A summary of green turtle growth rates and residency durations at three long-term study sites in West Hawai‘i

Laura Jim and Marc Rice
Hawai’i Preparatory Academy Sea Turtle Research Program
laura.jim@hpa.edu, mrice@hpa.edu

Acknowledgements

George Harvey Balazs

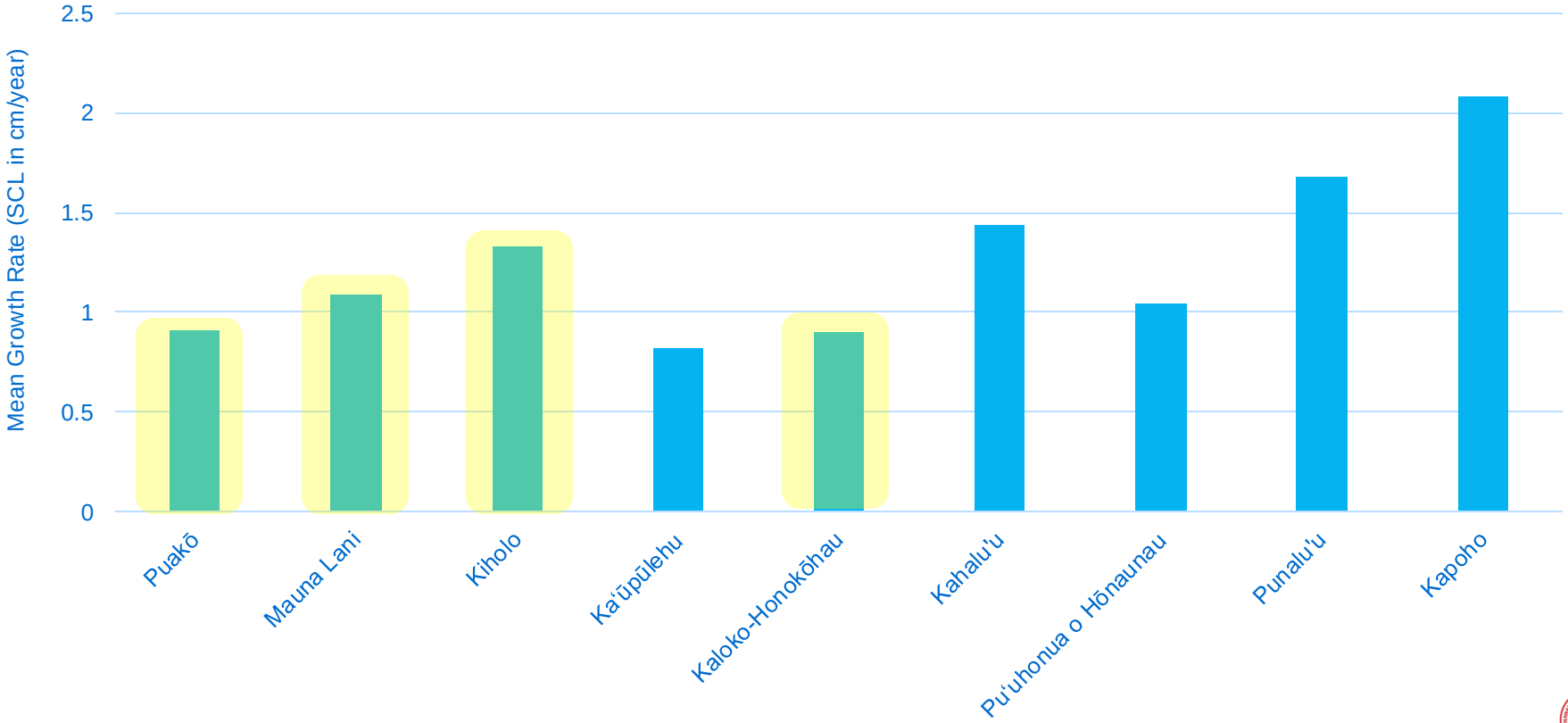
Global Independent Sea Turtle Scientist

"People Make Partnerships"

Study Sites


Puakō
Mauna Lani
Waikoloa (Hilton)
Kīholo
Kaloko-Honokōhau National Historical Park

Mean Growth Rate (SCL in cm/year) of green turtles at various locations on Hawai‘i Island

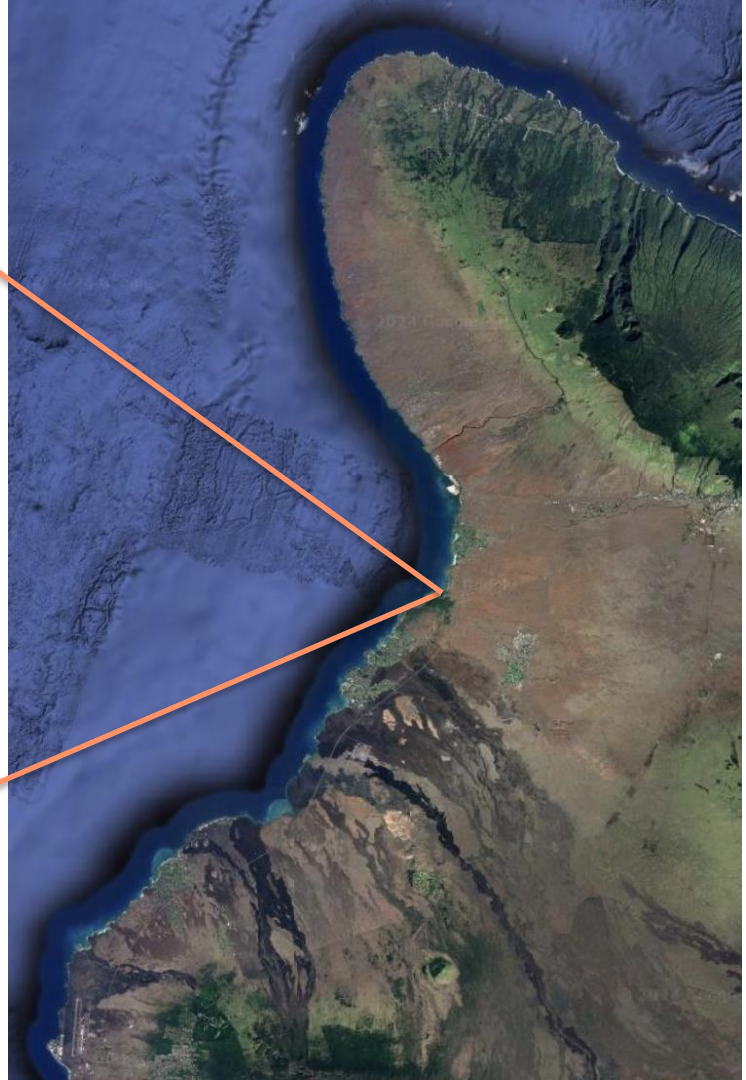


Have the growth rates varied over time at sites in West Hawai‘i?

