

GH BALAZS

PART 2 OF 2

SLP  
Dec 1 2023

First Annual Workshop on  
Green Turtle Diets in Hawai'i-  
Food for Thought in 2020



SEA LIFE PARK VISITS

"VISION FOR THE FUTURE"

February 10, 2020  
Hawai'i Pacific University  
Aloha Tower Marketplace Campus, Honolulu, Hawai'i



www.GeorgeHBalazs.com

2nd APRIL 8, 2022 3RD HPU OCT. 6, 2023

808-683-8402

1-4th

4TH ANNUAL HPU WORKSHOP

2020-2024 HPU WORKSHOPS

WIDE RULED

100 SHEETS

9 3/4 IN x 7 1/2 IN  
(24.7 cm x 19 cm)

(51) "CALL ATTENTION" CONVENED

7:110AM MARC CANEA

IN MEMORY OF JEFF PAWLOSKI  
2004-2022

Tell your story - Relaxed Conversation  
NOT A "PRESENTATION"

TALK STORY ABOUT YOUR INVOLVEMENT  
WITH SUTPTILES 1976-2022 - TELL US  
ABOUT YOUR HISTORY. TELL YOUR STORY

ROUND TABLE SELFINTRODUCTIONS

9AM START ETHAN <sup>WDEA</sup> SOUZA

10:30AM BREAK 10 min  
GROUP PHOTO

12:30pm FAREWELL -

PAY ATTENTION TO ZOOM PARTICIPANTS

CONVERSATION - QUESTIONS - ANSWERS  
DISCUSSIONS



### Original- Fw: You Are Invited to a Special Get-Together: 47 Years of Captive Breeding Hawaiian Green Turtles

**HOST:** Dean Brenda Jensen PhD, Hawaii Pacific University.

↓ **Brief Background and Rationale:** Forty-seven years have now passed since Sea Life Park at Makapu'u in Waimanalo first bred Hawaiian green turtles in captivity. Hatchlings have been produced and released into the sea nearly every year since the initial success in 1976. In addition, hatchlings and juveniles displayed and reared at Sea Life Park have been made available for other educational, cultural, and scientific endeavors. Prominent players have included the Maui Ocean Center since 1998, the Mauna Lani Resort since 1989, and the Kahala Hotel (~2006-2019). It can be safely said that, over the years, millions of children and adults have been favorably influenced for conservation and cultural understanding by the breeding colony and offspring Sea Life Park holds in trust for the people of Hawaii.

A major goal of the session on December 1<sup>st</sup> will be to create greater awareness, both locally and globally, of Sea Life Park's 47 years of contributing to the conservation of the Hawaiian green turtle.

**Note-** The meeting is invitational, but observers will be warmly welcomed. Question & Answer opportunities will be made available.

**Virtual Participation-** Zoom will be made available for invited participants mainly from outside of the Hawaiian Islands. We hope that all those invited from within Hawaii will recognize the significance of this meeting and attend in person for the greatest benefit to all.

Additional Information and background composed by George Balazs-- "About a month ago I woke up with the realization that ...47 years... have now gone by since I witnessed and, in small ways, was a part of that 1976 first summer of captive nesting at Sea Life Park. 47 is a lot of years! I lived through them all, working with the Park and ever-changing staff on a regular productive basis to achieve an array of things that all add up to a Big Bundle of meaningful accomplishments. Science-wise and Conservation-wise. PIT tagging hatchlings, working with Jeff Palowski and Dr. Bob Morris, is one such example. I dare to say that no one, overall, knows the 47-year history better than I do. In many cases the history to others has been lost, forgotten, never known, and/or no longer focused up. As I've said often, for years now, Sea Life Parks's captive breeding program, and the offshoot partners, are an integral part of my life with turtles in Hawaii. Yes, my own legacy in partnership with scores of great folks over the decades- both within and outside Sea Life Park.

All of these above thoughts caused me to feel that something needed to be done to recognize, praise, and congratulate the Park for the turtle things done during the past 47 years. Maybe I'll be around to see the big 50th anniversary of that first captive breeding/nesting. But, to me, for now, 47 will suffice because it's the 'here and now' and no one can ensure the future.

So, the overriding objective of the December 1<sup>st</sup> meeting, as reflected in the invitation is:

To create greater awareness, both locally and globally, of Sea Life Park's 47 years of contributing to the conservation of the Hawaiian green turtle."

Dr. Thierry Work and I are the organizers- I took the idea to him first- as per the above- and he thought it reasonable and appropriate- worth doing. We did not take the idea to Sea Life Park to be an organizer- that is, join in the planning with us,- because normally the guest of honor doesn't plan their own 'recognition, praise, and congratulation'.

HONU  
47 YEARS  
SOLE CAPTIVE  
COLONY OF GT  
IN USA  
NEVER INTENDED  
FOR "HEAD  
STARTING"  
"ALMOST BY  
ACCIDENT"  
PRE-ESA  
TURTLES  
DONATED BY  
HAWAII FISHERS  
LATE 1960S  
LARGE BUT  
SIZES UNKNOWN

TURTLE  
LAGOON

now, Sea Life Parks's captive breeding program, and the offshoot partners, are an integral part of my life with turtles in Hawaii. Yes, my own legacy in partnership with scores of great folks over the decades- both within and outside Sea Life Park.

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What the meeting **will not be** is a 'program review'. What it **will be** is a focus on the first 47 years- from 1976 until Jeff Palowski was no longer here to be the caretaker of the program.

There will only be a few stand-up formal science style PP/video presentations. The majority of the time will be what we plan to call commentaries or testimonials. After the Hawaiian Blessing and Self-Introductions each participant will be asked to 'tell their story' (talk story) about what the program was or is and means to them, and their personal or professional history linked to the program. I (George Balazs) will start this off with my own story. I won't be using PPs, but others can, if they wish. The discussions (meaning questions and conversation), after and within each testimonial, will be free flowing, and only lightly structured."

TURTLES  
DONATED BY  
HAWAII FIRST  
LATE 1960S  
LARGE BUT  
SIZES UNKN

MYSTORY OR RATHER  
(MY WIFE LINDA & MY STORY)

1963

1964 7 MONTHS PAEA

1965 JANUARY (58 years) WAIMANALO,  
TAP & KAREN PRIOR

1971 HIMB

1972 Reared Turtles - Diets

1973 1st FFS Summer

1974 Captive Turtles - Waikei Aquarium

1974 - & INTANKS (OU Herman)  
FLIPPER SLP + PRIVATE FISH PONDS

1975 TAG LOSS CONCERN - MODEL 500

TURTLE  
AGOON

ED SHALLENBERGER TO MY OFFICE  
PLANS BUILT TURTLE AGOON & BEACH

SUMMER 1976 - MATING & HATCHLINGS

→ SOURCE OF SMALL TURTLES FOR  
DISPLAY & RESEARCH

116  
7 Feb

Wally CTO

20 employees

Madre  
1/2 hr wife

Minnesota

"Back of a leatherback"  
PB - An anecdotal way

905 AM

12-1-2023

(118)

Rooted in Culture

PD Main HI is part of  
Hawaiian Stock

with  
Flexibility

Rel few - related MHI

Hard wired "not 100%"  
Natal home  
Then no new nesting

Wanders - imperfect

Colonization over  
evolutionary time

will play out

Might have been facilitated by SLP



(118)

1-1-81

MA  
COP

Rooted in Culture

# KAREN VIDEOS

1. Karen's first video

2. Karen's second video

3. Karen's third video

4. Karen's fourth video

5. Karen's fifth video

6. Karen's sixth video

PD-

"Bottle necking"

~~SLP~~  
MAX Is.  
vest Maternal

one mole  
SECONDARY contribution

weed Rice PP

i.e. Turtles

Karen B, Georg G

Wally ITO

WAV Pixley

Joy  
NADINE

1998 2002 first release

3 show releases -

CHRIS Coulworld INI

8 Million MOC

"Ripple effect" Gregg

Bob <sup>BRAN</sup> Access to real live animals

ADDE

No. me Questions

Where are the Turtles?

96 year old Grandfather

DAVID  
ALESIS

Jade - DOLPHIN QUEST  
KATHALA  
Value of  
all work for tomorrow

124

"  
Takes a village to raise  
the turtles"  
"

Adjourn - 1245pm  
DEC. 1<sup>ST</sup> Friday 2023

(17)

# Ripley's Believe It or Not!

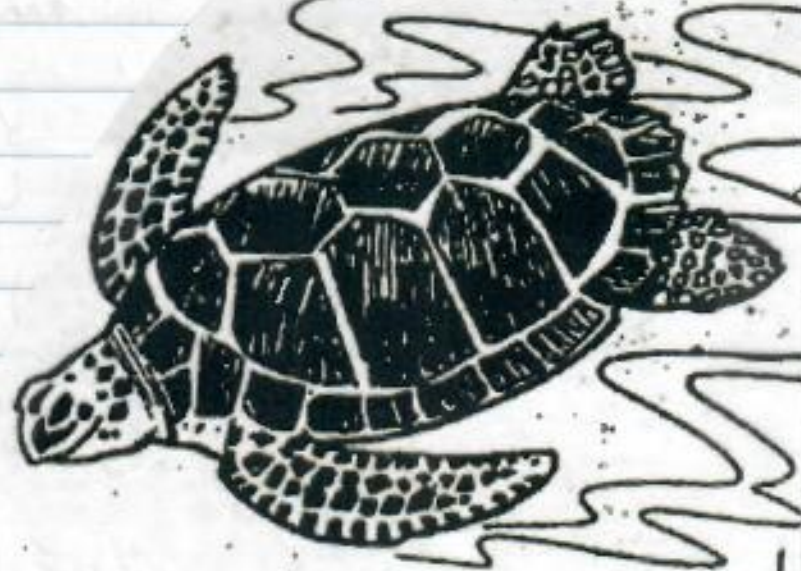
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**ELEPHANTS**  
 in Delhi,  
 India, ARE FITTED  
 WITH REAR-END  
 REFLECTORS  
 WHILE WORKING  
 IN THE STREETS  
 AT NIGHT!

Believe It or Not!  
 WORKING ELEPHANTS  
 in nearby Kerala  
 WILL ENJOY FULL  
 RETIREMENT  
 BENEFITS AT AGE  
 65!



9-16

**Believe It or Not! THE MARINE TURTLE RESEARCH PROGRAM in Honolulu, Hawaii, HAS TRACKED A JUVENILE GREEN TURTLE THAT TRAVELED 3,000 MILES IN EIGHT MONTHS AND RETURNED TO THE SAME AREA WHERE IT WAS FIRST RELEASED!**

See  
p. 109 4 MARCH 24<sup>02</sup> Monday

Gift Shop  
CASSY -  
old SLP  
POSTCARDS

SLP 3:30 PM 3/4/2024  
MONDAY

P, H, K  
L, P, E  
N, U.

3 will be A  
3/24  
5:00  
Turk  
R  
B  
G

HOLSC  
J A  
W J A  
N = 4  
CARETAKER

J, C, A, W  
N = 10  
TOTAL

N = 6  
CARETAKER

NP, L, M, E, J, K  
11/30/2023

+ 4  
N = 11

George Balazs

This Non-Transferable Pass is valid for one daily admission to park by legitimate passholder whose name and picture is associated with this card. Days/Hours subject to change without notice. Pass not valid for seasonal, special or private events. Good for admission only - parking, food, merchandise, rentals, games/rides, etc. require additional charge. Guests must comply with all safety rules, including wearing signs and instructions. Please see park website for full list of Passholder Terms & Conditions or visit the Season Pass Processing Location.



8029007

4/25/24

Ad.

SLP - NEW ANNUAL PASS (128)

5-11-2024 Review Annual PASS  
2PM-230pm  
10 TOTAL IN LAGOON 4 BLUE 6 PINK

Laying on drain = PINK U  
NURSERY IN BACK - Said to have MALE  
+ 5 juveniles (I saw 3 (2 in the water, one  
BASKING = Photos)



### SATURDAY

STAFF SAID - NO EGGS YET

(SLP) 5-31-24 FRIDAY 3-4 PM (SLP)  
Apon Arrival (U) CRAWLING on sand  
turned to BASK. ~ 3:45pm walked by  
again (E) Along BASKING. Photos.  
Talked to Michelle, Saw "Nursery"  
3x Juveniles Painted

New  
vet  
order  
Beth

"Scum" algae on surface water  
3 Juveniles - #19 & #21 painted +  
one NO PAINT (said to be #18)

7/2/2024 SLP with Avery 10:15 - 11:15 AM  
@ Blue Male w/ deep cavity (2?) in Carapace  
Michelle Benedict said there have been 3  
DIAG-EGGS UNKNOWN - Mid July hatch, 2/148  
projected if there are eggs 10 P. ✓



↓ Draft title of 4<sup>th</sup> Annual HPU Sea Turtle Workshop-  
"Signals of Carrying Capacity for Green Turtles in Hawaii"

SEARCHING FOR  
SPEAKERS

Goal/Description would include the rise of shoreline fishing turtle entanglement dilemma (animal welfare and making of a 'Pleasing Environment' for both turtles and people. The foundation paper would be-

Wabnitz, Balazs, Beavers, Bjorndal, Bolten, Christensen and Hargrove (2010) Ecosystem structure and processes at Kaloko Honokohau, focusing on the role of herbivores, including the green turtle in reef resilience. MEPS.

ALREADY

Hints of other aggregations of green turtles in Hawaii approaching carrying capacity, based on slowing of growth rates, are contained in-

Balazs and Chaloupka (2004) Spatial and temporal variability in somatic growth of green sea turtles resident in the Hawaiian Archipelago.

Ideal candidates for our Rotating Organizing Committee Member (or Members- maybe we can should have two) would be:

Karen Bjorndal- (see her paper- one of many- Bjorndal et al. (2000) Green turtle somatic growth model: Evidence for density dependence. Ecological Applications.

Colette Wabnitz  
Milani Chaloupka  
Jeff Polovina (Ecopath creator)

KeyNote Speaker- Any one or more of the above.

Month of Possibly Convening- October 2024- conditional on HPU Brenda.

We are considering a workshop shorter than past years. Possibly 8am -12noon or 1230pm.

April 25, 2024 Lunch w/ TW  
2nd Meeting of the two of us to  
fresh out 4th HPU workshop.

MAY 6 Monday 11AM - 12NOON  
KAREN B. telecon

June 12, 2024 Tues.  
Lunch Meeting w/ Thier & Milani  
Downtown

"What do Sea  
Turtles Mean to You?"

Devlin @ALOHA Tower Restaurants  
Com

MEXI LULO  
CASA ALOHA  
Tax

PAST workshops

Writing

Capacity =

Henderson Bay

Agreement

Journeys

ENIGMATIC & mysterious

\* it Sifting the wheat from the chaff =

SHARKS - CARL MEYER

DISCUSSIONS

SR  
Colony Measures

SIGNALS of CAPACITY for AT IN (Hawaii)

(What more is needed?)

