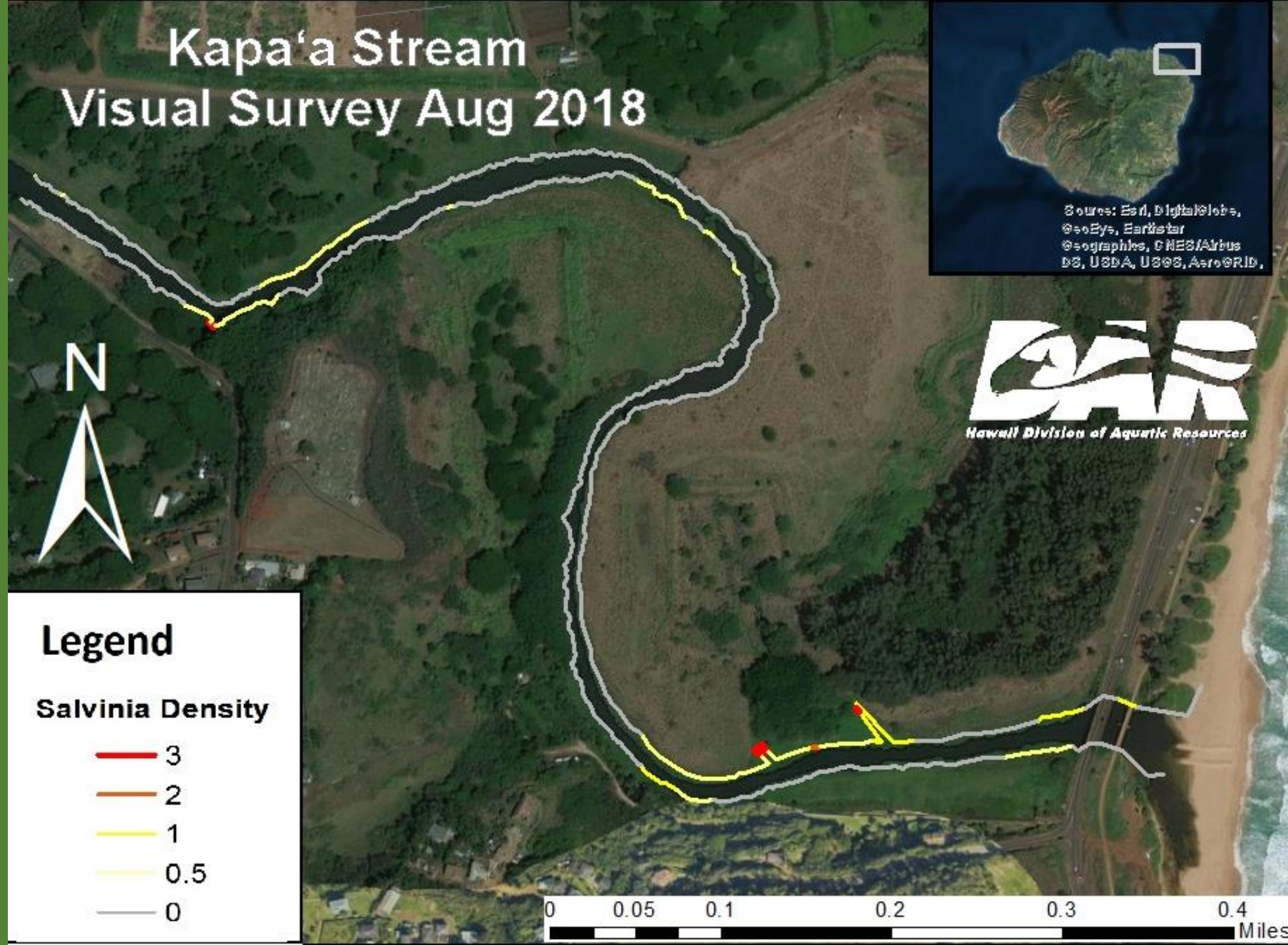
Kilauea River Bank Density August 2018



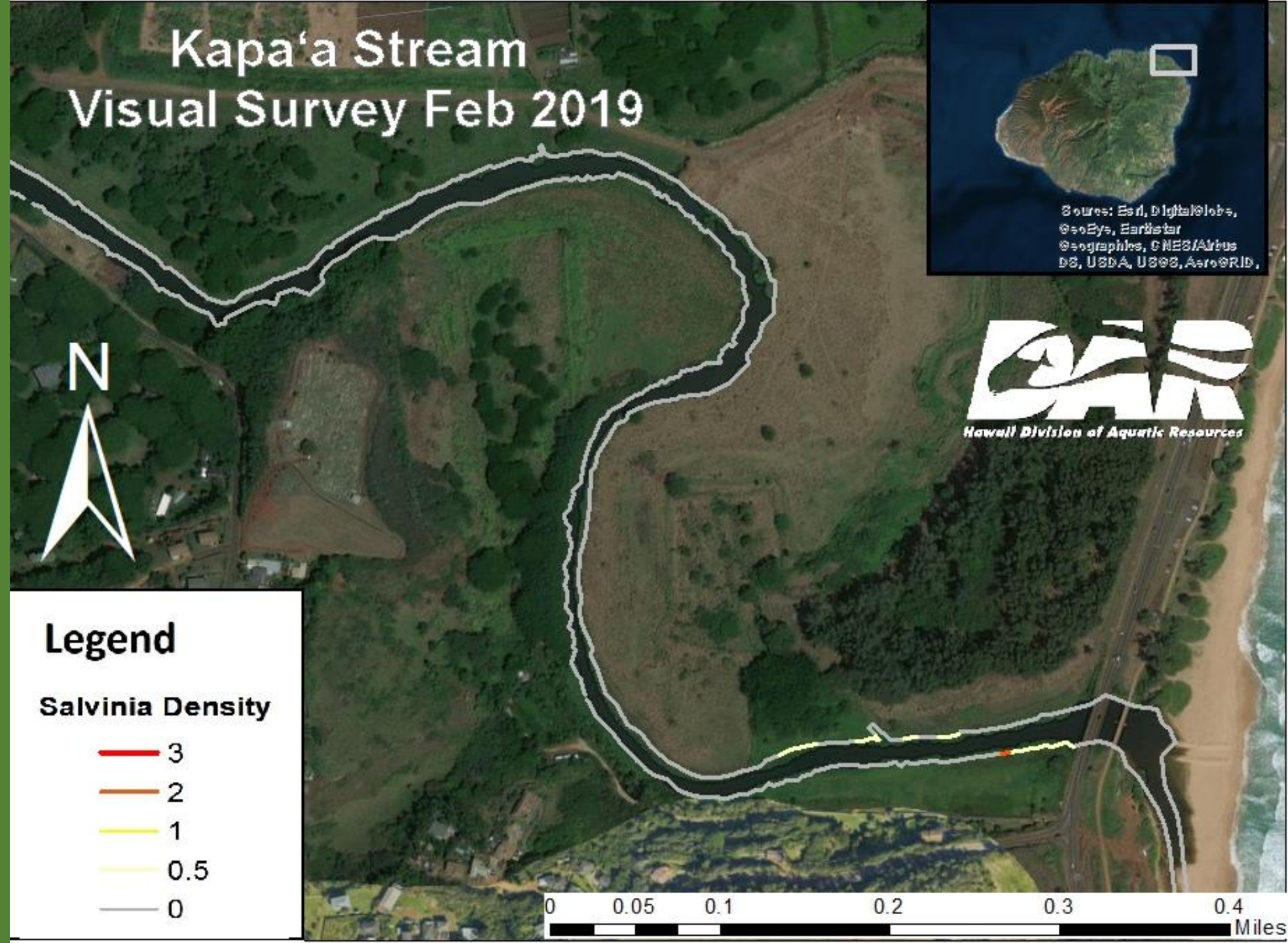
Kilauea River Bank Density Feb 2019



1. Relatively low population density
2. Decrease in population

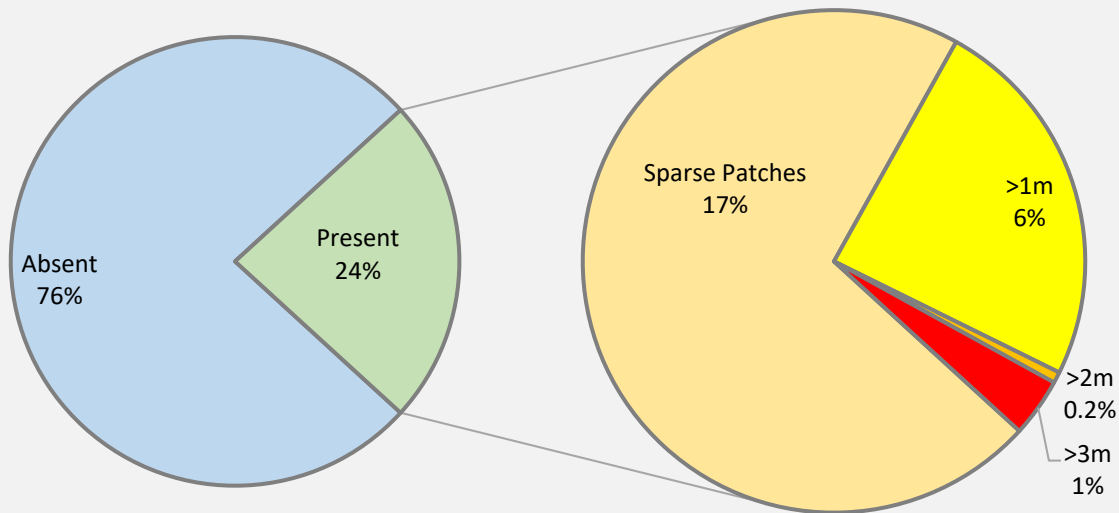


1. Relatively low population density
2. Decrease in population

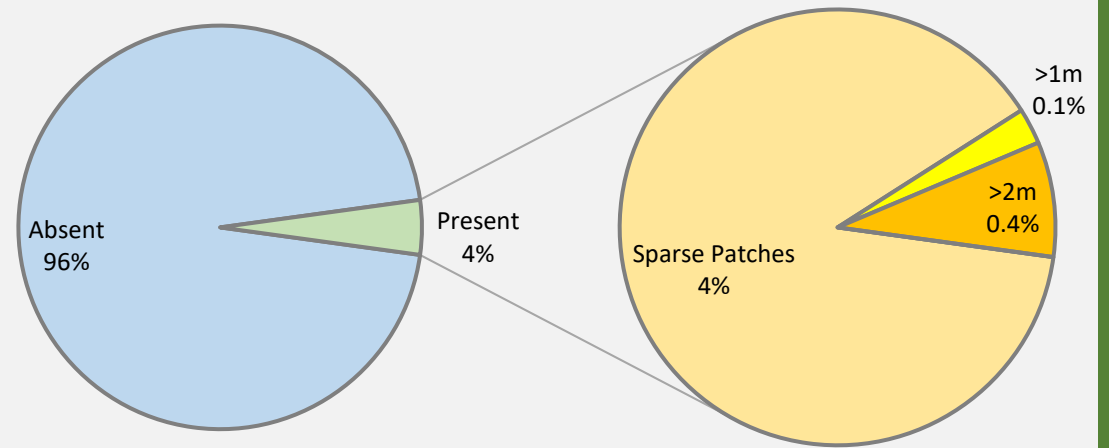


Kapa'a Density Composition

Kapa'a River Bank Density August 2018

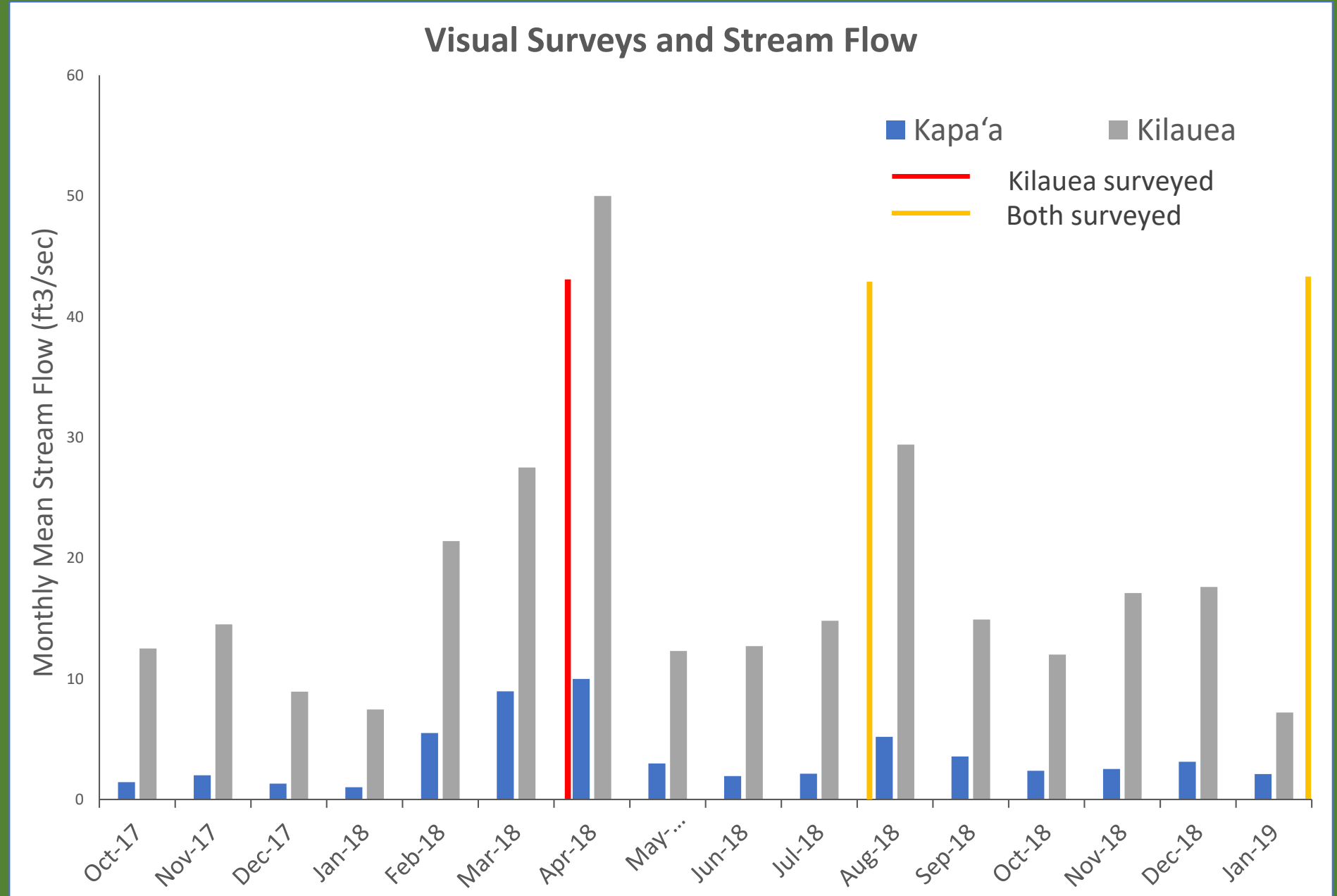