Methodology

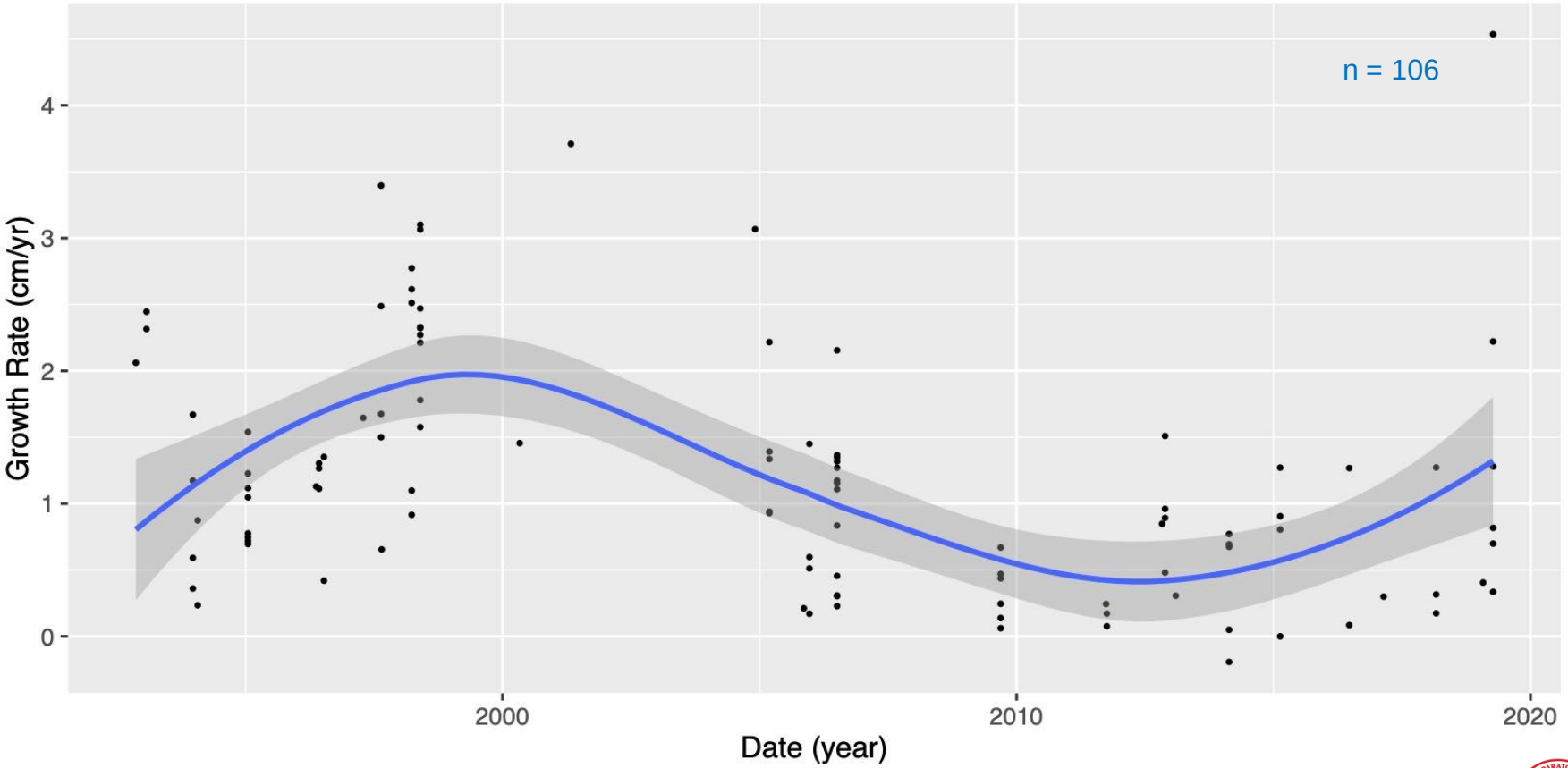
- SCL, measured to nearest mm, was used to determine growth rates as cm / year
- To qualify into decadal data turtle’s SCL had to have been measured twice within the decade with a 12 month minimum growth interval
- Decades are divided into 1980-1989, 1990-1999, 2000-2009, 2010-2019
- n represents the number of decadal data points (not number of turtles)
- Data on graph represents the growth at the last date turtle was observed during the respective decade
- Data provided by NOAA Fisheries’s online data center : (Pacific Islands Fisheries Science Center, 2024: PIR Marine Turtle In Water Captures & Observations, https://www.fisheries.noaa.gov/inport/item/5449)

Puakō

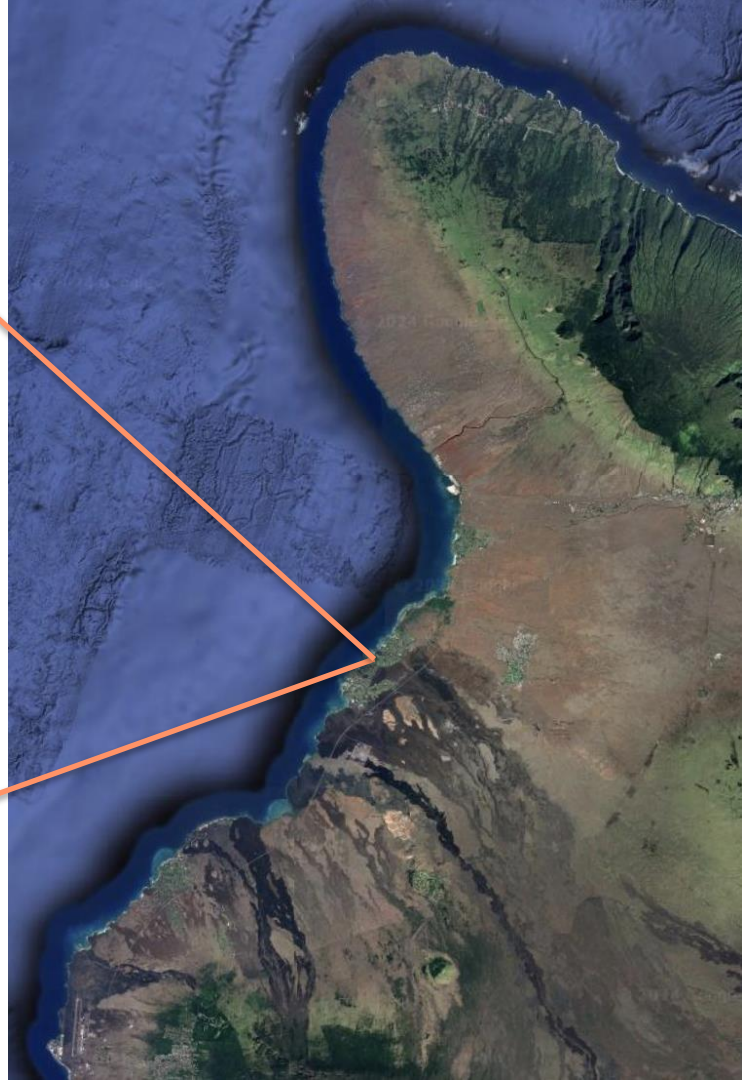


- 3 regular study sites
- Study site from 1993 to current
- Growth rate range : 0 to 4.5 cm/year
- Mean of this data set is 1.2 cm/year