TRUTH & CONSEQ  
- Growth rates X  
- Body condition X  
Bled on nec

BASKING on sand X  
DIPPING Foraging X  
Vow Hauling X  
Diet expansion X  
Tiger Shark  
Adding more turtles  
Fishing Entanglement X

USGS

MONK SEALS

MAYA ANNA STANKUS

LANI ANNA STANKUS  
BORN 7-14-2023

(132)

VIA GAZZIA  
95 PALAZZINA IRENE  
XIA, ROME  
00183  
ITALY

NURZIA HUMBURG

6/26/24 TW Lunch  
CARVAL CAFE  
STE 21 500 ALA MOANA BLVD  
HONOLULU, HI 968134902  
8085347007  
WWW.CARVALCATERING.COM  
Re HPU 4th

"overarching" = TW  
GOAL/OBJECTIVE

N=7 Milau; Thierry, Karen B.  
+ me DAVID HYRENBACH  
"B and Brenda" Jeff POFORINA, Jennie MANAWO  
Hypothesis/Hypothesizing SIGNALS

8-10 TALKS MAX.

- KALOKO / WABU et al 2010
- VAN HOUTAN et al. Pac. Science
- BALAZS & CHALOUPKA
- TAIWARI et al.
- BJORNAL et al. 2000

ADDITIONAL

- FP decline (should = more swimming turtles)
- EXPANDED DIET = grass & leaves
- EXPANDED HABITAT USE - RIVERS/STREAMS

# Sea Life PARK

Tuesday  
Feb 2024 w/ Avery

10:15 AM Honu Turtle Feeding and Talk Story (Honu Habitat)

11:00 AM Meet Kekoa! Hawaiian Monk Seal Talk Story

(Monk Seal Habitat)

Turtle C male Hides in shell

11:15 AM Feathered Friends Talk Story (Penguin Habitat)

11:30 AM Seabird Sanctuary Talk Story (Seabird Sanctuary)

11:45 AM Sea Lion Presentation (Sea Lion Nursery Habitat)

12:00 PM Hawaiian Seaweed Presentation (Reef Theater)

12:30 PM Aloha Nāi'a Presentation (Dolphin Lagoon)

1:45 PM Meet Kekoa! Hawaiian Monk Seal Talk Story (Monk

Seal Habitat)

2:00 PM Shark Cave Feeding Frenzy (Shark Cave upper level)

2:30 PM Feathered Friends Talk Story (Penguin Habitat)

2:45 PM Sea Lion Presentation (Sea Lion Nursery Habitat)

3:00 PM Seabird Sanctuary Talk Story (Seabird Sanctuary)

3:15 PM Honu Turtle Talk Story (Honu Habitat)

3:30 PM Aloha Nāi'a Presentation (Dolphin Lagoon)

Get the latest park calendar and hours



WABNITZ ET AL. 2010 SIGNALS OF CARRY CAPACITY / ECOSYSTEM HEALTH? TRUTH AND CONSEQUENCES?

Marine Biology (2024) 171:144  
https://doi.org/10.1007/s00227-024-04450-1

ORIGINAL PAPER

Protracted foraging RESTING RESIDENCE DECADAL  
Should I stay or should I go?  
conditions on green turtle r  
in foraging areas

VS. SLOW SOMATIC GROWTH VS MASS  
Emily G. Webster<sup>1</sup> · Stephanie Duce<sup>1</sup> · M.

Body CONDITION  
Received: 31 October 2023 / Accepted: 28 April 2024  
© The Author(s) 2024

HISTORICAL BT NUMBERS IN MAIN HI

Abstract Foraging animals move through the area

VS. DENSITY DEPENDENT

The influence of environmental residence time and outward transit

FAST GROWTH PAULINE W.H. → S. MAUI VAN HOUTAN ET AL.  
ark Hamann<sup>1</sup> · Nicholas Murray<sup>1</sup> · Takahiro Shimada<sup>2</sup> · Colin Limpus<sup>2</sup>

WEST HAWAII BASKING LETHARGY

SHORE FISHING ENTANGLEMENT

HONO KAHAU HARBOUR TURTLE SHIFT FROM NIGHT TO FEEDING

COOK ISLANDS CHRISTMAS IS.

FOOD OF CHIEFS ROYALTY

Food not consumption and risk-avoidance. STARKS

AGENDA for 11:00-1145am July 3rd  
HST= Re: Welcome to the Organizing  
Committee for the 4th HPU Workshop!



George  
Balazs



To: Milani Cha Wed 7/3/2024 7:56 AM

Cc: You

Aloha 4<sup>th</sup> HPU Organizing Committee  
Friends David, Milani, Brenda, Jeff, Jeannie,  
Karen & Thierry-

Our kick-off meeting tomorrow will be  
informal but structured to make certain key  
decisions. We are thinking that two more  
get-togethers by Zoom may be needed  
before October 4th. Thank you for the + HPU  
advice and guidance we need for the  
chosen workshop topic to truly take shape,  
"Signals of Carrying Capacity for Green  
Turtles in Hawaii- Sifting the Wheat from  
the Chaff"

Thierry and I will lead the meeting, with  
Thierry making sure I don't go astray in  
either time and talk.

-Introduction of Members

-Brief history of the HPU Sea Turtle  
Workshops

+ ORGANIZING  
COMMITTEES

TW & ME  
PREMEETINGS

-How this year's topic came into being  
Wabnitz, Balazs, Beavers, Bjorndal, Bolten,  
Christensen and Hargrove (2010) Ecosystem  
structure and processes at Kaloko  
Honokohau, focusing on the role of  
herbivores, including the green turtle in reef  
resilience. MEPS.

-Draft Overarching Goal- To stimulate  
interest and action in the answering of  
enigmatic questions long pondered about  
Hawaiian green turtles that seem highly  
relevant to their conservation status.  
Possibly pursued via PhD dissertation  
and/or other means.

DAVID H.  
Carrying  
Capacity  
Outside  
Perspective  
JAPAN  
Bermuda  
KAREN B  
BAHAMAS  
Denise  
MAPPING

- List of Hypothesized Signals of Carry  
Capacity-

- Growth Rates/Turtle Density
- Body Condition
- Protracted Residency in Foraging Sites
- Historical Numbers of Turtles
- Lethargic Behavior in and out of the water
- Nutritional Supplement Trial
- Skyrocketing Shoreline Fishing Entanglements
- Foraging on Fish Waste at Kaloko-Honokohau Boat Harbor
- Onset of Basking
- Onset of Daytime Foraging
- Monk Seal Predation on juvenile turtles
- Status of Tiger Sharks
- Presentations Relevant to the Above List and Workshop Theme/Title-  
Keynote?

RICE JIM  
KAHO KAHLEA  
RICE JIM  
BASK BEHAVIOR  
BAVAZ RICE  
MAIN ISLAND NESTING  
SEX RATIOS

Carl Meyer  
GRAPHIC



7/3/2024  
TUESDAY  
ZOOM

+ Possibly seven 15-min Presentations  
thereby Allowing Ample Time for Group  
Discussions involving attendees (i.e.,  
academic, government, students, NGOs,  
and especially.. the broad community of  
Hawaii citizenry)

GB INTRO OVERVIEW  
HISTORICAL A SERIES OF "TRIGGER QUESTIONS"

① BASKING & Nesting MAPS - Denise  
② NPS - KALOKO-HONOKOHAU Nearshore Counts

③ WARWITZ et al. 2010

④ MAIN IS. Nesting 2016 - present FWS

⑤ BODY CONDITION - Thierry

⑥ Growth RATES - MARC/AURA

⑦ " " - MILANI

⑧ Density dependent - Karen Bjørndal

MR ⑨ Expanded Diets -

⑩ DMIDH. INTRO TO CARRY CAPACITY (?)

⑪ Line Entangle Shore Line - IK

⑫ S. MARTIN

TALKS  
BASED TO  
RESULTS

DESCRIBE RESULTS

Sea Life  
Park Addition

⑬ Monitoring FFS TO BE MEANINGFUL TO 1973 -

⑭ MANIULA EAST CARRYING CAPACITY 2018

⑮ SEMINOFF PAPER TREND

⑯ TOMOKO HANABATA

\* SIGNALS we've seen BUT what do they mean? what might they mean  
7/3/24 (138)  
TUESDAY ZOOM

ZOOM 1ST HPU4 ORGANIZING Ecto themes  
KB - Couls energy lowers energies can increase overall level of productivity  
7/3/2024  
11 Wed. AM TO 1:55 AM  
A

AVID DH - other organisms most effect grazers

ecology REACTING JM - High schoolers

\* BASKING in the Dark - sorting out awful Thinking from Truth

J Polovina guest definition of Carry Capacity in context of exit 10 to ecosystems  
water pump DRIVERS

Milani - SWOT Graphics Eco Role + Poster  
Ecosystem MAP DRIVERS ecological health small but healthy consequences of climate change

BJ<sup>ENSEN</sup> - CULTURAL NOTION  
2024 May not be what  
it should be

HPV  
JPOLOVINA IS IT  
- Relevant to management?

MCHALOUKKA  
- NRC

\*Ecosystem wrap \*

1158AM end

Re USGS TW & GB presentation  
+ HPU 4th

140

TW &  
GB  
Lunch  
Talk

sen Inove  
Callahan  
1992  
KALOKO  
Bash  
NGS  
Mona  
Matters  
ACCESS

7/15/24  
TUES  
Mental  
CST  
water  
nesting  
not just  
STRANDINGS  
Body  
Condition

TRAINING  
&  
Capacity  
BIRD  
PHOTO  
RIM  
MIAWA  
OVER  
SLEEP

BUCKET  
TWO  
LUNCH  
7/15/24  
body  
count

Cc: Mila

To my taste the wording: "To stimulate interest and action in the answering of enigmatic questions long pondered about Hawaiian green turtles that seem highly relevant to their conservation status" seems a bit verbose.

SP  
I'd suggest something like: To stimulate interest and action to answer <sup>ENIGMATIC PUZZLING</sup> critical questions for Hawaiian green turtles that seem highly relevant to their conservation status. Just a thought:) Jeff

On Sun, Jul 7, 2024 at 9:31 PM

George Balazs

<[itsahonuworldinhawaii@hotmail.com](mailto:itsahonuworldinhawaii@hotmail.com)

m> wrote:

Dear Organizing Committee 2024

Hawaii Pacific University 4<sup>th</sup> Sea

Turtle Workshop

Aloha everyone

Need PRIOR FIRST ANNOUNCEMENTS

Agree with the more succinct wording and would suggest these edits to strengthen the statement:

(DH) Puzzling critical?  
To stimulate interest and action to <sup>enigmatic</sup> answer <sup>critical</sup> critical questions relevant to the conservation status of Hawaiian green turtles.

Regarding the List of Hypothesized Signals Relevant to Carry Capacity, I would add variables relevant to reproductive effort:

- age of first egg laying
- time interval between successive egg layings
- clutch size
- egg size / quality

SIGNALS SEEM TO BE MANY

Finally, we mentioned the role of other grazers (urchins and herbivorous fish) and the bottom-up influence of the physical oceanography and changing ocean climate on the carrying capacity.

7/23/2014 HONOKOHAU LUNCH  
TUESDAY w/ MARC RICE

HARBOR  
MOUSE

CATCH-UP IN PERSON OR FIRST & SO FAR  
ONLY O.C. Zoom Meeting (7/7)

1 Hour looking for turtles in Harbor

0 5 greens & hawks  
Attracted to HARBOR for food walking  
due to imbalanced unfavorable  
coast ecosystem.

Hence more prone to Boat prop  
strike.

NEED "BRIEFING SHEET" for  
HANDOUT.

send  
back

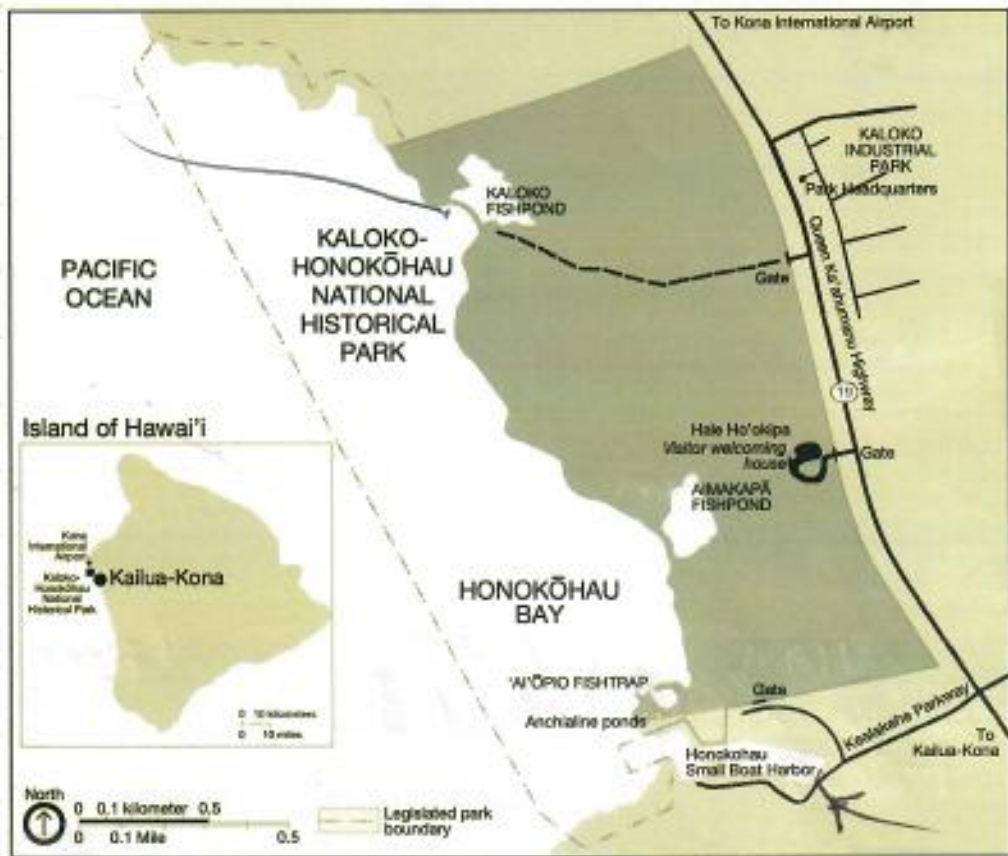
=

"PUTTING  
SIGNALS

X CARRY CAPACITY  
ALL

DAVE COHEN - DAR URCHINS (3) &

144



Kaloko-Honokōhau National Historical Park (Kaloko), located on the west coast of the Big Island, Hawai'i.