Kapa'a River Bank Density Feb 2019



USGS Stream Flow Data

- Kilauea stream sampled before rain event in April 2018
- Regrowth not observed in Kapa'a
- Less high flow months in Kapa'a system



Management Strategy: target control efforts

- High flowing stream water following heavy rain events significantly decrease the *S. molesta* population in Kilauea Stream
- Most winter seasons will have heavy rain events
- Plan control effort following a large event and maximize effectiveness by treating a smaller *S. molesta* population
- Can judge relative *S. molesta* population against repeated visual surveys
- Maximizes chance of full eradication



Moving Forward

- Public education on issues caused by *S. molesta* and how to avoid spread
- Manual removal shown to have high time and personnel cost
- Meetings with neighborhood board about targeted control efforts
- Scope herbicide application
- Purchase and stage control equipment
- Set threshold stream flow rate to trigger visual survey
- If survey shows low levels of salvinia implement control
- Post control surveys and re apply control if needed
- Continued eDNA testing to detect reintroduction



Mahalo

Any Questions?

Contact Info

DLNR - Division of Aquatic Resources

Daniel Lager, AIS Technician

daniel.j.Lager@Hawaii.gov

Oceanic Institute

Mark Renshaw, Research Associate

mrenshaw@hpu.edu



Oceanic Institute
HAWAII PACIFIC UNIVERSITY