Growth rates by decade for green turtles, *Chelonia mydas,* at Puakō, Hawai‘i

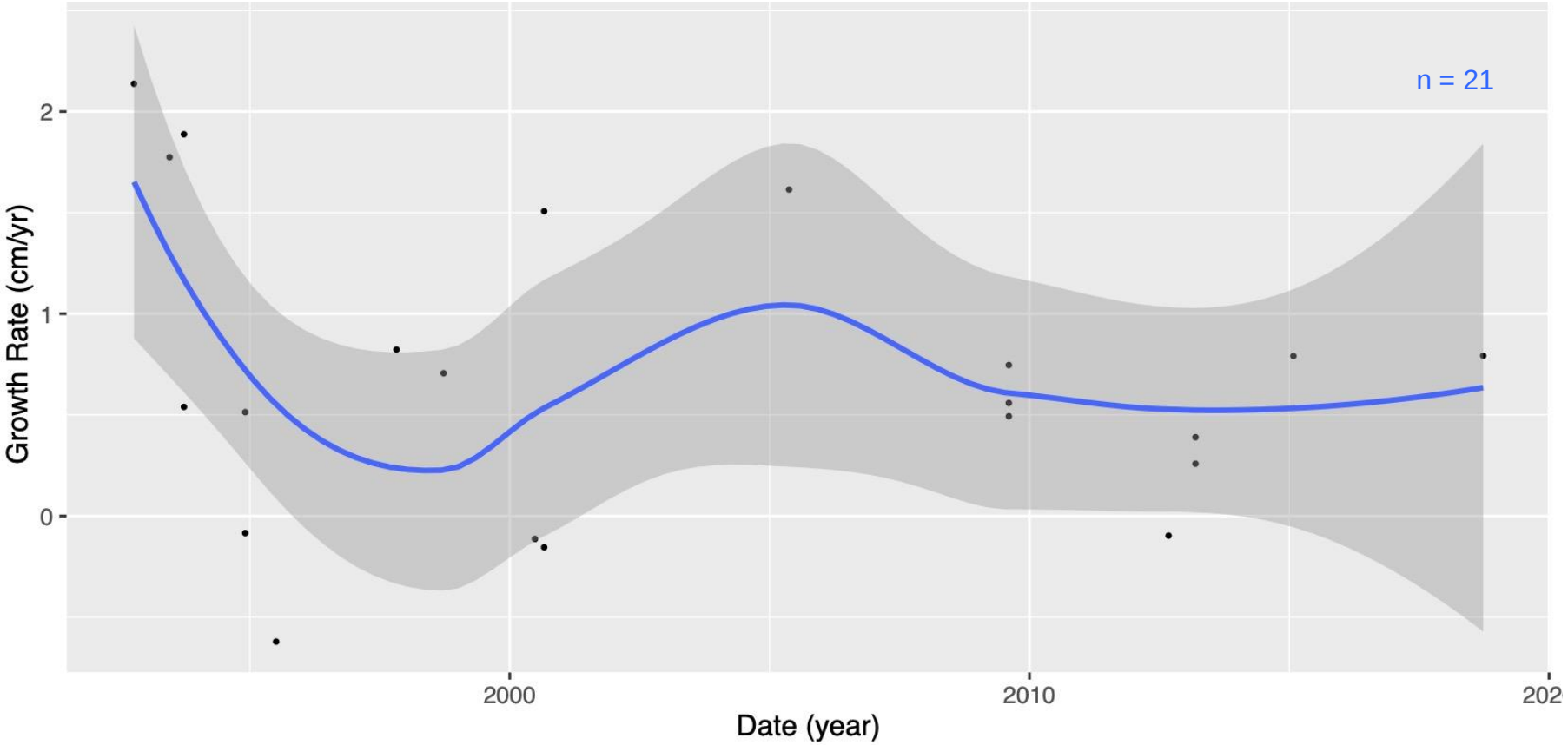


Mauna Lani

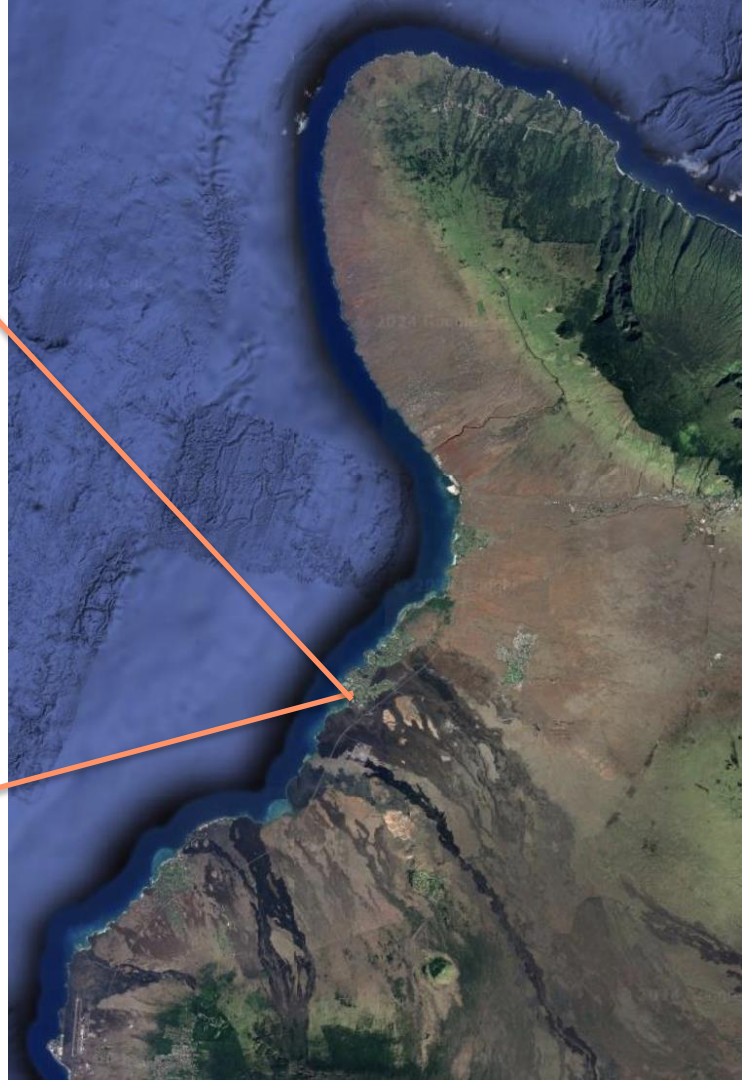


- 1 regular study sites
- Study site from 1991 to current
- Growth rate range: 0 to 2.1 cm/year
- Mean .7 cm/year