"multiply"

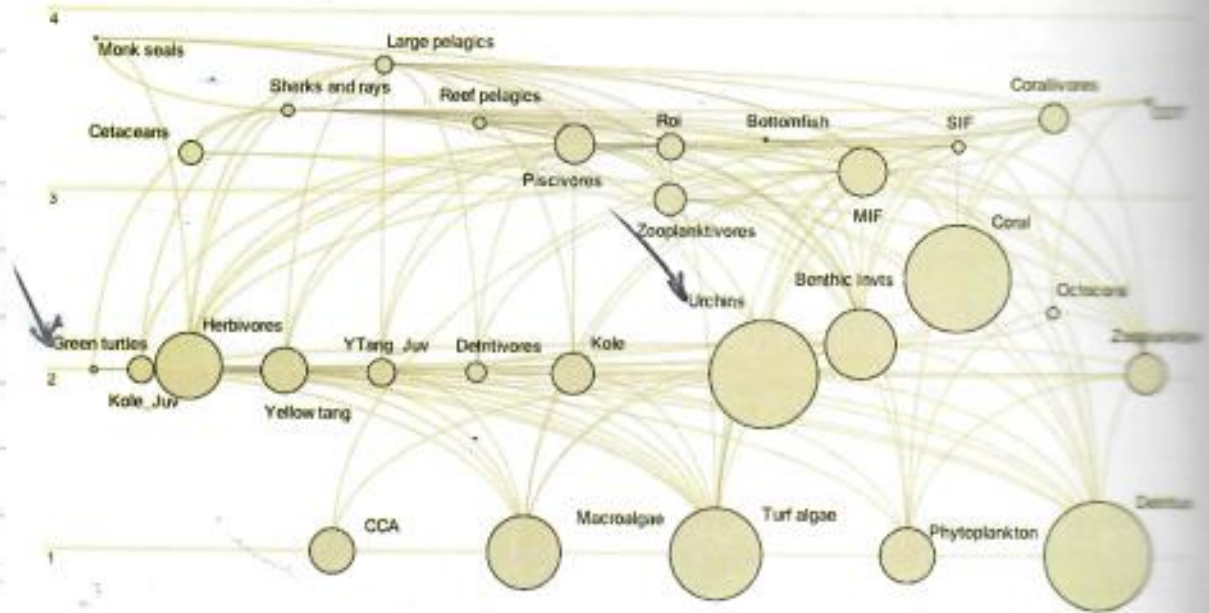


Figure 5 - Trophic flows within the Kona reef ecosystem. Each functional group is identified by a circle whose size represents the relative biomass of that group within the system. The light grey horizontal lines and associated numbers represent trophic levels; lines connecting individual functional groups represent trophic links. YTang = yellow tang; Juv = juvenile; COT = crown of thorns; CCA = crustose coralline algae; Invts = invertebrates

11AM DRAFT  
 Wednesday ZOO AGENDA  
 8-21-2024

RECORD BY ASL...

Handwritten notes in the lower section of the page, including the name "JAVE COHEN" and other illegible text.

## Modeling Sea Turtle Maturity Age from Partial Life History Records<sup>1</sup>

*Kyle S. Van Houtan,<sup>1,3,5</sup> Stacy K. Hargrove,<sup>2,4</sup> and George H. Balazs<sup>2</sup>*

2014  
85

**Abstract:** In the absence of direct observations, demographic traits such as age and reproductive status may be modeled through proxies. We examined 35 yr of over 10,000 captures of Hawaiian green turtles (*Chelonia mydas*) and compared results from skeletochronology studies with mark-recapture records. For 109 turtles that were captured as juveniles and later observed nesting, we estimated maturity age first from skeletochronology-based models of age to length and second by estimating age at first capture using skeletochronology and then adding the time elapsed to first nesting. The second method involving mark-recapture gave younger and less variable age estimates. From these data we developed a scaling rule that calculates that females first bred at 23 yr (95% interval: 16.8–28.1). This result was corroborated by tag returns in the Caribbean and Hawai'i showing that green turtles first nest at 16–20 yr. We validated this approach using life table models, successfully reconstructing four decades (1973–2012) of nesting surveys at East Island, French Frigate Shoals. We then compared our results with observed somatic growth rates, which suggest that nearshore studies may sample an atypical subset of the population that is chronically sedentary and slow growing. When exact life history traits are unknown, we recommend consulting multiple lines of evidence and independently validating proxy studies.

4(1)



**Editor's Response:**

Differences of opinion create a learning environment. In your letter citing my supposition as being incorrect about the "probable" drugging of the baby monk seal, I'd like to point out my use of the word "probably." As it is defined in Webster's, probably means "based on evidence which inclines the mind to believe but leaves some room for doubt." Checking further with those involved in preparing monk seals for transport we were told the following: baby monks are not tranquilized for the simple reason they are too frightened to move about in the shipping cage. On the other hand, our source advised us that adult monk seals are sedated with drugs because they go nuts during the ordeal of transportation in cages. Your response implies that the baby monk seal just kicked back and enjoyed the trip between snoozes. I am still "inclined" to believe transportation and relocation are stressful experiences.

Of additional interest, since the removal of the baby monk seal, the police and DLNR have been inundated with calls from La'ie on the North Shore to 'Ewa Beach (nearly 50 miles of coastline) reporting sightings of a monk seal (presumably the mother seal) poking its head out of the inshore waters, searching the coastline and possibly looking for her young pup. Just maybe there's an attachment or bonding between the two you are not aware of.

~~While on the subject of transporting mammals on the endangered species list, how about shipping a few thousand green sea turtles to less populated areas? The green sea turtles have repopulated the main islands to the point where they are now in plague proportions in many areas. It's not unusual to see 30 or more crowding the shallows of beaches on O'ahu, Lana'i and Moloka'i. It has been reported that their excrement has polluted sandy beaches. Plus, they are devouring quantities of limu and tako, two of their food sources. It appears that the green sea turtle is no longer endangered in the main islands, and in fact has, under the protective provisions of the law, reached nuisance proportions. Perhaps the recent reports of sick and dying turtles infected with ugly tumors are an indication of overcrowding or nature taking its course to balance an explosive population in a fragile ecosystem subject to the meddling of man.~~

JOHNSTON HFN ... Chuck  
EDITOR

HFN

1991

**PARKING PASS** 107282

used

DATE: SEP 04 2024

VALID ON THE DAY OF VISIT ONLY  
DISPLAY TICKET ON DRIVER'S SIDE OF WINDOW WHEN PARKING AT OUR PREMISES

From P. 120

SLP 8-8-2024 Thursday  
330 - 4 PM

Photo

(148)

still  
10 TOTAL  
IN LAGOON



J, A, M & L  
Males.  
W BASKING  
Gentian violet  
on neck?

Man employee said no digging for about  
a month. No hatching thus far.

9-4-24 Wednesday SLP  
230 - 3 PM - 10 IN LAGOON

Freshly painted PINK & BLUES  
"MAVIL" seen in "Nursery Pond" +  
6 yearlings.  
"NO HATCHLINGS THIS YEAR" - staff  
MALE D photos - holes in  
CARAPACE.

"BASKING IN THE DARK"

0 DANNY & ANNA AKAKA OPENING BLESSINGS

IP KAUAI'S HONU PHENOMENON:  
THE CROSSROADS OF COEXISTENCE  
LISA HARRINGTON

LY THE ORIGINS OF ECD PATH AND ITS  
APPLICATION TO THE KALOKO-HONOKOHAU  
MARINE ECOSYSTEM  
JEFFREY POLOVINA

3 Z CORPULENT OR MALNOURISHED? DEPENDS  
WHERE THE WORLD'S MOST ABUNDANT LARGE  
MARINE HERBIVORES LIVE  
CHALOUPEK, BJORNDAAL, LIMPOS, BALAZS

4 V BALANCING MARINE LIFE: TOWARDS  
MANAGING GREEN TURTLES AND SEAGRASS  
ECOSYSTEMS IN OKINAWA, JAPAN  
HAMABATA, NISHIZAWA, ICHIKAWA, YOSHIDA,  
SHIMABUKURO, SUDO, KITAKADO, HORI,  
YAMAGATA, SUGIMOTO, OKUYAMA

5 IP TIGER SHARK RESEARCH IN HAWAII ④  
KIM HOLLAND

NOT SOMETHING SOME FOLKS WANT TO FACE

Hypothesized  
SIGWALS

150

- 6 IP NECROPSY SHOWS LOW BODY CONDITION IN TURTLES FROM KONA VS OTHER SITES IN HAWAII  
THERRY WORK ⑧
- V 7 ESTIMATING CARRYING CAPACITY AT THE GREEN TURTLE NESTING BEACH OF EAST ISLAND, FFS (Loli) ③  
MANJULA TIWARI
- IP 8 A SUMMARY OF <sup>GREEN TURTLE</sup> GROWTH RATES AND RESIDENCY DURATIONS AT THREE LONGTERM STUDY SITES IN WEST HAWAII ⑦  
LAURA JIM AND MARC RICE
- IP 9 THE THEORY AND MATH OF MODELLING CARRYING CAPACITY ①  
DAVID HYRENBACH
- IP # GB - DRAFT ⑥

$$IP = 5 + 1 \quad Z = 1 \quad V = 3$$

4<sup>th</sup> at HPU's Aloha Tower Marketplace Campus in Downtown Honolulu.

To Register, Please Click Here:

<https://forms.gle/C2ZVTQ6wifLyGTFV9>

TO  
TURTLE  
ETC.

Registration is simple, seamless, and fast (<2 minutes). Where it asks for your Address, please feel free to only provide brief information, if you so wish. For example, I put in 'Hawaii-Kai, Oahu.' After completing and submitting, you will immediately receive email confirmation of successful registration.

Note that we really do sincerely encourage the full spectrum of Hawaii/Oceania and Cturtle's diverse communities to attend. All are welcome, all voices will be heard, and all views will be respected. The HPU Sea Turtle Workshop is meant for everyone. It is far more than a meeting place for academics and other professionals involved with sea turtles.

This year's Workshop Title and Focus:

**"Signals of Carrying Capacity from Green Turtles in Hawaii- Sifting the Wheat from the Chaff"**

And the Workshop Goal:

**"To stimulate interest and action in finding answers to puzzling important questions relevant to the conservation status of Hawaii's green turtle population"**

WEDNESDAY  
8-21-2024

152

DRAFT AGENDA 8-21-2024  
for Zoom 11AM-12NOON

-Hawaiian Blessing followed by Provost  
Brenda HPU Welcome

Zoom II

-List of Presentations We Have Confirmed-  
Update & Possible Order of Presenting

-Presentations Declined

SM - carry bag  
IK - Fishie  
FWS  
So Plan

-A Presentation before the ~~of the~~ Start of  
the Presentations- Brief Workshop History  
and.. What are the Puzzling Questions  
Raised Over the Decades? We are pursuing  
a Good-Faith Science-Based Effort to 'Sift  
the Wheat from the Chaff'. Recognition of  
Possible Push Backs.

-Status of Registrations (Thank You,  
Jeannie!)

TO LEAD TALKS DAVID  
HPU MATT YAKI ?

-How do we Proceed after the  
Presentations? Short Q & A after each  
presentation? Group Discussion involving  
everyone following the Presentations?

-HPU Logistical Topics: Web Link to Upload  
Video Presentations; Morning Coffee &  
Pastry; Carry Away Bag Lunches? HPU  
Students to Assist (mic transport etc);  
Recording Talks/Discussions; HPU Publicity?

-Promoting the Workshop Near and Far.

Close of Zoom Onward we Go! Mahalo!

---



8:45-9:00 AM  
 WHY THIS WORKSHOP? PUZZLING  
 \*IMPORTANT QUESTIONS ABOUT  
 THE CONSERVATION STATUS OF  
 HAWAIIAN HONU AND THEIR ECOSYSTEM

By George

PUZZLING  
 // CURIOUS +  
 QUESTIONS

Presentation Draft Titles, Presenters, and Possible Order to be Presented. - Please make suggestions. 8/21/2024 wed.

9:00-9:15

Requested Zoom 12 NOON - 1 PM

1) The theory and math of modelling carrying capacity- David Hyrenbach (In Person) PHD Dr. MORE MINUTES

9:15-9:30

2) The origins of ECOPATH and its application to the Kaloko-Honokohau marine ecosystem- Jeffrey Polovina (Video) Dr. PHD

9:30-9:45

3) Estimating carrying capacity at the green turtle nesting beach of East Island, Loli (FFS) - Manjula Tiwari (Video) Dr. PHD

9:45-10:00 AM

4) Tiger shark research in Hawaii- Kim Holland (In Person) Dr. PHD

10-10:15 AM

5) Kauai's honu phenomenon: the crossroads of coexistence- Lisa Harrington (In Person) Dr.

10:15-10:45

BREAK + PHOTOS Debbi Herrewa

10:45-11 AM

6) Corpulent or malnourished? Depends on where the world's most abundant large marine herbivores live- Milani Chaloupka (Zoom) Dr. and team

11-11:15 AM

7) A summary of green turtle growth rates and residency durations at three long-term study sites in West Hawaii- Laura Jim (In-Person) and Marc Rice

1115-1130 AM

8) Necropsy shows low body condition in turtles from Kona versus other sites in Hawaii- Thierry Work (In-Person)  
*Dr.*

1130-1145 AM

9) Balancing marine life: towards managing green turtles and seagrass ecosystems in Okinawa, Japan by Tomoko Hamabata *and Team*  
*Dr.*  
*Team*

Note the above reflects 5 In Person, 1 Zoom and 3 Video.

Co-authors of presentations (as in past years) should be listed on the title/authorship slide of the presentation. Only the presenter of the talk will be listed in the printed program- pending agreement by this year's Organizing Committee.



To: You; Bre Wed 8/21/2024 12:04 AM

Aloha Organizers- Here below is a draft agenda for tomorrow's Zoom, for one hour starting at 11am HST (please see Jeannie's Zoom link access below- thank you Jeannie!)

Please add to the draft agenda as you see fit.

*DISCUSSIONS*  
*→ PASS BY MONDAY TO PREPARE*  
*PASS OUT SHEET*

I'm pleased to report that, in my view, we are at a Very Good Place in the organizing process! Pieces are coming together very nicely. We now have 10 confirmed presentations- all are relevant and important. I recommend we stop at 10 as being fully sufficient. Other years we had...20 (too many). The titles and approximate suggested draft order of presenting will be sent to you later today. We have Danny & Anna Akaka giving the opening Hawaiian Blessing (flying from Kona to do that for us). We have our Banner. We have interest. We have affirmation that our topic is an important one worthy of greater attention. But most of all, we have... Each of you Involved in the Guiding, AND we have... Hawaii Pacific University!

### DRAFT AGENDA

-Hawaiian Blessing followed by Provost Brenda HPU Welcome

-List of Presentations We Have Confirmed-

*Need to be defined*  
*8/31/24*  
*SATURDAY*  
*TALK TO*  
*SENT TO*  
*Registration*

*Need to be defined*  
*A CALIFORNIA*  
*INCOME TAX*

*HYPOTHESIS*

SIGNAL <sup>SEARCHING</sup> <sup>IDENTIFYING</sup> <sup>ATTENDING</sup>

1) WABNITZ (2010) <sup>K=HHP</sup> <sup>AT OR NEAR CARRYING CAP</sup>  
MARINE ECOPATH MODELING  
KALOKO-HONOKOHAI N.H.S.  
LOW POLOVINA + MANJULA TIWARI

2) <sup>SLOW</sup> GROWTH RATES AS A <sup>TERRESTRIAL</sup> SIGNAL  
LAURA JIM  
BALAZS & CHALOUKA WABNITZ

3) Body CONDITIONS  
Thiering work  
CHANGE FROM NIGHT & DAY

4) DAYTIME FORAGING differences

5) <sup>the</sup> BASKING <sup>behavior</sup> ONSET & EXPANSION  
CRAZY DAY & NIGHT NIGHT & DAY

6) ~~MAIN HAWAIIAN ISLANDS~~ Nesting grounds  
POUNDS & HARBORS

7) RIVERS, <sup>OTHER</sup> NEW <sup>UPPER</sup> HABITATS USED <sup>DOWN</sup> IN AND OUT OF

8) <sup>FOOD SOURCE</sup> DIET EXPANSION  
RISE <sup>NOB-NATIVES</sup> GRASS & TREE LEAVES

9) <sup>LIMU</sup> SHORELINE FISHING ENTANGLEMENT

MONK SEALS AS ~~AND~~  
TOP PREDATORS  
APEX  
KIM HOLLAND TIGERS

II) TUMOR DISEASE  
DECLINE  
STATE-WIDE  
ISLANDS-WIDE  
HAWAII  
TUMOR DISEASE  
DECLINE  
TDD = MDSA  
TUMOR DISEASE  
DECLINE  
MORE TURTLES  
SURVIVE ALIVE

- Webster Refugia
- cleaning stations

Michael 10-4-2024  
Chelonia Cast

Can find it at [theturtleroom.org/](http://theturtleroom.org/)

- interested in talking to anyone <sup>Cheloniacat</sup>  
and everyone about turtle research  
and conservation.