Growth rates by decade for green turtles, *Chelonia mydas,* at Mauna Lani

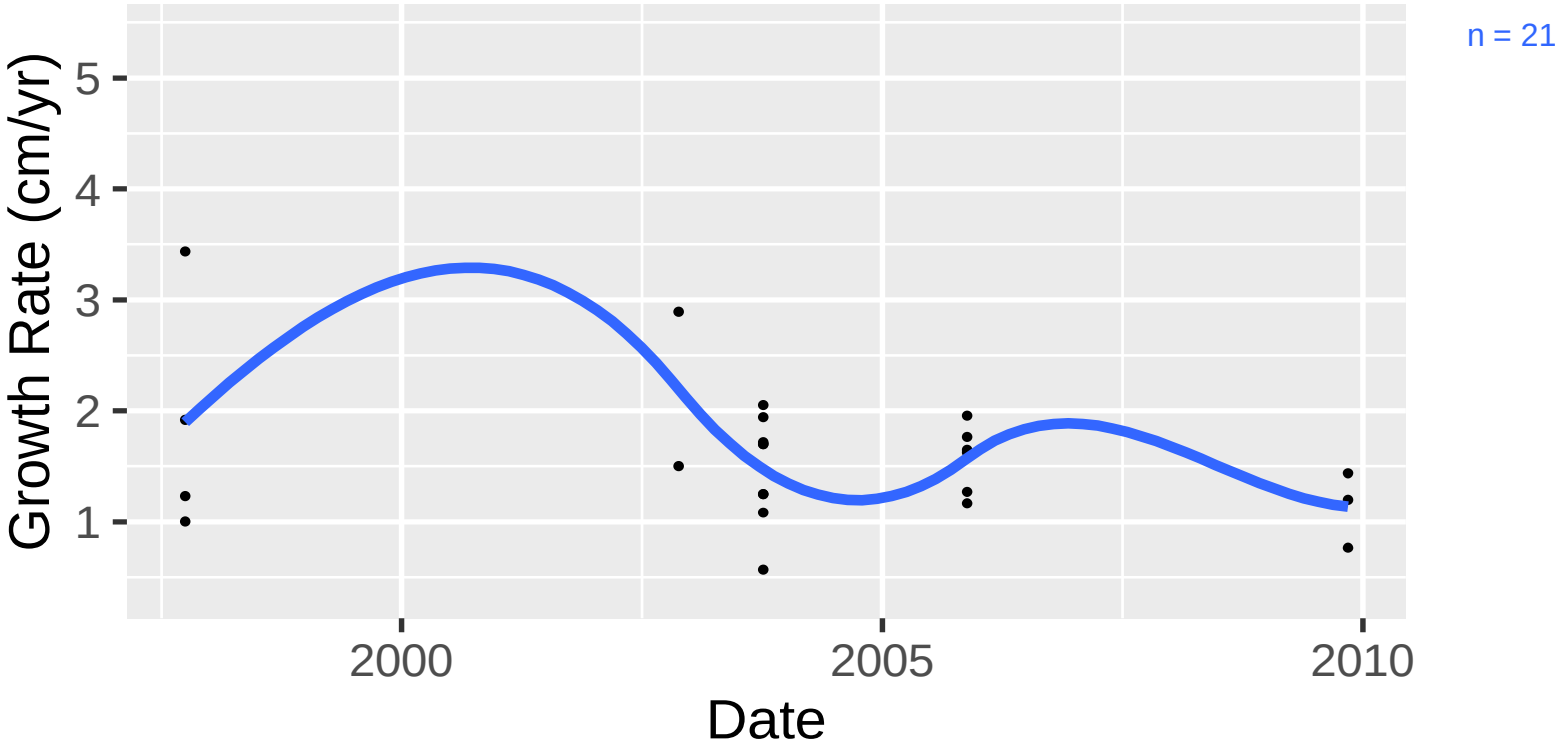


Waikoloa

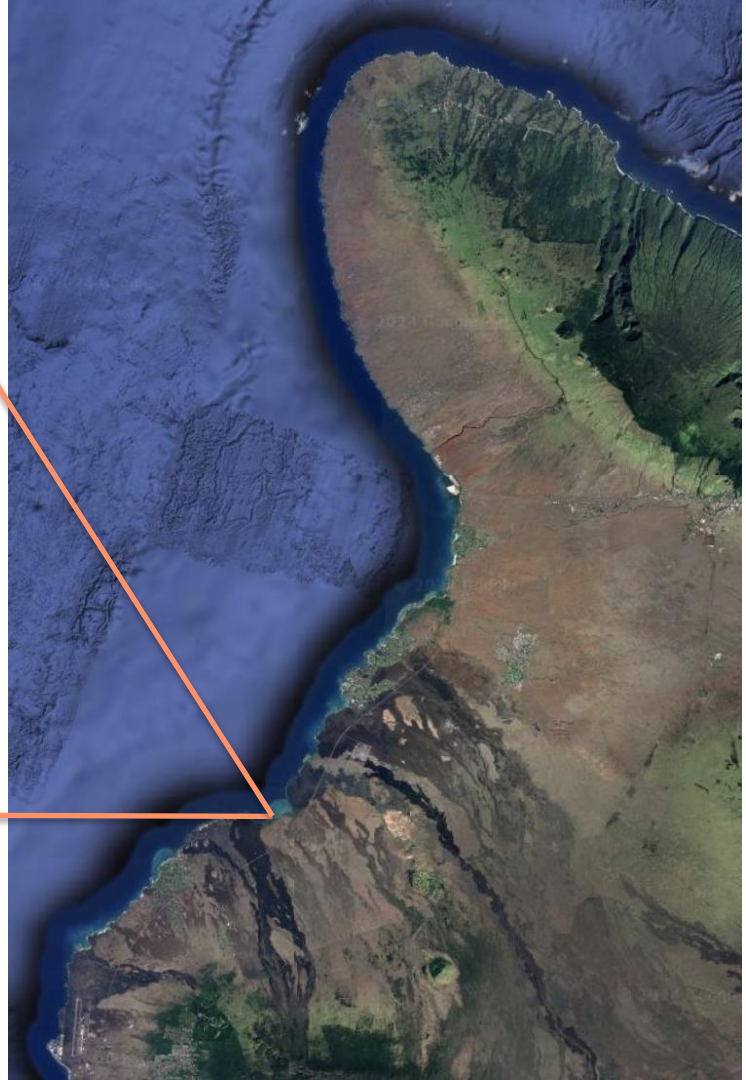


- 1 regular study sites
- Study site from 1992 to current
- Growth rate range: 0.5 to 3.4 cm/year
- Mean 1.6 cm/year

Growth rates by decade for green turtles, *Chelonia mydas,* at Waikoloa

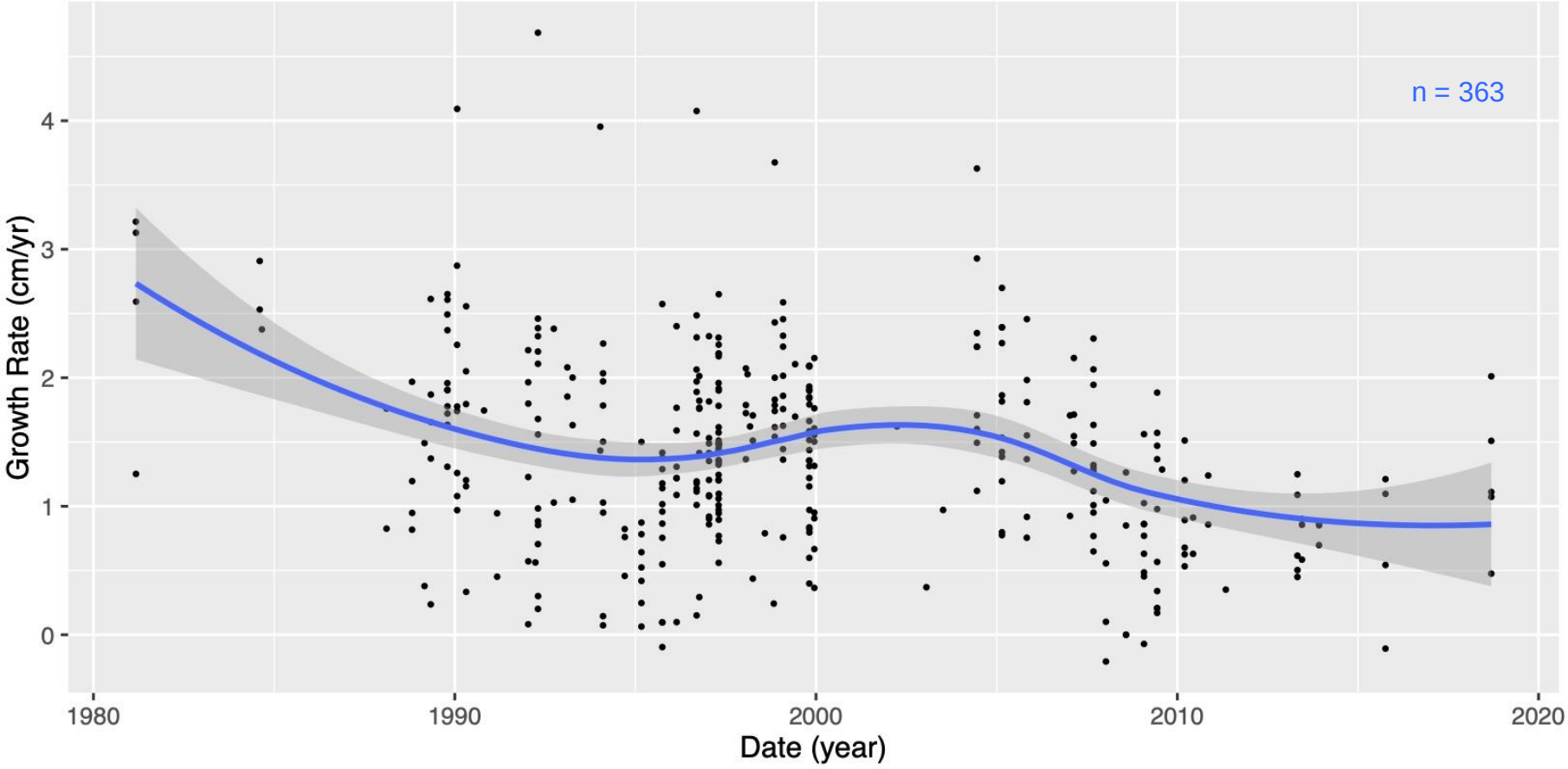


Kīholo

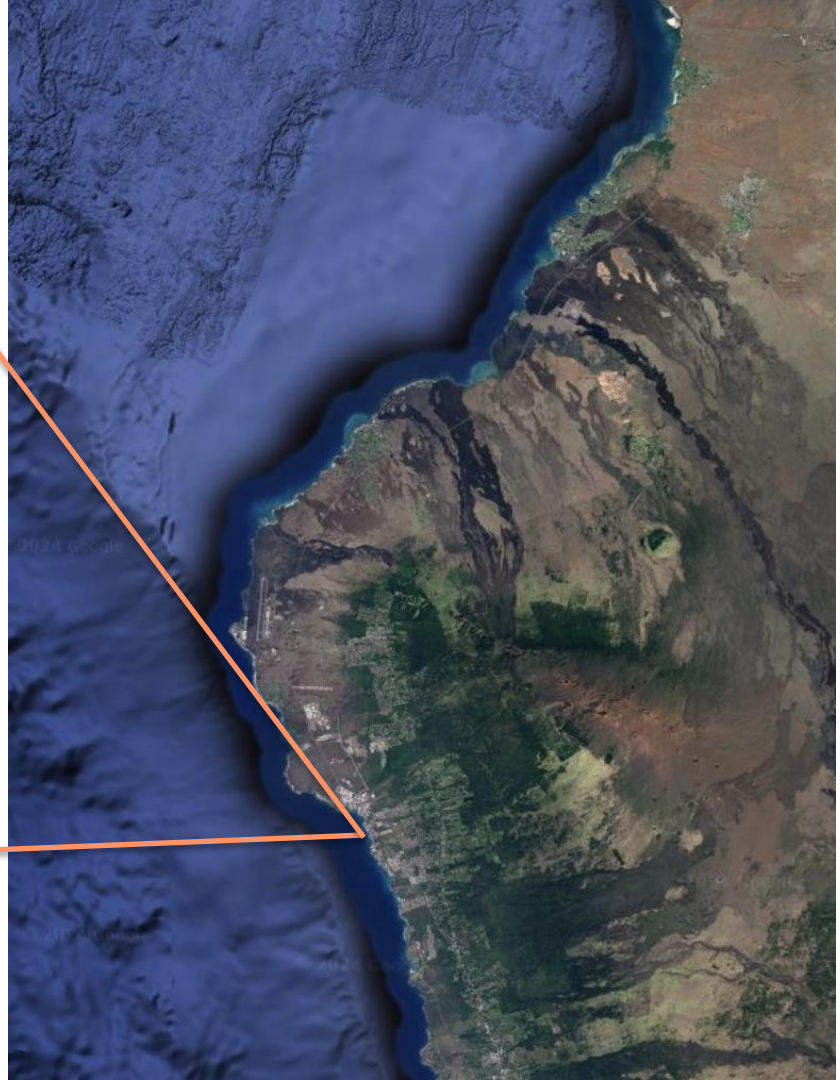


- 3 study sites (lagoon, shoreline, and loko i‘a)
- Study site from 1981 to 2020
- Growth rate range: 0 to 4.7 cm/year
- Mean 1.4 cm/year

Growth rates by decade for green turtles, *Chelonia mydas,* at Kīholo Bay, Hawai‘i