Refined 9/2/2024

MORE TURTLES THAN EVER BEFORE RECORDED  
TRYING TO MAKE SENSE OF IT ALL  
SIGNALS OF CHANGE

- 1) CARRYING CAPACITY AT WHAT DOES THE WABBIT PAPERS LOOK - HOWOKOTTAU MEANS?
- 2) GROWING <sup>(SLOW)</sup> [NTIP]
- 3) BODY FITNESS <sub>EASY TO CATCH</sub>
- 4) NIGHT-TO-DAY FORAGING SHIFTS
- 5) CRAWLING ASHORE [TO BASKING]
- 6) NESTING <sup>(EXPANSION)</sup> ...
- 7) USING [NEW PLACES] [RIVERS, PONDS & HARBORS]
- 8) EATING [DIFFERENT] THINGS [NEW] [NON-NATIVE LIMB GRASS, TREE LEAVES, FISH SCRAPES]
- 9) HOOKED AND ENTANGLED
- 10) MONK SEALS [AS] APEX PREDATORS
- 11) TUMOR DISEASE DECLINE

NEW DIETS

More BRIEF 9/3/24 Tuesday 2010

- 1) The Wabnitz Carrying Capacity Paper
- 2) Slow Growing
- 3) Body Fitness
- 4) Night-to-Day Foraging
- 5) Coming Ashore to Bask
- 6) Expanded Nesting
- 7) NEW Novel [Terrestrial] Habitats
- 8) New Foods
- 9) Hook<sup>ed</sup> and Entangled
- 10) ~~MAN~~ Monk Seal Apex Predators
- 11) Tumor Disease Decline

(801)  
830 AM BRENDA OPENING - DANNY/ANNA BLESSING

845 AM BALAZS #1

9 AM HYRENBACH, DAVID #2

915 AM POLOVINA, JEFF #3

930 AM TIWARI, MANJULA #4

945 AM HOLLAND, KIM #5

1000 - 1030 AM BREAK & GROUP PHOTO  
1030 - 1045 HARRINGTON, LISA/HERRERA, J.

1045 - 1100 AM CHALOUPEK, MILANI #7

1100 - 1115 AM JIM, LAURA #8

1115 - 1130 AM WORK, THIERRY #9

1130 - 1145 AM HAMABATA, TOMOKO #10

1145 - 200 PM OPEN DISCUSSIONS  
TALK STORY FOR ALL  
MODERATED BY THIERRY WORK



$N=11$

Most?  
Others?

160

## Signals of Change Trying to Make Sense of it All

- The Wabnitz 2010 Carrying Capacity Paper
- Slow Growing
- Body Fitness
- Night-to-Day Foraging
- Coming Ashore to Bask
- Expanded Nesting Range
- Novel New Neritic Habitats
- New Foods
- Hooked and Entangled
- Tiger Sharks and Monk Seal Apex Predators
- Tumor Disease Decline

(001)

9-19-2024 ORGANIZING COMMITTEE MEETING  
Zoom Thursday  
N=7 (DAVID & BRENDA COULDN'T MAKE IT)

HYPOTHESES

9-19-24

Fwd: Zoom Agenda for This Thursday + Thursday  
please see below links to 27 selected papers

see below links to 27 selected papers

Thank you, Jeannie, for setting up and sending out the Zoom info for Hawaii

Date/Time----September 19<sup>th</sup> this Thursday at 11am. Please see Jeannie's message sent earlier today.

Here's a few broad-topic agenda items we can run through in our 45 min together. Please (please) suggest additions-

- Brief Outline Overview of the workshop day- start to end
- Lunch Food Plans (you should receive a message about this prior to Thursday)
- Drop Box or some mechanism for PP & Video presentations to be received- kindly noting that several of our overseas presenters have been asking me for a link, as some will soon be in the field away from the internet
- Recording the Talks etc. with my recommendation we do the same as past HPU sea turtle workshops

Zoom  
person (Monitor Zoom @)  
Program  
PP  
Means  
To Jeannie  
PP

"Very confused  
Greatly  
Drowsy"  
KB

Renee  
Notes

→ (Ecosystem perspective)

-Our All-Important Discussion Facilitator ~1215pm - ~215pm. Last week we kindly awaited the HPU Professor Barbara to indicate availability and interest, but that didn't work out. I have rethought what will be involved and came to the conclusion it needs to be someone closer to the workshop planning all these many months. Several could do it in a highly professional fashion, but I'm feeling that Thierry should be the one. He indicated interest to me, with his affable grin, when I asked him one-on-one. So let's please make a final decision on Thursday..

KB  
Climate Change

BRANDY  
MAYO BY  
1988

"very captured  
questy & monotonous  
50704115"

-I've been assembling a list of papers that MAY relate to Hawaii carrying capacity in one manner or another. Thought you might like to browse when time allows. They are all hyperlinks. Note the situation in the Okinawa islands of Japan is dire,- fishers upset and turning to killing- a major 3-year project has started there. We are fortunate to have Dr. Hamabata-san present on this topic at our HPU workshop-- please see \*\*\* referenced below (2022). She (via video) will be the last of our 10 talks. I have no plans

▶▶▶

2024 YOMOKO HAMABATA  
**Presentation Description** "The seagrass beds along the Okinawan coast of Japan are crucial not only for the marine ecosystem but also for the local fishing industry, which supports the livelihoods of coastal communities. In recent years, an environmental issue has emerged, as seagrass beds have been deteriorating and becoming depleted due to increased grazing pressure from the growing population of green sea turtles. Our new project aims to explore how these turtles can coexist with the seagrass beds and leverage this knowledge to promote sustainable ecosystem management."

### George's Request to Chat GPT-

Please provide an easily understood description of carry capacity in green sea turtles *Chelonia mydas*.

### ChatGPT's Response-

"Carrying capacity in green sea turtles (*Chelonia mydas*) refers to the maximum number of individuals of this species that an environment can support without leading to negative effects on the turtles or their habitat. It is influenced by various factors including the availability of food, nesting sites, and the overall health of the ecosystem.

In simple terms, it is like having a certain number of seats available in a theater: once all seats are filled, no more people can enter without causing overcrowding or discomfort. For green sea turtles, when the population reaches carrying capacity, resources such as seagrass beds (their primary food source) might become scarce, leading to competition, malnutrition, and a decline in turtle health. Additionally, overcrowding on nesting beaches can result in damage to nests and lower hatching success.

Maintaining the carrying capacity is crucial to ensure a balanced ecosystem where green sea turtles and other species can thrive. Conservation efforts aim to protect habitats and manage turtle populations to stay within this capacity, preventing overuse of resources and ensuring long-term survival."

## Signals of Change Trying to Make Sense of it All

- The Wabnitz 2010 Carrying Capacity Paper
- Slow Growing
- Body Fitness
- Night-to-Day Foraging
- Coming Ashore to Bask
- Expanded Nesting Range
- Novel New Neritic Habitats
- New Foods
- Hooked and Entangled
- Tiger Sharks and Monk Seal Apex Predators
- Tumor Disease Decline

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**SPEAKER INTRODUCTIONS FOR OCTOBER 4, 2024 HAWAII PACIFIC UNIVERSITY'S 4<sup>th</sup> ANNUAL SEA TURTLE WORKSHOP- "SIGNALS OF CARRYING CAPACITY FROM GREEN TURTLES IN HAWAII: SIFTING THE WHEAT FROM THE CHAFF"**

**#1**

**George Balazs- Self Introduction**

**#2**

**Dr. David Hyrenbach** was born in Spain, received a Ph.D. in Oceanography from the Scripps Institution, and moved to Hawaii in 2008. Currently a professor of oceanography at Hawai'i Pacific University, David Hyrenbach's lab focuses on the habits and habitats of Hawaiian seabirds, through tracking and diet studies. This research seeks to quantify the threats posed by fisheries bycatch and marine pollutants to these far-ranging marine predators.

**#3**

**Dr. Jeffrey Polovina** conducted and directed marine ecosystem research at the Pacific Islands Fisheries Science Center, NOAA fisheries in Honolulu for 38 years. Now retired he serves as an affiliate faculty in the Marine Biology Program at UH and collaborates with an international group of researchers studying the migration of loggerhead sea turtles in the North Pacific. He would love to give his presentation in person and participate in the symposium but his long-scheduled vacation plans have him traveling in SE Asia most of October.

**#4**

**Dr. Manjula Tiwari** is a Conservation Scientist and the President of Ocean Ecology Network. Her sea turtle projects cover a wide range of issues, including nesting beach ecology, the impact of fisheries on sea turtle populations, and developing holistic conservation strategies in Africa, the Middle East, Asia, and the Western Pacific. A fun fact about Manjula: local communities in the Turtle Islands of Sierra Leone have named a beach "Manjula Beach" in recognition of her efforts to conserve their sea turtles.

**#5**

**Dr. Kim Holland** founded the Pelagic Fisheries and Shark Research Groups at the Hawaii Institute of Marine Biology. A major focus of both groups has been the use of various electronic tracking devices to elucidate the movement patterns and habitat usage of top predators such as tunas and sharks. Currently, shark research focuses primarily on the movement patterns of tiger sharks and investigation of devices that might potentially deter shark bites and reduce shark bycatch.

**#6**

**Dr. Lisa Harrington** volunteers on the "basking" and "nesting" teams with Mālama i na Honu on Kauai Island. She spent 30 years as a PK-12 Educator in a large district in California. She was a classroom teacher for 12 years and a school administrator for 18. She currently is an Adjunct Faculty member with both the University of Hawaii Manoa and Fresno Pacific University where she teaches Master of Arts in Teaching and PK-12 Teacher Candidates and is a field supervisor

for candidates who are working toward their licensure. Dr. Harrington's love of learning about the world around her and having the basking Honu in her "backyard" has been the impetus for her involvement with the research on Poipu Beach. She hopes information garnered through this ongoing research supports a global understanding and guides our human actions in co-existing with these magnificent creatures; \*AND\*

**Debbie Herrera** is the Volunteer Education Coordinator for Mālama I nā honu on both Oahu and Kauai. She is also Oahu's nesting coordinator. She has over 20,000 hours of field work experience with Hawaiian Green sea turtles. Her mission is to spread awareness on how co-existence can look and be beneficial to all involved.

**#7**

**Dr. Milani Chaloupka** is a recognised expert in statistical and mathematical modelling of complex ecological systems including endangered species population dynamics modelling for whales, seabirds, sharks and marine turtles. He is the Director of a research company that provides statistical and mathematical consulting on ecological issues for a wide range of clients from industry, government, academia, environmental law firms and international nongovernmental organizations. He has been for the past 22 years a statutory member of the Scientific and Statistical Committee (Western Pacific Regional Fishery Management Council, Hawaii), which is the premier scientific fisheries advisory group for management of all US pelagic fisheries in the Pacific Ocean. He is also in the Marine Spatial Ecology Lab (University of Queensland) with responsibilities for PhD student supervision in interpretable machine learning and Bayesian statistical modelling of marine ecosystem processes.

**#8**

**Laura Jim** is a seasoned educator at Hawai'i Preparatory Academy on the Big Island of Hawai'i. As Co-Director of HPA's Sea Turtle Research and Stranding Program, she teaches SCUBA, Coral Reef Ecology, Vertebrate and Invertebrate Zoology, and conducts sea turtle research both in Hawaii and internationally. Additionally, she assists in stranding efforts for sea turtles on Hawaii Island, coordinates the West Hawai'i Fishing Line Recycling Program, and supports various independent student projects on marine-based topics and issues. Whether professionally or personally, she dedicates her time working towards a healthier planet and inspiring current and future generations to be engaged stewards.

**#9**

**Dr. Thierry M. Work** is currently the project leader for the USGS National Wildlife Health Center Honolulu Field Station where he leads a team that provides support to safeguard wildlife and ecosystem health through research and technical assistance to federal, state, and international partners.

**#10**

**Dr. Tomoko Hamabata** is a specially appointed assistant professor at the Graduate School of Information Sciences, Tohoku University in Japan, and a researcher at the Advanced Institute for Marine Ecosystem Change. She has over 10 years of experience researching sea turtles using genetic techniques, studying their distribution, foraging aggregation, and population history.

NOT ENOUGH? TOO MANY?  
OR JUST RIGHT?

How many is best for  
a healthy balanced  
ecosystem?

16



# 11 Signals of Change Trying to Make Sense of it All

- 1) - The Wabnitz 2010 Carrying Capacity Paper JEFF POLOVINA
- 2) - Slow Growing MANUELA TIVARI  
DAVID HYLANDS  
MILANI CHALOUPKA  
LAURA JIM
- 3) - Body Fitness TOMOKO  
MAHARAJA  
Thierry Work
- 4) - Night-to-Day Foraging
- 5) - Coming Ashore to Bask DR. LISA HAMILTON  
DEBBIE HERRERA
- 6) - Expanded Nesting Range FWS 2016 - present FWS
- 7) - Novel New Neritic Habitats
- 8) - New Foods PASCALUM McDERMID 2015  
LEAVES 2018
- 9) - Hooked and Entangled
- 10) - Tiger Sharks and Monk Seal Apex Predators TONY 2016
- 11) - Tumor Disease Decline DR. KIM HOLLAND

MORE/OTHERS?

...the world around by ...  
...the world around by ...



11 Green Turtle

ISLAND

1, 2 & 3 - FORAGING PASTURES IN West Hawaii, FROM HONAUNAU TO PUAKO, WITH THE EXCEPTIONS OF HONOKOHAU HARBOR AND THE WAIKOLOA HILTON LAGOON, ARE SIMILAR TO KALOKO-HONOKOHAU NHP IN ALGAL TURF COVER, REEF STRUCTURE, AND DENSITY COMPOSITION OF TURTLES."

4) THE transition from night-to-daytime foraging AT MANY Coastal AREAS, STARTING IN THE LATE 1980s, CAN BE LINKED TO LESS THAN OPTIMAL food RESOURCES for the increasing numbers of turtles.