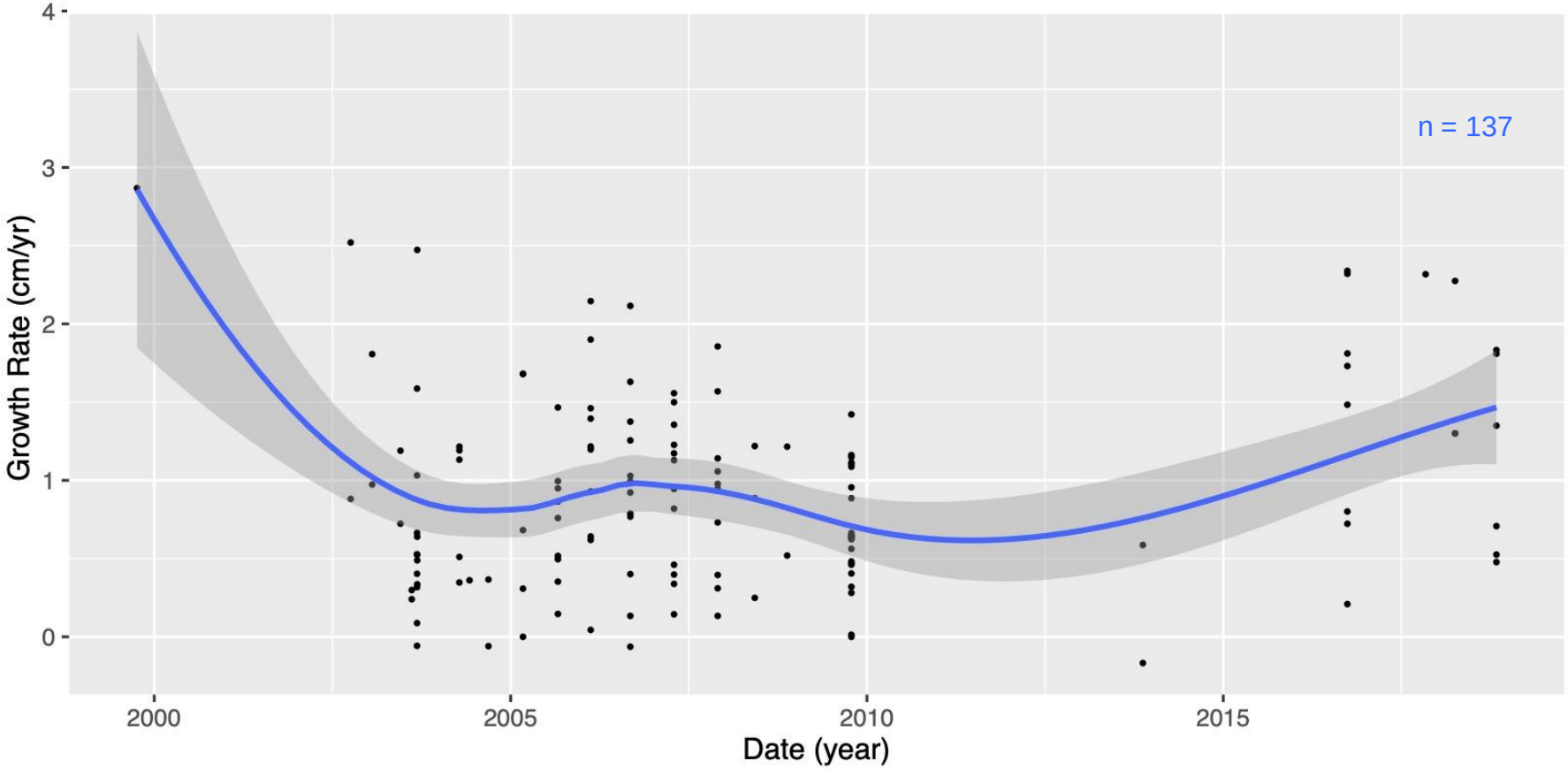


Kaloko-Honokōhau

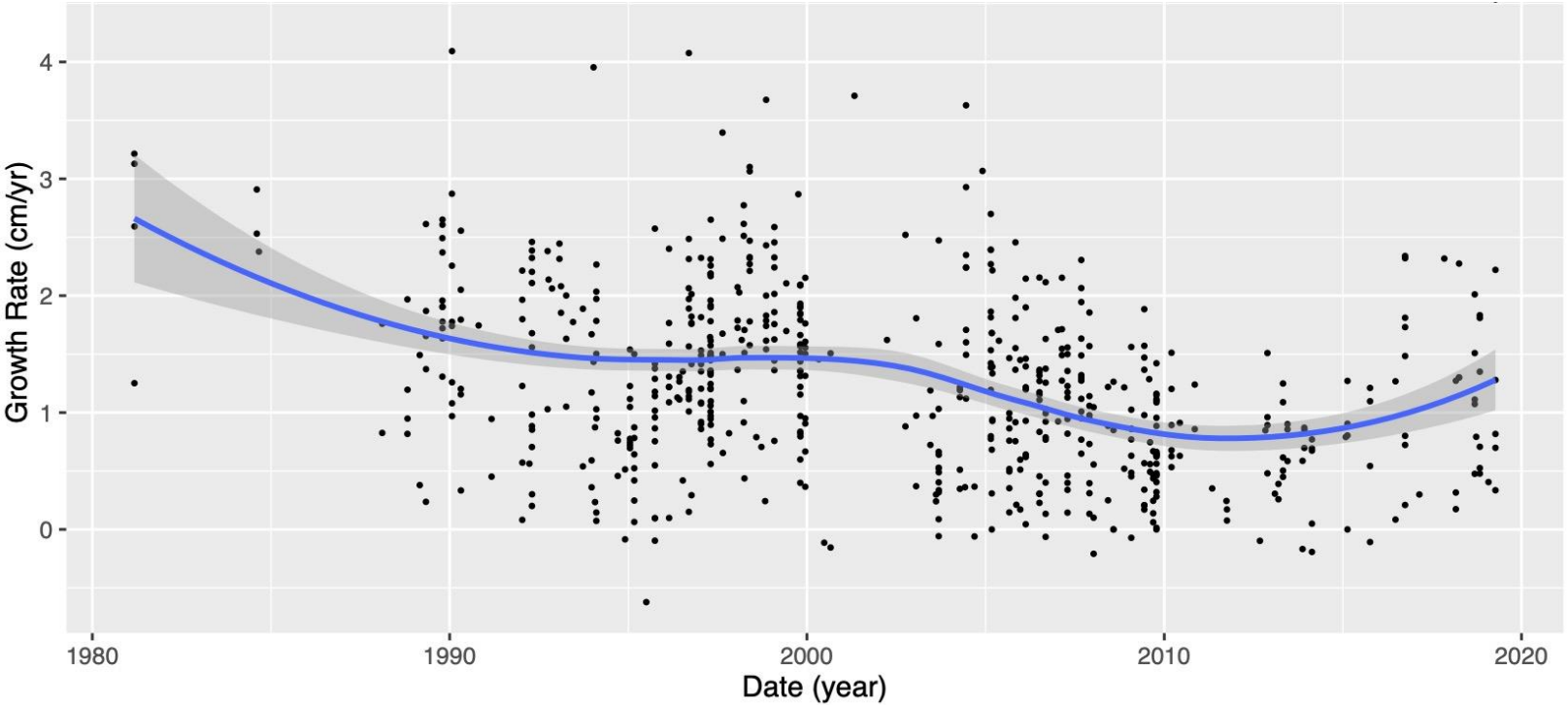


- 1 regular study site divided into regions
- Growth rate range: 0 to 2.9 cm/year
- Study site from 1991 to current
- Mean .9 cm/year

Growth rates by decade for green turtles, *Chelonia mydas,* at Kaloko-Honokōhau National Historical Park, Hawai‘i

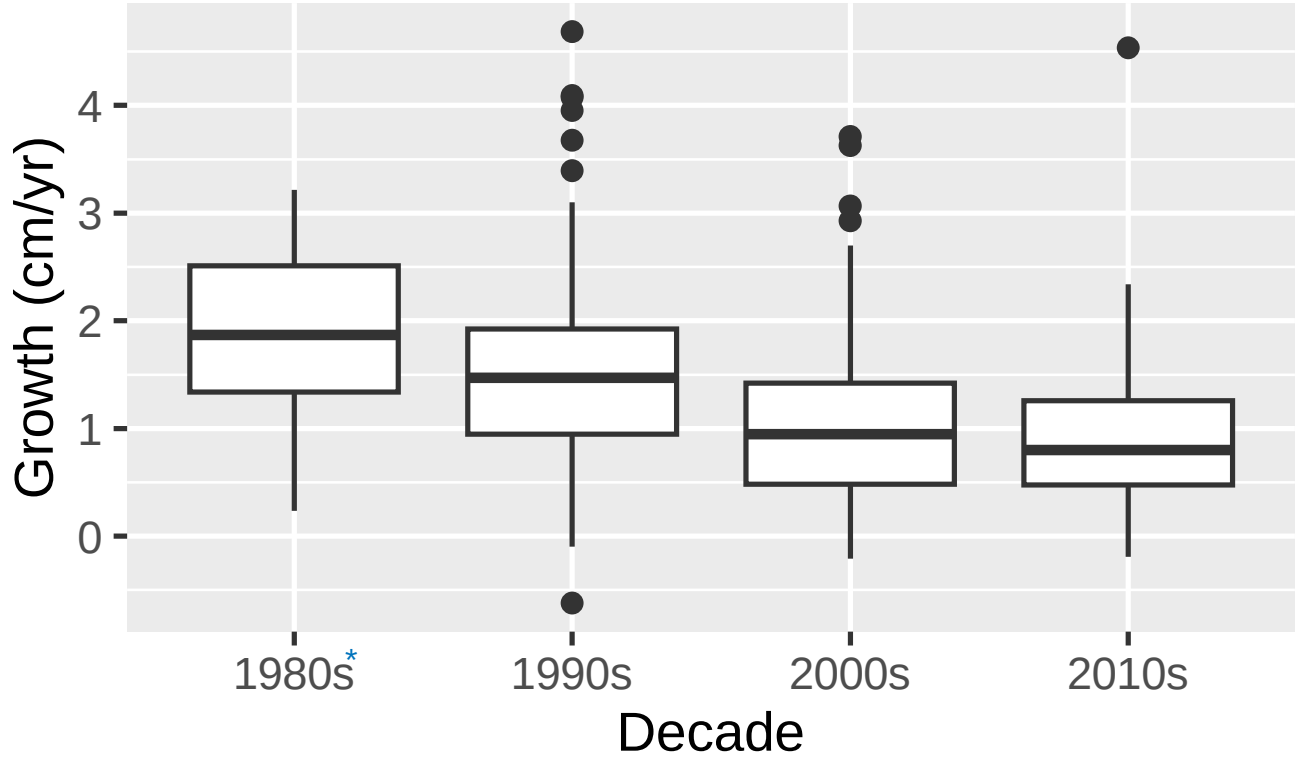


Growth rates by date for green turtles at 3 sites in Hawai‘i (Puakō, Kīholo, Kaloko-Honokōhau)



*1980s – only 1 location (Kiholo) included with n = 37 turtles represented

Decadal boxplot of composite growth data (cm/year) of green turtles, *Chelonia mydas,* at three locations (Puakō, Kīholo, and Kaloko-Honokōhau) in West Hawaii



**1980s – only 1 location (Kīholo) included with n = 37 turtles represented*

Balazs, G. (1982). Growth Rates of Immature Green Turtles in the Hawaiian Archipelago [Review of *Growth Rates of Immature Green Turtles in the Hawaiian Archipelago*]. *Biology and Conservation of Sea Turtles*. https://georgehbalazs.com/wp-content/uploads/2020/03/Balazs_1982_GrowthRatesOfImmatureGreenTurtlesInTheHawaiianArchipelago.pdf

Table 2. Summary of growth rates and projected number of years to maturity for immature green turtles sampled at 7 study areas in the Hawaiian Archipelago

Location, number tagged and size range	*Growth rate cm per month*			*Interval in months*	*Years to maturity (35 to 81 cm)*		*Years to maturity (35 to 92 cm)*	
	Mean	*Range*	*N*		*Mean*	*Range*	*Mean*	*Range*
Kau, Hawaii N = 72 37.7–79.4 cm	.44	.38–.52	4	7.5–17.5	8.7	7.4–10.1	10.8	9.1–12.5
Bellows, Oahu N = 21 38.1–61.6 cm	.20	.19–.21	2	13.5–22	19.2	18.3–20.2	23.8	22.6–25.0
Necker N = 7 39.4–48.3 cm	.14	—	1	20	27.4	—	33.9	—
French Frigate Shoals N = 130 36.4–67.9 cm	.08	.02–.13	19	3–35.5	47.9	29.5–191.7	59.4	36.5–237.5
Lisianski N = 23 35.9–53.3 cm	.13	—	3	2	29.5	—	36.5	—
Midway N = 250 36.5–59.4 cm	.09	.03–.21	8	6–37	42.6	18.3–127.8	52.8	22.6–158.3
Kure N = 21 29.5–61.6 cm	.08	.04–.12	2	13–24	47.9	31.9–95.8	59.4	39.6–118.8

What are the longest recorded “residencies” at these locations?

Methodology

- Identified the longest durations of sea turtles observed at these singular locations
- For Kīholo included turtles that were recaptured at the location for at least 17 years.
- For Kaloko-Honokōhau and Puakō included turtles that were recaptured at the location for at least 13 years.

Longest “residents” of three mark-recapture sites on the west side of Hawai‘i Island

Puakō

turtle id	residency time (yrs)	SCL (cm) - last capture
11021	19	58.5
B175	14	75.7
K320	18	63.7
N631	13	64.7
Q426	15	61.7
Q507	13	66.4
Q511	15	62.2
Q573	15	61.3
Q612	13	54
Q769	14	53
R565	20	61.9
R825	13	61.5

Mean SCL: 58.5 cm
Turtles >12 years

Kīholo

turtle id	residency time (YRS)	SCL (cm) - last capture
3317	17	71.6
7751	21	66
7770	20	63.5
B927	18	55.3
H220	19	65.1
H30	17	59.7
H34	18	62
J85	17	52.3
K452	19	54.3
N522	23	61.5
Q740	21	65.3
Y235	18	61.1

Mean SCL: 61.5 cm
Turtles >16 years

Kaloko-Honokōhau

turtle id	residency time (yrs)	SCL (cm) - last capture
42947	13	62.9
32340	13	60.5
F131C	17	57.8
53101	16	63.5
2532E	17	61.5
5566D	12	64.9
1104D	17	59.4

Mean SCL: 61.5 cm
Turtles >12 years

Is there movement of green turtles between locations on Hawai‘i island?

Methodology

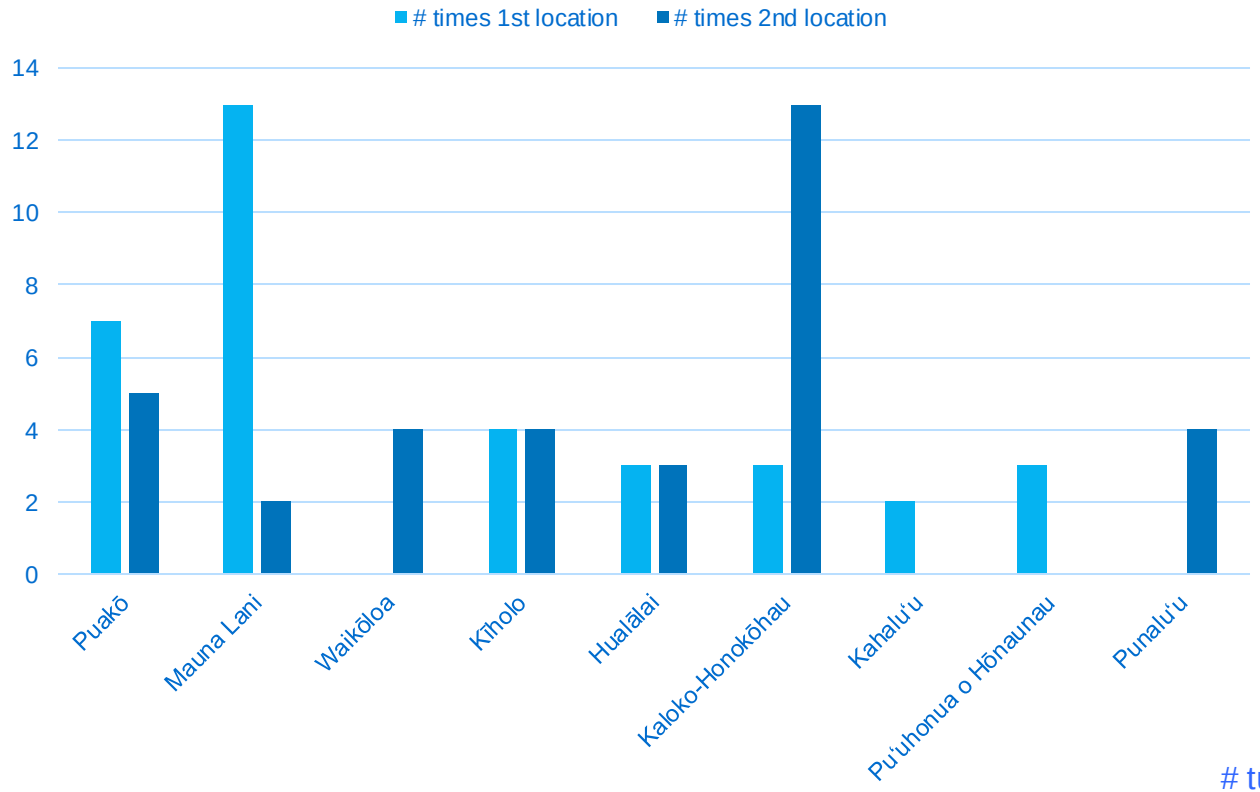
- Reviewed data set for turtles found at different locations
- Classified each location as either “1st location observed” (turtles left this location) or ”2nd location observed” (turtles moved to this location)
- Removed three turltes from group that returned to original location

  422D53015D: Kahalu‘u to Hualalai and back to Kahalu‘u

  44137B7406: Puako to Kaloko-Honokōhau and back to Puako

  4451611B45: Kaloko-Honokōhau to Hualalai and back to Kaloko-Honokōhau

Number of times sites served as the 1st location (from) and as 2nd location (to)



turtles = 35

What are growth rates of turtles in captivity?

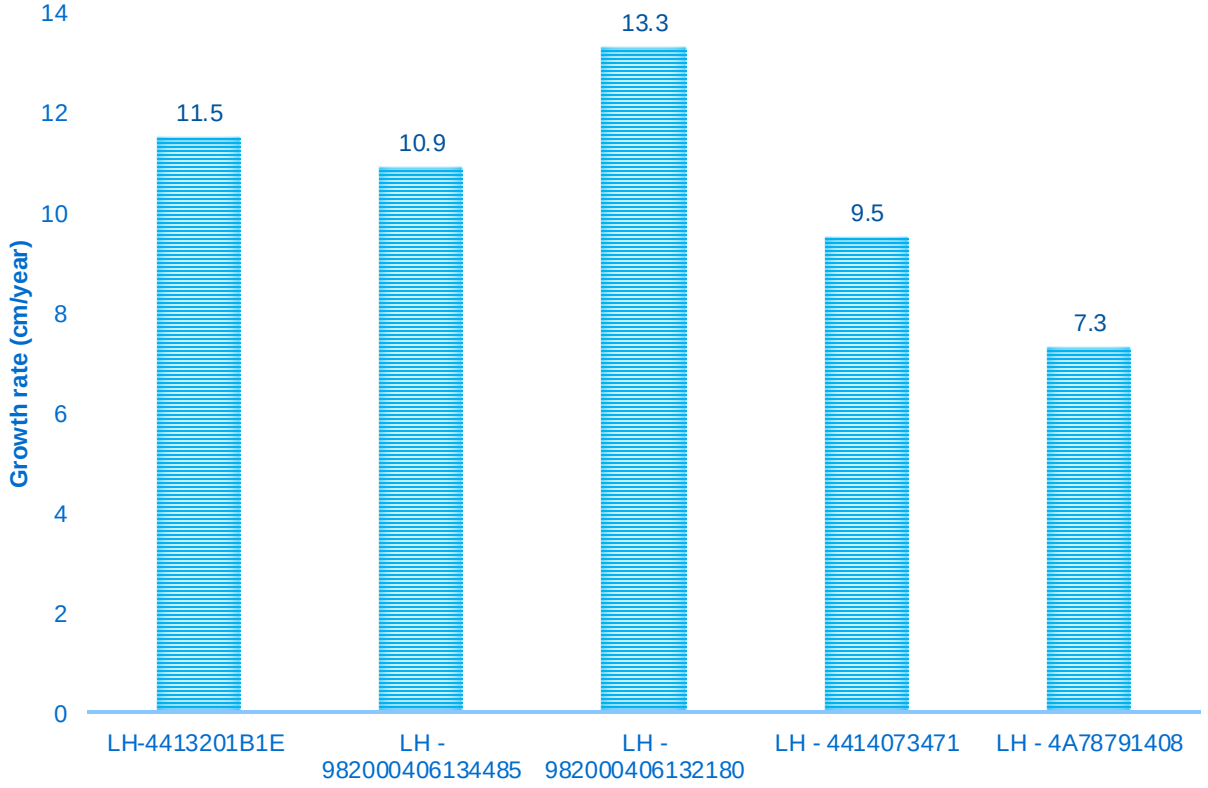
Captive Reared

- Partners at Mālama Honu, Mālama Honua shared data from their captive reared education program of 5 turtles
- Growth rates determined from turtles beginning at an SCL of 30.0 cm