5) THE <sup>early</sup> 1990s ONSET of Green turtles crawling ashore to bask in the MHI, BOTH DURING THE DAY AND AT NIGHT, WAS primarily an energy conservation measure linked to food resources [Limitations].

6) A Robustly increasing green turtle population with a marginal isolated far-away (historically-rooted) nesting location Gives RISE to [more attempts] to colonize new and better nesting areas. BUT INCREASED GAVE

108  
Deductive Reasoning  
Parsimony

DATA

INTUITIVE / INTUITION

INSTINCT / INSTINCTIVELY

2024  
20  
2009

7 & 8) A Robustly <sup>NECESSITATED</sup> INCREASING Green Turtle  
POPULATION (PROMOTED) EXPANSION  
INTO NEW AND NOVEL MARINE HABITATS  
AND USE OF NON-TRADITIONAL  
FOOD SOURCE

9) UNDERNOURISHED TURTLES <sup>HAVE</sup> INCREASINGLY  
TURNED TO BAITED HOOKS TO SATISFY  
THEIR NUTRITIONAL NEEDS THEREBY  
RESULTING IN <sup>GREATER</sup> MORE FISHING LINE  
ENTANGLEMENT.

10) A) HEALTHY NUMBERS OF TIGER SHARKS  
[PRESENTLY EXIST] IN THE HAWAIIAN ISLANDS  
FULFILLING THEIR ECOLOGICAL ROLE  
AS APEX PREDATORS THAT INCLUDES  
[CONSUMPTION OF] EATING GREEN TURTLES. <sup>THE DIETARY COMPONENT</sup>  
OF GREEN TURTLES

10) B) A SIGNIFICANT RANGE SHIFT  
BY THE HAWAIIAN MONK SEAL INTO  
THE MAIN HAWAIIAN ISLANDS <sup>HAS</sup> RESULTED  
IN PERIODIC REPORTS OF PREDATION  
AND HARASSMENT OF GREEN TURTLES

~~2024~~  
~~20~~  
~~2004~~

11) A SIGNIFICANT DECLINE IN  
FIBROPAPILOMA DISEASE RESULTED  
IN INCREASED SURVIVAL RATES  
OF GREEN TURTLES.



George B

To: Thierry W. Tue 10/22/2024 2:39 AM

TW- Draft for your thoughts please. The following expands upon the 11 Signals of Change we presented at the Workshop- numbers correspond to what's shown in the image below. Each statement is meant as a 'straw man' to either shoot down or accept as plausible at some level, e.g., scoring system you proposed at our lunch.

"Separating the Wheat from the Chaff!  
Enjoy, gb

---

1, 2 & 3- Foraging pastures in West Hawaii Island, from Honaunau to Puako, with the exception of Honokohau Harbor and the Waikoloa Hilton Lagoon, are similar to Kaloko-Honokohau National Historical Park in algal turf cover, reef structure, and density and size classes of green turtles.

4- The transition from night-to daytime foraging at many coastal areas, starting in the late 1980s, can be circumstantially linked to less-than-optimal food resources for the increasing number of turtles.

5- The early 1990s onset of green turtles crawling ashore to bask in the Main Hawaiian Islands, both during the day and at night, is primarily an energy conservation measure linked to low food resources.

6- A robustly increasing green turtle population with a marginal and far-away historically rooted nesting site gives rise to increasing attempts to colonize new sand beach areas for nesting in the Main Hawaiian Islands.

7 & 8- A robustly increasing green turtle population necessitated expansion into new and novel marine habitats and use of non-traditional food sources.

9- Undernourished green turtles in Hawaii have increasingly turned to baited hooks to satisfy their nutritional needs thereby resulting in increased fishing line entanglement and hooking.

10A- Healthy numbers of tiger sharks in the Hawaiian Islands fulfill their ecological role as apex predators of green turtles.

10B- A significant range shift by the Hawaiian monk seal into the Main Hawaiian Islands has resulted in periodic reports of predation and harassment of green turtles.

11- A significant decline in fibropapilloma disease over the past two decades resulted in the increased survival of green turtles.

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CHANGES OF TURTLES

**TW Inputs- 11 Signals of Change- The Slightly Longer Story (Draft)**

<itsahonuworldinhawaii@hotmail.com>

**Subject:** RE: [EXTERNAL] 11 Signals of Change- The Slightly Longer Story (Draft)

That captures it. See below suggestion of what to send out. We would ask committee to rank for each the following:

Plausibility: score 1-3 or 1-5 with low score being improbable and high being highly probable  
Ease of investigation: Low score being hard and high being easy.

Mean of scores would allow one to rank signals in terms of priorities. For instance, a high mean score for a signal indicates a highly plausible signal that would be relative easy to confirm.

Signal	Plausible	Ease of investigation
1, 2 & 3- Foraging pastures in West Hawaii Island, from Honaunau to Puako, with the exception of Honokohau Harbor and the Waikoloa Hilton Lagoon, are similar to Kaloko-Honokohau <b>NHP IN ALGAL TURF COVER, REEF STRUCTURE, and DENSITY AND SIZE CLASSES OF TURTLES</b>		

classes of green turtles.	
4- The transition from night-to daytime foraging at many coastal areas, starting in the late 1980s, can be circumstantially linked to less-than-optimal food resources for the increasing number of turtles.	
5- The early 1990s onset of green turtles crawling ashore to bask in the Main Hawaiian Islands, both during the day and at night, is primarily an energy conservation measure linked to low food resources.	
6- A robustly	

increasing green turtle population with a marginal and far-away historically rooted nesting site gives rise to increasing attempts to colonize new sand beach areas for nesting in the Main Hawaiian Islands.

7 & 8- A robustly increasing green turtle population necessitated expansion into new and novel marine habitats and use of non-traditional food sources.

9- Undernourished green turtles in

Hawaii have increasingly turned to baited hooks to satisfy their nutritional needs thereby resulting in increased fishing line entanglement and hooking.

GO TO →





**Kia'i Kanaloa statement regarding the importance of authentic relationship-building**

***4th Annual Sea Turtle Workshop  
October 4, 2024***

Last year, our statement focused on the issue of the disposition of honu. Kia'i Kanaloa will soon be in talks with NOAA NMFS PIRO & DLNR to formalize more culturally appropriate ways to care for our honu once they have transitioned to the pō. We are collectively making progress.

Our statement also advised you to develop authentic relationships with Hawaiian cultural practitioners and organizations such as ours who carry the kuleana of caring for our Kanaloa forms. Through these kinds of co-stewardship relationships, you, your departments, and your agencies can begin to rebuild trust with communities and build your own kahua (foundation) in understanding what it means to care for our Kanaloa forms here in Hawai'i. It would be interesting to note how many took that advice.

*'A'ohe hale i piha i ka hoihoi; hā'awi mai a lawe aku nō.  
No house has a perpetual welcome; it is given, and it is taken away.*

When invited into someone's home, how you treat and engage with that 'ohana and that home lends to whether you receive an invitation to return. The consequences of that kind of relational accountability are evident in this 'ōlelo no'eau (wise saying).

In these times of extreme environmental fragility, we must recognize that if individuals, organizations, & agencies do not immediately change course and bring the empirical knowledge and marginalized voices of Hawaiians who were the original and most successful stewards of this 'āina, the collective will not survive. It should not take federal mandates like the 2021 White House ITEK Memo or the 2022 Joint Secretarial Order 3403 for organizations and agencies not just to recognize but empower Hawaiians to fulfill our ancestral duty of caring for our Kanaloa forms such as the honu.

Hawai'i should lead this critical shift in research, conservation, and advocacy. In building authentic, collaborative relationships with Hawaiian cultural practitioners and organizations, you take the first steps toward manifesting the change that needs to happen here in Hawai'i. In support of that intention, we offer you this simple framework as a means to reflect, evaluate, and direct intentions, mindset, and actions toward building and maintaining authentic relationships with Indigenous practitioners and communities.

***Ola i ke au a Kanaloa!***

*For questions or further consultation contact our Executive Director, Dr. Roxane Keli'ikipikāneokolohaka at [kiaikanaloa@gmail.com](mailto:kiaikanaloa@gmail.com).*

## Kāpili Pili: A Framework For Building Authentic Relationships with Indigenous Practitioners & Communities

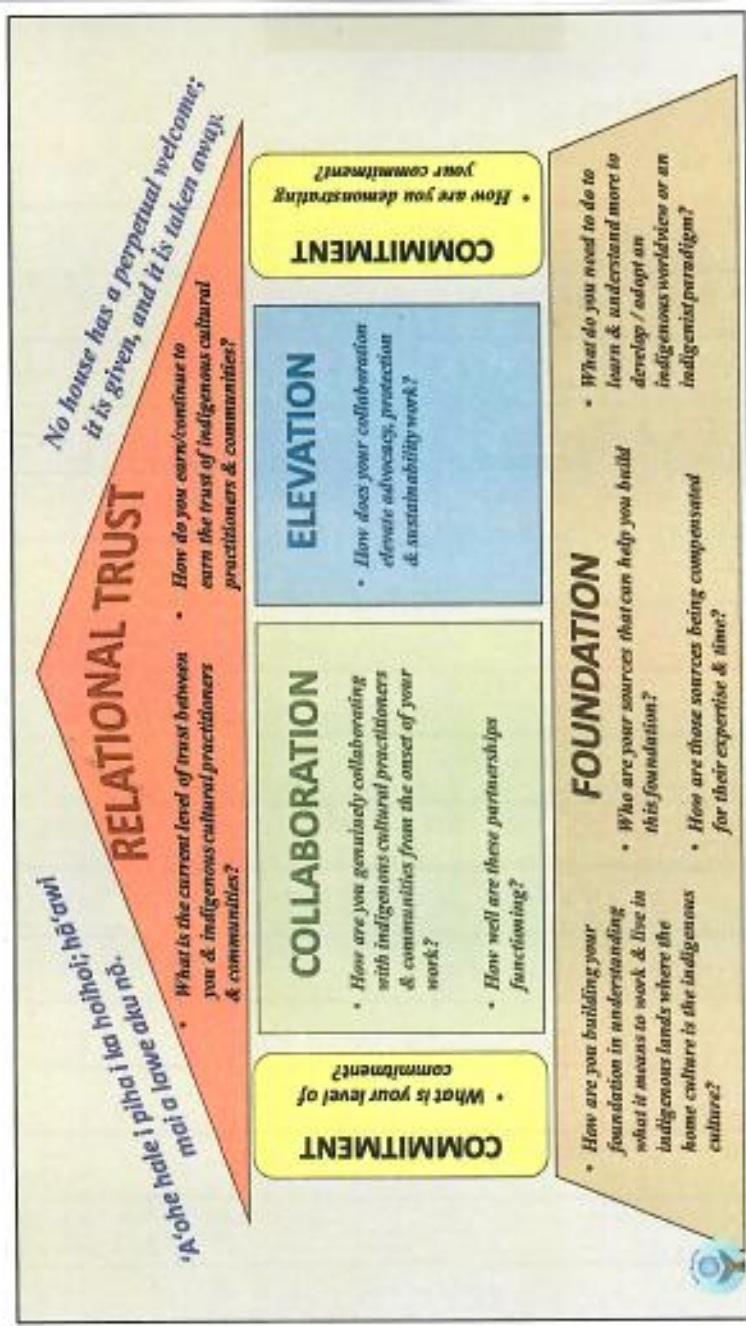


### Pehea kow hāle? How is your house?

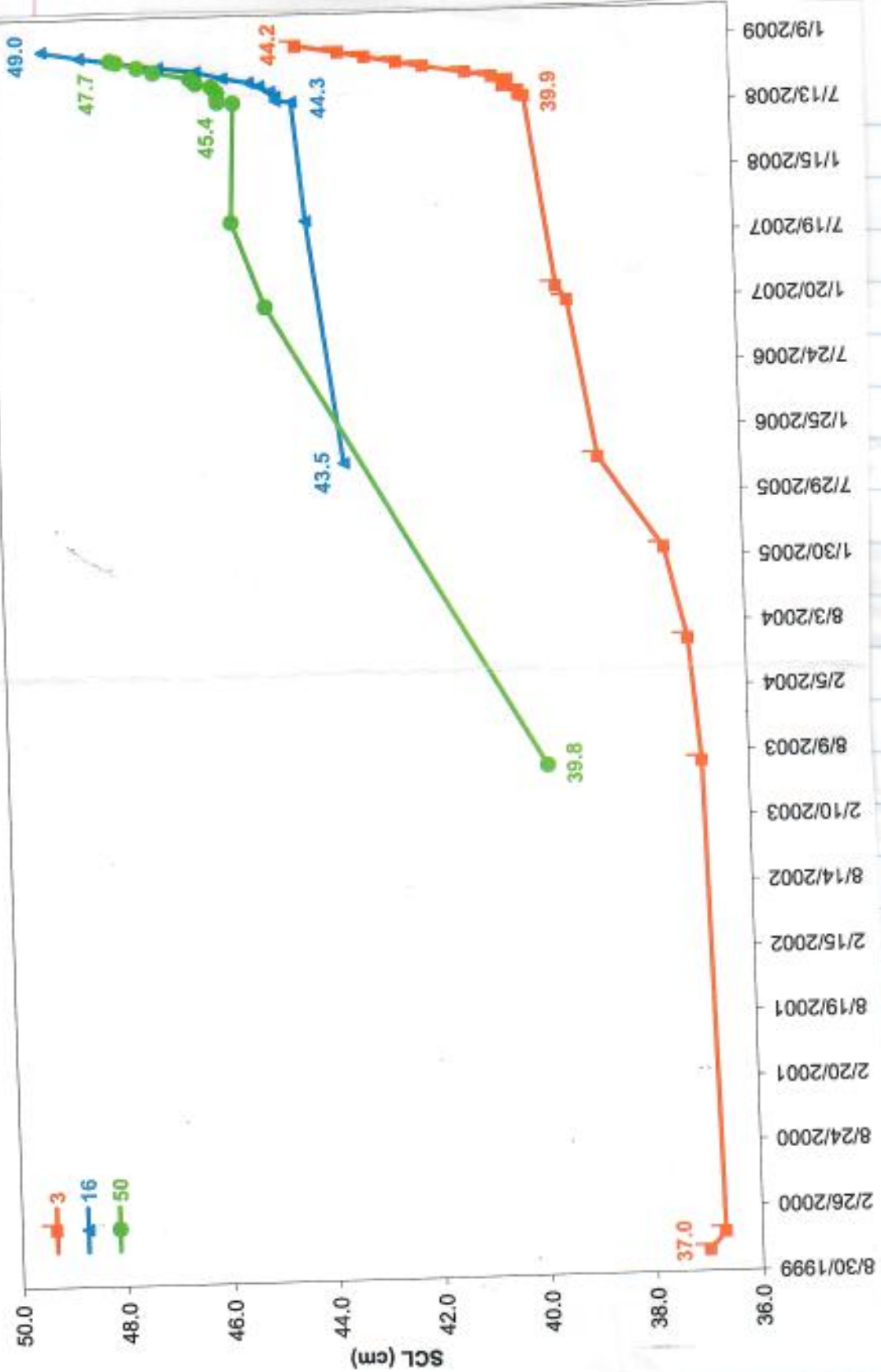
The Kāpili Pili Framework provides a means to reflect, evaluate, and direct intentions, mindset, and actions toward building and maintaining authentic relationships with indigenous practitioners and communities.

Each probing question should catalyze the conversations within your group, organization or agency that help you determine how “sound” your house is. You may find that you need to rebuild the entire structure or you may find that only one aspect of the house needs to be refortified.

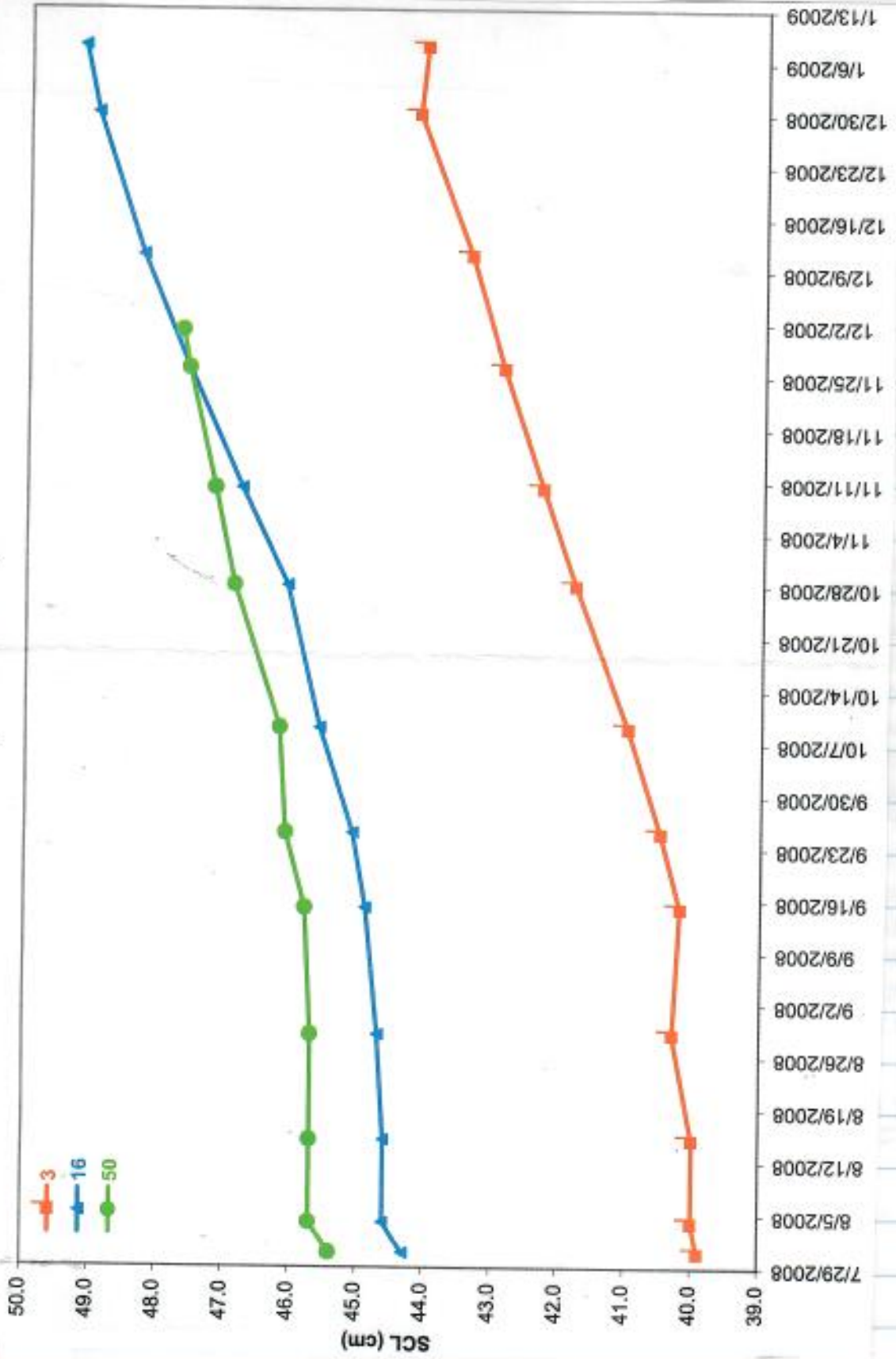
For those who are yet to develop these relationships, the framework functions as the best practice road map.



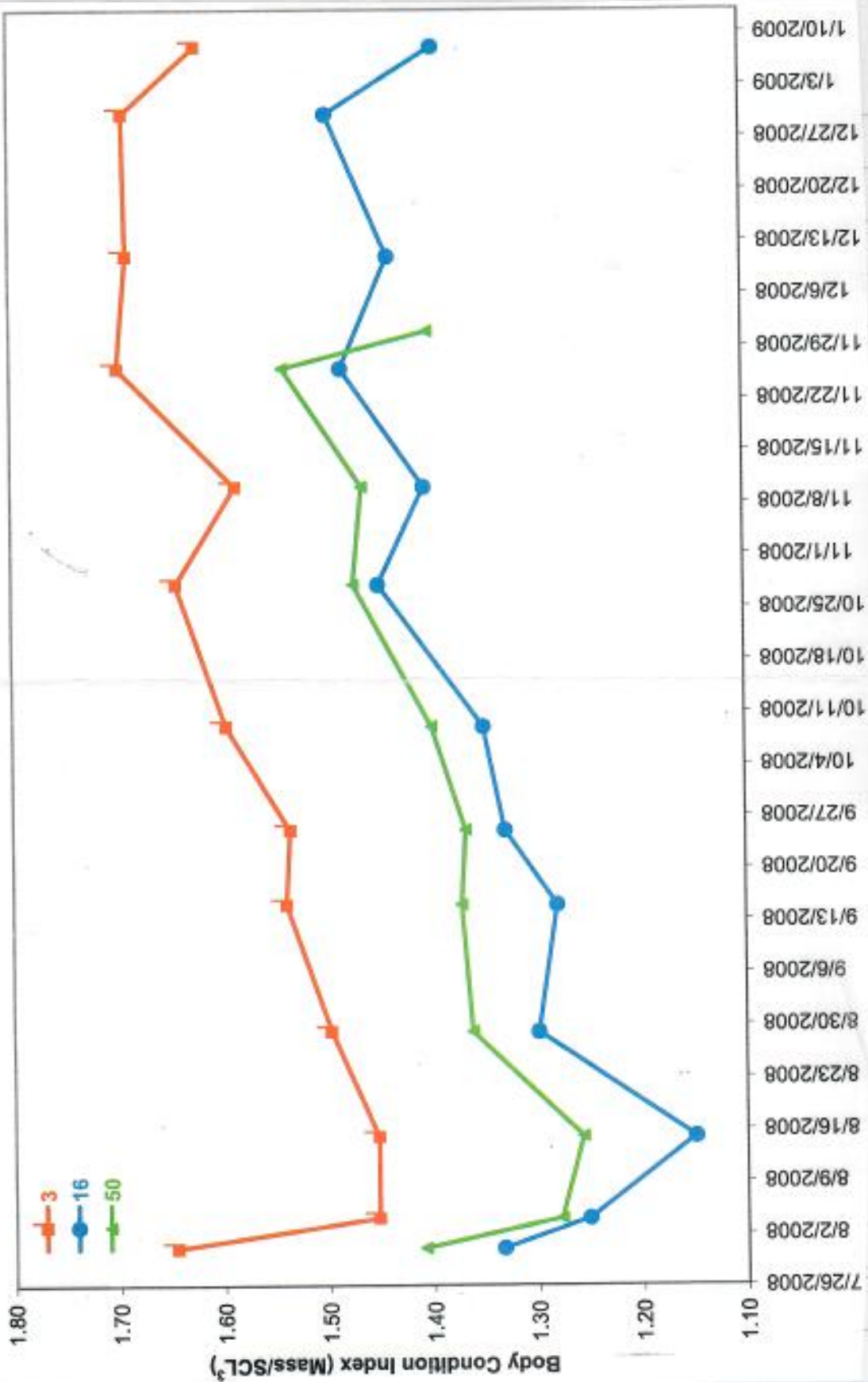
Growth History for 3 Juvenile Hawaiian Green Turtles from Kiholo Bay  
Undergoing Nutritional Rehabilitation at the PIFSC KRF



Growth Rates of 3 Juvenile Hawaiian Green Turtles from Kiholo Bay  
 Undergoing Nutritional Rehabilitation at the PIFSC KRF  
 (7/31/08 - 1/8/09)



Body Condition Index of 3 Juvenile Hawaiian Green Turtles from Kiholo Bay  
 Undergoing Nutritional Rehabilitation at the PIFSC KRF  
 (7/31/08 - 1/8/09)

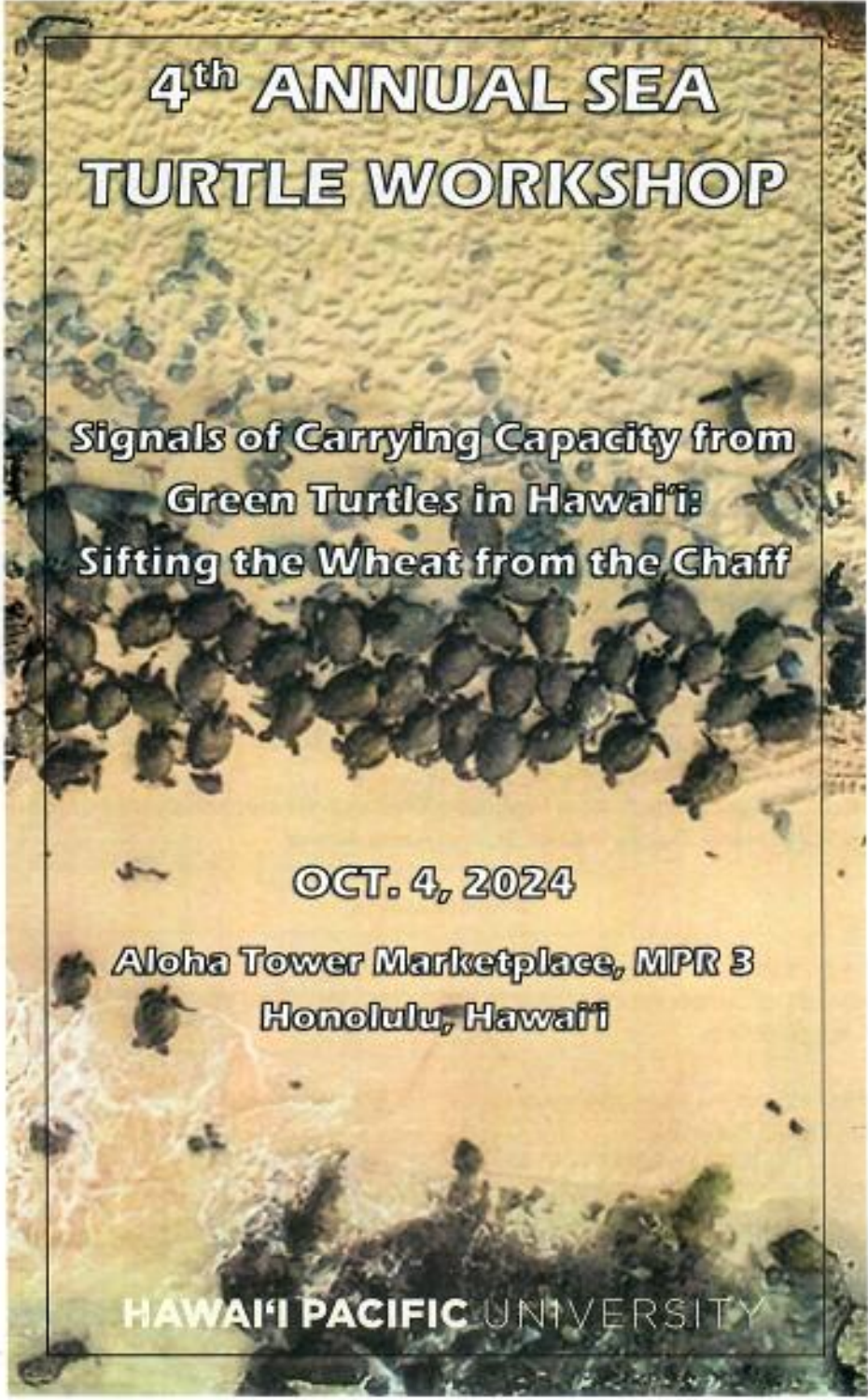


APRIL 2024 K-H.N.H.P.  
H.P.A. RICE & JIM GREEN TURTLE RECAPTURE.

TOOL #	(HA)	te of first captie	of latest capt	first SCL	latest SCL	second mass	latest Mass	ELAPSED TIME/YRS	Growth cm/yr
	215	9/26/2023	4/18/2024	54	55	20.1	20.6	0.561644	1.78
	153	10/20/2022	4/18/2024	49	50.2	17.2	17.4	1.49589	0.80
	148	10/20/2022	4/18/2024	63	63.3	31.6	31	1.49589	0.20
	148	6/28/2011	4/18/2024	49.4	63.3			12.81644	1.08
	209	9/26/2023	4/18/2024	55.5	56.1	23.3	23.8	0.561644	1.07
	69	10/23/2019	4/18/2024	46.2	51.8	14	20	4.490411	1.25
	217	9/26/2023	4/18/2024	60.9	61	32.6	31.6	0.561644	0.18
	217	8/13/2003	4/18/2024	48.2	61			20.69589	0.62
	154	10/20/2022	4/18/2024	52.7	53.3	21.2	20.8	1.49589	0.40
	222	9/26/2023	4/18/2024	53	54.2	19.6	20.4	0.561644	2.14
	146	10/20/2022	4/18/2024	57.6	58.4	24	27.2	1.49589	0.53
	147	10/20/2022	4/18/2024	60.8	61.1			1.49589	0.20
	213	9/26/2023	4/18/2024	40.1	42.3	9.4	11	0.561644	3.92
	220	9/26/2023	4/18/2024	41.9	42.7	9.3	10.4	0.561644	1.42
	216	11/1/2018	4/18/2024	57.1	59	20.9	22.7	5.465753	0.35
	214	9/26/2023	4/18/2024	57.9	59.4	29.1	30.2	0.561644	2.67
	214	11/13/2017	4/18/2024	54.4	59.4			6.432877	0.78
	152	10/20/2022	4/18/2024	53.1	54.1	16.8	21.4	1.49589	0.67
	251	9/28/2016	4/18/2024	50.5	55.5	18.3	21.4	7.558904	0.66
	221	9/26/2023	4/18/2024	65.7	65.4	36.7	35.8	0.561644	-0.53
	221	1/22/2003	4/18/2024	45.6	65.4			21.25205	0.93
	218	9/26/2023	4/18/2024	48.5	50.7	16.3	18.6	0.561644	3.92
	255	11/15/2013	4/18/2024	57.2	64.8	24.9	35.2	10.43014	0.73
								MEAN GROWTH RATE CM/YR	1.14

NOT USED IN "MEAN" CALCUALTION

Working Group of East Island, French Frigate Shoals (Laysan)  
Dr. Amanda Taves

An aerial photograph of a large group of green turtles on a sandy beach. The turtles are clustered together, with some facing towards the camera and others with their backs to it. The sand is a light tan color, and there are some dark spots and debris scattered around. The background shows the ocean with some seaweed and rocks.