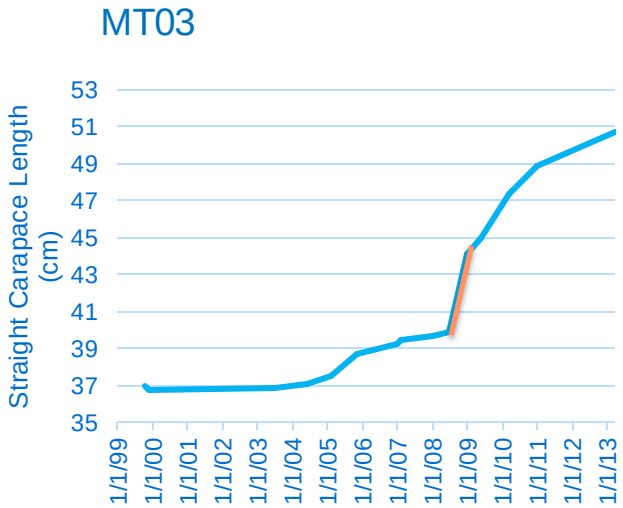
Nutritional Rehabilitation in 2009

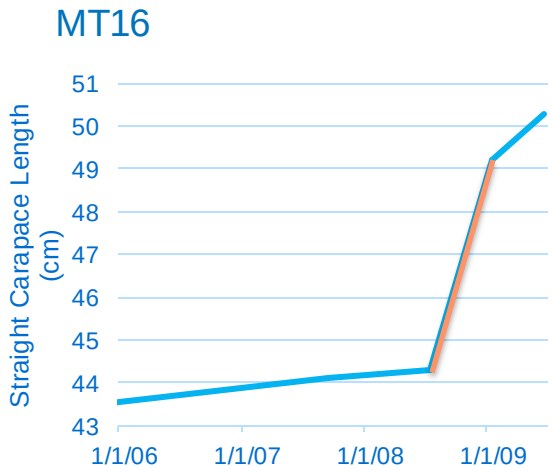
- Turtles residing in Kiholo collected and transfered to NOAA facility on Oahu on July 31, 2008. Turtles were returned to Kiholo on January 29, 2009, 6 months later.
- Growth rates were determined before nutritional rehabilition, during rehabilitation, and following rehabilitation.

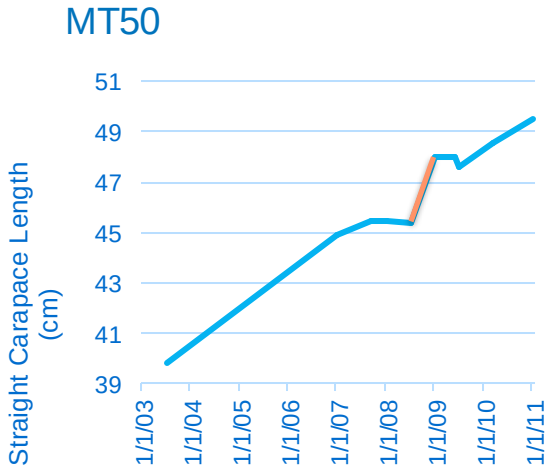
Growth rates for captive reared green turtles, *Chelonia mydas,* at the Mālama Honu, Mālama Honua Program



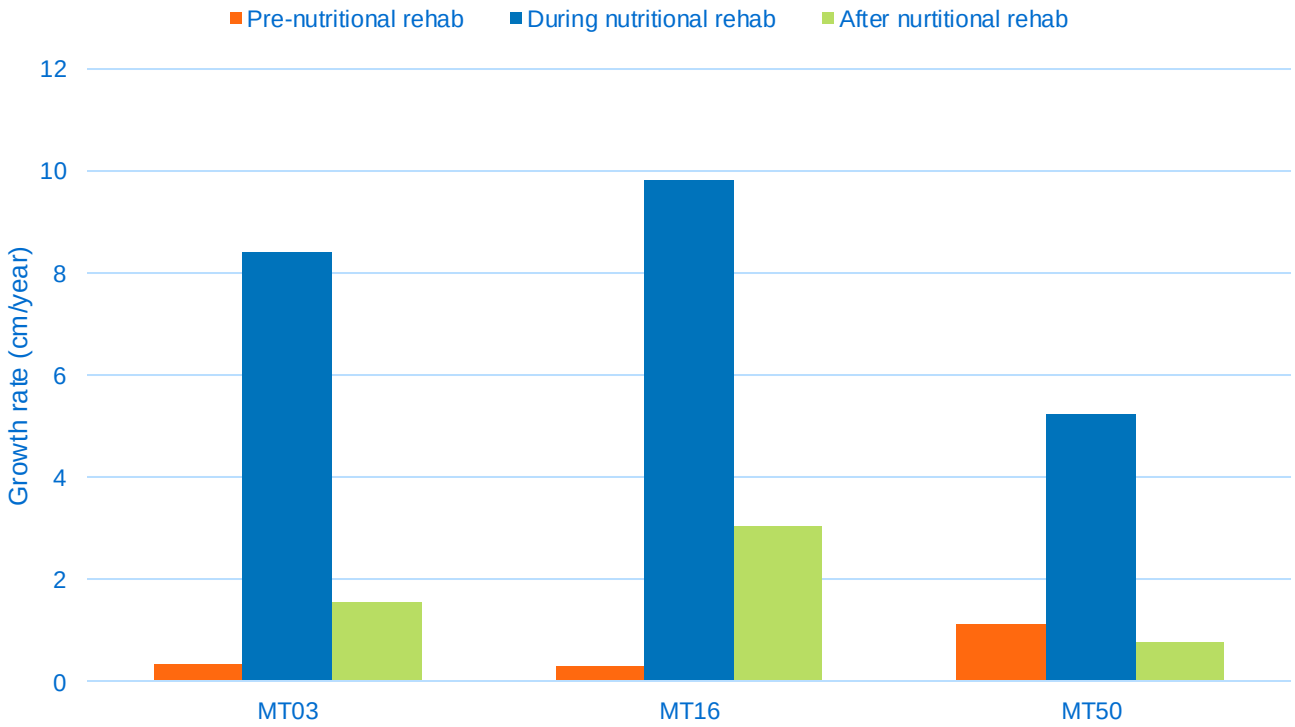
Straight carapace length for three green turtles, *Chelonia mydas,* at Kīholo, Hawai‘i, before, during and after nutritional rehabilitation







Growth rates for three green turtles, *Chelonia mydas,* at Kīholo, Hawai‘i, before during and after nutritional rehabilitation



In Conclusion

- Growth rate variations: based on mark-recapture studies there are fluctuations in growth rates over time with further statistical analysis needed
- Residency at locations: minimal movement between mark-recapture sites within West Hawai‘i with some turtles staying for a very long duration
- Captivity growth rates: As suspected, turtles can grow much faster (as observed through captivity and nutritional rehabilitation) but when returned to the wild their growth rates return to ”normal” limits
- Opportunities for further study
  - Carrying capacity with collective grazing pressures from other herbivores
  - Food availability and nutritive quality
  - Movement of larger size classes to other locations and its impact on their growth rates (does compensatory growth occur?)
  - Sampling bias – Are mark-recaptures in West-Hawaii targeting chronically sedentary and slow growing population?

Laura Jim (laura.jim@hpa.edu)
Marc Rice (mrice@hpa.edu)