**4<sup>th</sup> ANNUAL SEA  
TURTLE WORKSHOP**

**Signals of Carrying Capacity from  
Green Turtles in Hawai'i:  
Sifting the Wheat from the Chaff**

**OCT. 4, 2024**

**Aloha Tower Marketplace, MPR 3  
Honolulu, Hawai'i**

**HAWAII PACIFIC UNIVERSITY**



## **SIGNALS OF CARRYING CAPACITY FROM GREEN TURTLES IN HAWAII: SIFTING THE WHEAT FROM THE CHAFF**

**2024 Workshop Goal** - "To stimulate interest and action in finding answers to puzzling important questions relevant to the conservation status of Hawaii's green turtle population"

**745-830am Registration Sign-In, Coffee & Pastries**

**830-845AM \*\*\*Start of Zoom\*\*\***

Welcome and Ceremonial Hawaiian Blessing of Attendees and Turtles by Kahu Hānai Danny Akaka, Jr. and Anna Akaka

### **Presentations**

**845-900am #1** - Why this workshop? Puzzling important questions about the conservation status of Hawaiian Honu and their Ecosystem - George Balazs

**900-915am #2** - The theory and math of modelling carrying capacity - Dr. David Hyrenbach

**915-930am #3** - The origins of ECOPATH and its application to the Kaloko-Honokohau marine ecosystem - Dr. Jeffrey Polovina

**930-945am #4** - Estimating carrying capacity at the green turtle nesting beach of East Island, French Frigate Shoals (Lalo) - Dr. Manjula Tiwari



**945-1000am #5** - Tiger shark research in Hawai'i - Dr. Kim Holland

**1000-1030am** - Break and Group Photo in Courtyard

**1030-1045am #6** - Kauai's honu phenomenon: The crossroads of coexistence - Dr. Lisa Harrington and Deborah Herrera

**1045-1100am #7** - Corpulent or malnourished? Depends on where the world's most abundant large marine herbivores live - Dr. Milani Chaloupka

**1100-1115am #8** - A summary of green turtle growth rates and residency durations at three long-term study sites in West Hawai'i - Laura Jim

**1115-1130am #9** - Necropsy shows low body condition in turtles from Kona versus other sites in Hawai'i - Dr. Thierry Work

**1130-1145am #10** - Balancing marine life: Towards managing green turtles and seagrass ecosystems in Okinawa, Japan - Dr. Tomoko Hamabata

**1145am-200pm** - BYOL Lunch in Meeting Room with Facilitated Group Discussions, Questions & Answers Striving to ...'Sift the Wheat from the Chaff' - Dr. Thierry Work

**200pm Closing** - Follow-ups and Farewell until our HPU 5th Workshop.

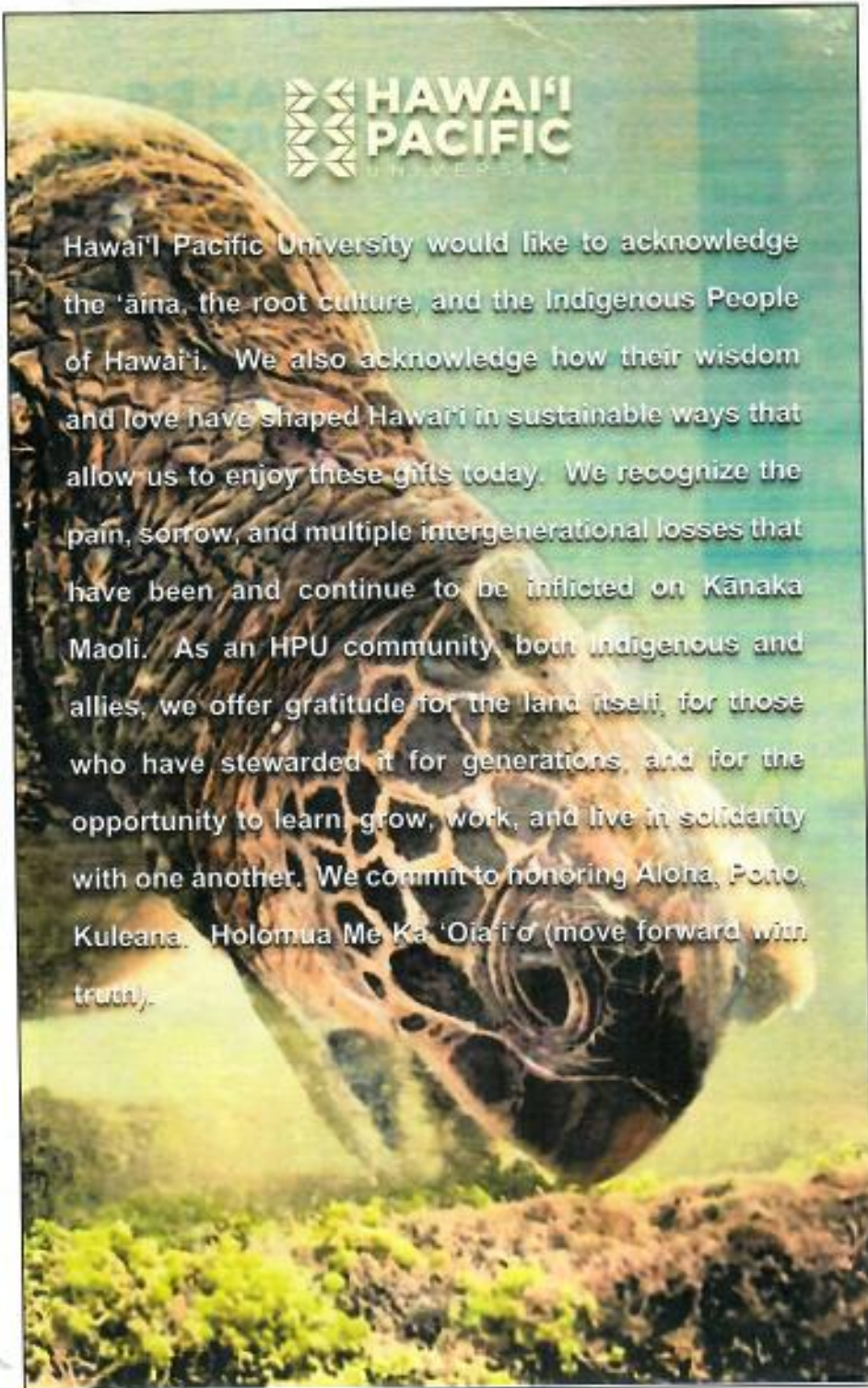


*"The most erroneous stories are those we think we know best – and therefore never scrutinize or question." -Stephen Jay Gould*





Hawai'i Pacific University would like to acknowledge the 'āina, the root culture, and the Indigenous People of Hawai'i. We also acknowledge how their wisdom and love have shaped Hawai'i in sustainable ways that allow us to enjoy these gifts today. We recognize the pain, sorrow, and multiple intergenerational losses that have been and continue to be inflicted on Kānaka Maoli. As an HPU community, both indigenous and allies, we offer gratitude for the land itself, for those who have stewarded it for generations, and for the opportunity to learn, grow, work, and live in solidarity with one another. We commit to honoring Aloha, Pono, Kuleana. Holomua Me Ka 'Oia'i'o (move forward with truth).



10A- Healthy numbers of tiger sharks in the Hawaiian Islands fulfill their ecological role as apex predators of green turtles.	
10B- A significant range shift by the Hawaiian monk seal into the Main Hawaiian Islands has resulted in periodic reports of predation and harassment of green turtles.	

range shift by the Hawaiian monk seal into the Main Hawaiian Islands has resulted in periodic reports of predation and harassment of green turtles.	
11- A significant decline in fibropapilloma disease over the past two decades resulted in the increased survival of green turtles.	

Thierry M. Work  
 #####PLEASE NOTE NEW ADDRESS PHONES BELOW###  
 US Geological Survey- National Wildlife Health Center  
 Honolulu Field Station  
 820 Mililani Street, Suite 300  
 Honolulu, HI 96813  
 Cell: 808 554 6490  
 Lab: 808 585 6020  
 Off: 808 528 7149  
 Thierry\_work@usgs.gov

G. H. Balazs · M. Chaloupka

## Spatial and temporal variability in somatic growth of green sea turtles (*Chelonia mydas*) resident in the Hawaiian Archipelago

Received: 7 October 2003 / Accepted: 19 April 2004 / Published online: 28 May 2004  
© Springer-Verlag 2004

**Abstract** The somatic growth dynamics of green turtles (*Chelonia mydas*) resident in five separate foraging grounds within the Hawaiian Archipelago were assessed using a robust non-parametric regression modelling approach. The foraging grounds range from coral reef habitats at the north-western end of the archipelago, to coastal habitats around the main islands at the south-eastern end of the archipelago. Pelagic juveniles recruit to these neritic foraging grounds from ca. 35 cm SCL or 5 kg (~6 years of age), but grow at foraging-ground-specific rates, which results in quite different size- and age-specific growth rate functions. Growth rates were estimated for the five populations as change in straight carapace length (cm SCL year<sup>-1</sup>) and, for two of the populations, also as change in body mass (kg year<sup>-1</sup>). Expected growth rates varied from ca. 0–2.5 cm SCL year<sup>-1</sup>, depending on the foraging-ground population, which is indicative of slow growth and decades to sexual maturity, since expected size of first-time nesters is ≥80 cm SCL. The expected size-specific growth rate functions for four populations sampled in the south-eastern archipelago displayed a non-monotonic function, with an immature growth spurt at ca. 50–53 cm SCL (~18–23 kg) or ca. 13–19 years of age. The growth spurt for the Midway atoll population in the north-western archipelago occurs at a much larger size (ca. 65 cm SCL or 36 kg), because of slower immature growth rates that might be due to a limited food stock

and cooler sea surface temperature. Expected age-at-maturity was estimated to be ca. 35–40 years for the four populations sampled at the south-eastern end of the archipelago, but it might well be > 50 years for the Midway population. The Hawaiian stock comprises mainly the same mtDNA haplotype, with no differences in mtDNA stock composition between foraging-ground populations, so that the geographic variability in somatic growth rates within the archipelago is more likely due to local environmental factors rather than genetic factors. Significant temporal variability was also evident, with expected growth rates declining over the last 10–20 years, while green turtle abundance within the archipelago has increased significantly since the mid-1970s. This inverse relationship between somatic growth rates and population abundance suggests a density-dependent effect on somatic growth dynamics that has also been reported recently for a Caribbean green turtle stock. The Hawaiian green turtle stock is characterised by slow growth rates displaying significant spatial and temporal variation and an immature growth spurt. This is consistent with similar findings for a Great Barrier Reef green turtle stock that also comprises many foraging-ground populations spanning a wide geographic range.

Vol. 657: 191-207 2021  
<https://doi.org/10.3354/meps13544>

MARINE ECOLOGY PROGRESS SERIES  
Mar Ecol Prog Ser

Published January 7



# Global synthesis of sea turtle von Bertalanffy growth parameters through Bayesian hierarchical modeling

Limburg  
Growth

2021

Matthew D. Ramirez<sup>1,2,\*</sup>, Tamara Popovska<sup>3</sup>, Elizabeth A. Babcock<sup>3</sup>

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<sup>2</sup>Graduate School of Oceanography, University of Rhode Island, Narragansett, RI 02882, USA

<sup>3</sup>Department of Marine Biology and Ecology, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL 33149, USA

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# Duration of prolonged simulated green turtle grazing affects *Thalassia testudinum* regrowth dynamics following grazing cessation in a subtropical Caribbean ecosystem

Alexandra G. Gulick<sup>1,2</sup> · Kathleen M. Hanes<sup>1,3</sup> · Alan B. Bolten<sup>1</sup> · Karen A. Bjorndal<sup>1</sup>

Received: 29 January 2023 / Accepted: 29 August 2023

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## Abstract

Populations of the green turtle (*Chelonia mydas*), a megaherbivore that maintains distinct areas of seagrass via cultivation grazing, are recovering worldwide. Evaluating seagrass regrowth dynamics in grazed areas following prolonged, known-durations of herbivory is challenging in situ, but is critical to understand ecosystem function as meadows return to a natural grazed state. Based on a 27-month study in a subtropical Caribbean seagrass meadow (The Bahamas; 23.46° N, 76.06° W), we evaluate *Thalassia testudinum* regrowth dynamics over 11 months following two durations of simulated green turtle grazing (11 and 16 months; 11clip and 16clip, respectively). By the end of the clipping treatments, simulated grazing had induced significant changes in most *T. testudinum* leaf morphology and nutrient variables in clipped plots compared to reference plots, while belowground biomass and nutrient content were unaffected. However, most leaf variables in clipped plots returned to levels comparable to reference plots by 6.5 months after the cessation of clipping, with the exception of leaf area index (LAI) and leaf width. The effects of grazing duration on regrowth in clipped treatments were evident in 11clip and 16clip plots. In 11clip plots, LAI increased to reference plot levels within 6.5 months after cessation of clipping, while leaves did not widen until 11 months post-clipping. However, LAI in 16clip plots did not reach reference plot levels until 11 months post-clipping, and leaves remained significantly narrow throughout the experiment. These regrowth patterns indicate the capacity of *T. testudinum* to rebound following prolonged, repetitive cropping of leaf biomass by green turtles, and that decreased leaf width and LAI after cessation of grazing may be a lingering effect of shifts in plant growth allocation in grazed systems. This study provides a valuable contribution to understand the effects of cultivation grazing and grazing duration on *T. testudinum* regrowth dynamics and tolerance to herbivory.

2023 MB



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## GREEN TURTLE SOMATIC GROWTH MODEL: EVIDENCE FOR DENSITY DEPENDENCE

KAREN A. BJORN DAL,<sup>1,2</sup> ALAN B. BOLTEN,<sup>1</sup> AND MILANI Y. CHALOUPKA<sup>2</sup>

<sup>1</sup>Archie Carr Center for Sea Turtle Research and Department of Zoology, University of Florida,  
P.O. Box 118525, Gainesville, Florida 32611 USA

<sup>2</sup>Queensland Department of Environment, P.O. Box 155, Brisbane Albert Street, Queensland 4002, Australia

**Abstract.** The green turtle, *Chelonia mydas*, is a circumglobal species and a primary herbivore in marine ecosystems. Overexploitation as a food resource for human populations has resulted in drastic declines or extinction of green turtle populations in the Greater Caribbean. Attempts to manage the remaining populations on a sustainable basis are hampered by insufficient knowledge of demographic parameters. In particular, compensatory responses resulting from density-dependent effects have not been evaluated for any sea turtle population and thus have not been explicitly included in any population models.

Growth rates of immature green turtles were measured during an 18-yr study in Union Creek, a wildlife reserve in the southern Bahamas. We have evaluated the growth data for both straight carapace length (SCL) and body mass with nonparametric regression models that had one response variable (absolute growth rate) and five potential covariates: sex, site, year, mean size, and recapture interval. The SCL model of size-specific growth rates was a good fit to the data and accounted for 59% of the variance. The body-mass model was not a good fit to the data, accounting for only 26% of the variance. In the SCL model, sex, site, year, and mean size all had significant effects, whereas recapture interval did not.

We used results of the SCL model to evaluate a density-dependent effect on somatic growth rates. Over the 18 yr of our study, relative population density underwent a sixfold increase followed by a threefold decrease in Union Creek as a result of natural immigration and emigration. Three lines of evidence support a density-dependent effect. First, there is a significant inverse correlation between population density and mean annual growth rate. Second, the condition index ( $\text{mass}/(\text{SCL})^3$ ) of green turtles in Union Creek is positively correlated with mean annual growth rates and was negatively correlated with population density, indicating that the green turtles were nutrient limited during periods of low growth and high population densities. Third, the population in Union Creek fluctuated around carrying capacity during our study and thus was at levels likely to experience density-dependent effects that could be measured.

We estimate the carrying capacity of pastures of the seagrass *Thalassia testudinum*, the major diet plant of the green turtle, as a range from 122 to 4439 kg green turtles/ha or 16–586 million 50-kg green turtles in the Caribbean. Because green turtle populations are probably regulated by food limitation under natural conditions, carrying capacity can serve as a baseline to estimate changes in green turtle populations in the Caribbean since pre-Columbian times and to set a goal for recovery for these depleted populations.

Finally, we compare the growth functions for green turtle populations in the Atlantic and Pacific oceans. Not only does the form of the size-specific growth functions differ between the two regions (monotonic declining in the Atlantic and nonmonotonic in the Pacific), but also small juvenile green turtles in the Atlantic have substantially higher growth rates than those in the Pacific. Research is needed to evaluate the causes of these differences, but our results indicate that demographic parameters between ocean basins should only be extrapolated with great caution.

**Key words:** Australia; Bahamas; carrying capacity; *Chelonia mydas*; demography; density-dependent effect; green turtles; growth models; growth rate; marine turtles; nonparametric regression; sustainable use.



## ABSTRACT FOR XMAS 2025 14-17 JANUARY

**Balancing marine life: towards managing green turtles and seagrass ecosystems in Okinawa, Japan**

XIAMEN, CA

Tomoko Hamabata<sup>1</sup>, Hideaki Nishizawa<sup>2</sup>, Kotaro Ichikawa<sup>2</sup>, Nao Yoshida<sup>3</sup>, Hiromori Shimabukuro<sup>3</sup>, Kenji Sudo<sup>3</sup>, Toshihide Kitakado<sup>4</sup>, Masakazu Hori<sup>3</sup>, Yoshiki Yamagata<sup>5</sup>, Aoi Sugimoto<sup>5</sup>, Junichi Okuyama<sup>3</sup>

<sup>1</sup> Tohoku University, <sup>2</sup> Kyoto University, <sup>3</sup> Japan Fisheries Research and Education Agency, <sup>4</sup> Tokyo University of Marine Science and Technology, <sup>5</sup> Keio University

The seagrass beds along the Okinawan coast of Japan are crucial not only for the marine ecosystem but also for the local fishing industry, which supports the livelihoods of coastal communities. In recent years, an environmental issue has emerged, as seagrass beds have been deteriorating and becoming depleted due to increased grazing pressure from the growing population of green sea turtles. Since 2024, we have initiated a project to study the current statuses of green turtle foraging aggregation and seagrass beds in three coastal waters around Okinawa (Iriomote, Irabu, and Kume Islands). The project will collect information on the habitat use, population demographics, and life stage information of green turtles, assess the loss of seagrass beds, and calculate the carrying capacity of each seagrass area for green turtles. In addition, we will use a population dynamics model based on field data and experiments to simulate the factors behind the rapid increase in green turtle populations and develop future ecosystem management plans. We are also conducting sociological research to explore ecosystem management plans that are socially and ecologically acceptable. The research for this project will be carried out by experts from five universities and national research institutes, but the project as a whole will be driven by collaboration and communication with a range of local and external experts. Our goal is to explore how these turtles can coexist with seagrass beds and use this knowledge to promote sustainable ecosystem management. (239 words)



# Sequential overgrazing by green turtles causes archipelago-wide functional extinctions of seagrass meadows<sup>☆</sup>

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2021

## ARTICLE INFO

**Keywords:**  
Mega-herbivores  
Foraging aggregations  
Overgrazing  
Habitat loss  
Phase shift

## ABSTRACT

After centuries of decline, green turtle (*Chelonia mydas*) populations are showing handsome localized recoveries due to dedicated conservation efforts. This calls into question how much herbivory can be sustained by seagrass meadows that these turtle populations feed on. In our study, we documented the long-term impacts of green turtle foraging on seagrass meadows in the Lakshadweep archipelago, Indian Ocean. We tracked green turtle densities and seagrass areal extent in five atolls across the archipelago since 2005. Turtle densities first grew to record levels in the seagrass meadow of the Agatti lagoon around 15 years ago. Within a few years of intense herbivory, the meadow underwent radical biomass reduction and compositional shifts, leading to functional extinction and ultimately, bare sand. This trajectory of decline was repeated in every atoll, with turtle aggregations persisting 2 to 6 years before meadows were depleted, depending on their initial size. By 2019, all large meadows had declined, and in 2020, green turtles were distributed at low densities in every meadow. The meadows were limited to small patches of early successional species, maintained in a state of protracted recovery by constant, low-level herbivory. We measured the impacts of turtles on two key ecosystem services, a habitat for fish communities and stored organic carbon. Turtle overgrazing resulted in massive declines in seagrass fish diversity, biomass, and abundance, and major reductions in sediment-stored carbon. Apart from being important conservation flagships, green turtles are strong ecosystem interactors, and can potentially cause trophic cascades or functional extinction of seagrass ecosystems.

# Distribution of global sea turtle nesting explained from regional-scale coastal characteristics

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2024  
Scientific Reports

Climate change and human activity threaten sea turtle nesting beaches through increased flooding and erosion. Understanding the environmental characteristics that enable nesting can aid to preserve and expand these habitats. While numerous local studies exist, a comprehensive global analysis of environmental influences on the distribution of sea turtle nesting habitats remains largely unexplored. Here, we relate the distribution of global sea turtle nesting to 22 coastal indicators, spanning hydrodynamic, atmospheric, geophysical, habitat, and human processes. Using state-of-the-art global datasets and a novel 50-km-resolution hexagonal coastline grid (Coastgons), we employ machine learning to identify spatially homogeneous patterns in the indicators and correlate these to the occurrence of nesting grounds. Our findings suggest sea surface temperature, tidal range, extreme surges, and proximity to coral and seagrass habitats significantly influence global nesting distribution. Low tidal ranges and low extreme surges appear to be particularly favorable for individual species, likely due to reduced nest flooding. Other indicators, previously reported as influential (e.g., precipitation and wind speed), were not as important in our global-scale analysis. Finally, we identify new, potentially suitable nesting regions for each species. On average, 23% of global coastal regions between  $-39^{\circ}$  and  $48^{\circ}$  latitude could be suitable for nesting, while only 7% is currently used by turtles, showing that the realized niche is significantly smaller than the fundamental niche, and that there is potential for sea turtles to expand their nesting habitat. Our results help identify suitable nesting conditions, quantify potential hazards to global nesting habitats, and lay a foundation for nature-based solutions to preserve and potentially expand these habitats.

# Archaeological evidence for long-term human impacts on sea turtle foraging behaviour

2024  
Royal  
Society

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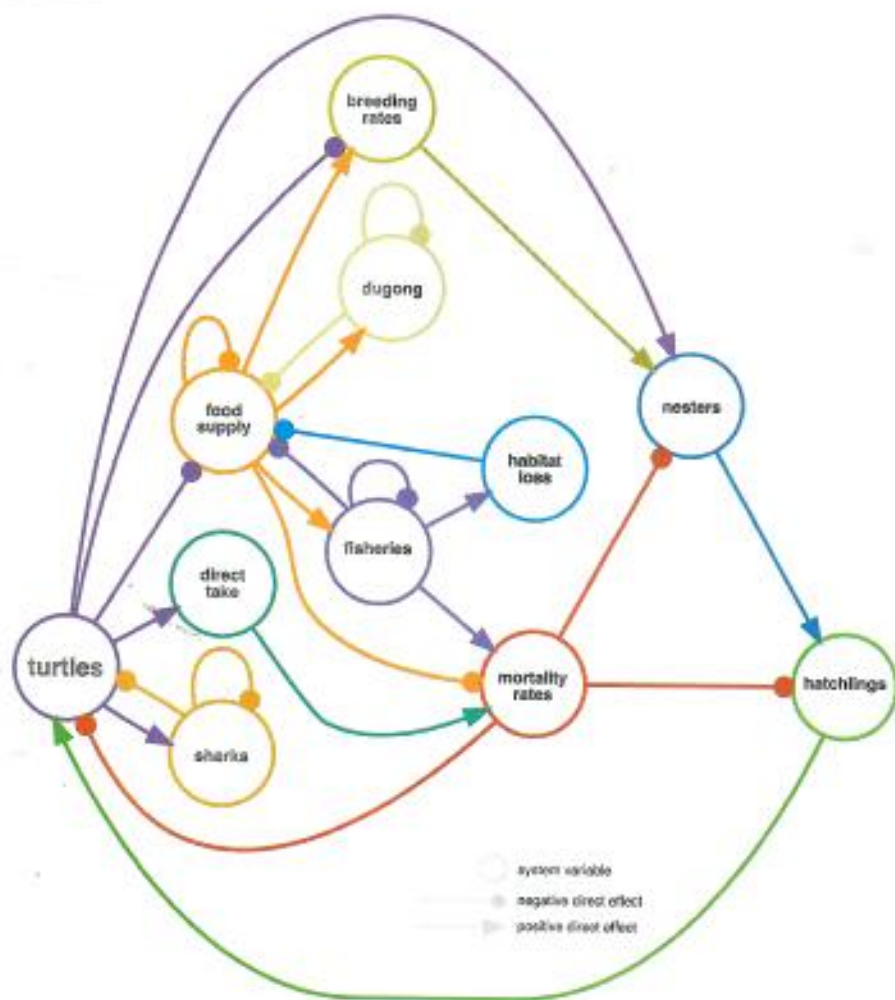
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Early conservation efforts to prevent the loss of green sea turtles (*Chelonia mydas*) from the Caribbean Sea jumpstarted marine habitat and biodiversity protection. However, even there, limitations on historical observations of turtle ecology have hampered efforts to contextualize foraging behaviours for conservation management. We integrate isotopic and zooarchaeological evidence from green sea turtles harvested at the Miskito Cays (Nicaragua) to assess foraging behaviour before and after a step change in harvesting intensity. Highly structured isotopic evidence shows greater foraging adaptability in earlier populations. This provides a counterpoint to recent synthesis, suggesting the ecological non-exchangeability of sea turtles, which complicates conservation planning focused on genetic-stock-based repopulation. In contrast, our results suggest future populations would have a capacity for higher degrees of ecological exchangeability than current perspectives allow. This highlights a need to consider the kinds of longer term perspectives, such as those offered by archaeological materials, when planning for future sea turtle recovery.



**Anthropogenic Hazards:**  
 habitat loss  
 direct take  
 fisheries  
 pollution & pathogens<sup>1</sup>  
 climate change<sup>1</sup>

**Abundance or States:**  
 marine food supply  
 mature turtles  
 nesters  
 hatchlings  
 dugong (competition)  
 sharks (predation)

**Demographic Rates:**  
 mortality rates  
 breeding rates  
 somatic growth rates<sup>1</sup>  
 1. not shown to reduce visual clutter

**Figure 1 CONCEPTUAL MAP** Qualitative ecological model for GBR marine turtle population dynamics embedded within a benthic food supply driven ecosystem. The conceptual map includes both competitor (such as for instance dugong for seagrass) and top predator such as sharks. Key state variables and rates are also indicated along with 5 primary hazards. Terminal dot indicates a negative effect for that directed link between a state or rate, a terminal arrow indicates a positive effect. Direct density-dependent feedbacks (terminal dots) are also included for some states such as "dugong", "sharks" and "food supply" such as seagrass density.

TEXAS

U

# HOW TO AVOID HARMING Sea Turtles While Fishing From Land

## TEN GOOD PRACTICES

- 1 **Inspect your gear before you begin fishing** to reduce line breaks while fishing.
- 2 **Use barbless hooks** to reduce injury to sea turtles.
- 3 **Use non-stainless steel hooks** that will eventually corrode.
- 4 **Use artificial bait** which is less attractive to sea turtles.
- 5 **Never leave fishing gear unattended** for any length of time, and check your bait often.



- 6 **Don't discard bait or fish scraps in the water** because this will attract sea turtles.
- 7 **Never intentionally feed sea turtles.**
- 8 **Put used fishing line in a recycling bin.** →
- 9 **Put all other trash in trash cans.**
- 10 **Report sea turtle sightings** using the iSeaTurtle app for Android or iPhone.



11/29/2022 Zoom

1030am TW/Brenda/GP

PLANNING for Dec 1st

HPU SLP

2PM - PARKING - Round table

Zoom - VIDEO EARLY - Blessing

TALK - NOT "PRESENTATION" - CONVERSATION/ANSWER QUESTIONS

- LAST CHANCE? Tell your story of NOAA

Only phone #

Record ANYONE NOT want

COFFEE SNACKS Break 1030AM

Group photo

Sign - ID "Telling"

Zoom - separate

3 Tag-Team Facilitators

PREACT turtles 10-11AM

PAY ATTENTION TO THOSE ON ZOOM

CONVE  
M  
CEN  
M  
G  
KIL  
LIT  
LENGT  
CAPAC  
WEIGH

c Measure

- = 1 cubic foot
- = 1 cubic yard
- = 1 cord of wood
- = 1 perch of stone
- 1 is a pile 8 feet
- 2 4 feet high,
- rock is 16-1/2
- wide, and 1

apols Weight

- = 1 ounce (oz.)
- = 1 pound (lb.)
- = 1 hundred-
- weight(cwt.)
- = 1 ton (T.)
- = 1 long ton(L.T.)

y Weight

- = 1 penny-weight (dwt)
- = 1 ounce (oz.)
- = 1 pound (lb.)

lar Measure

- = 1 minute
- = 1 degree
- = 1 circumference
- 's surface or a
- os at the equator.

aries' Weight

- = 1 scruple
- = 1 dram
- = 1 ounce
- = 1 pound (lb.)

te Measures

- = 1 sq. ft.
- = 1 sq. yd.
- = 1 sq. rod
- = 1 acre
- = 1 sq. mile

66.71 ft. on

- sq. mile.
- 160 acres.
- miles.

10	11	12
10	11	12
20	22	24
30	33	36
40	44	48
50	55	60
60	66	72
70	77	84
80	88	96
90	99	108

1 decagram (dkg)	=	10 g
1 hectogram (hg)	=	100 g
1 kilogram (kg)	=	1,000 g

10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144



*Dis-moi ce que tu  
manges, je te dirai ce  
que tu es.*

*Tell me what you eat,  
and I will  
tell you what you are.*

*Anthelme  
Brillat-Savarin  
1826*