IOSEA

NIO MTTF 4

May 2023, Baa Atoll, Maldives

SEA TURTLES & HUMANS

jack frazier

"SEA TURTLES AND HUMAN SOCIETIES"

or

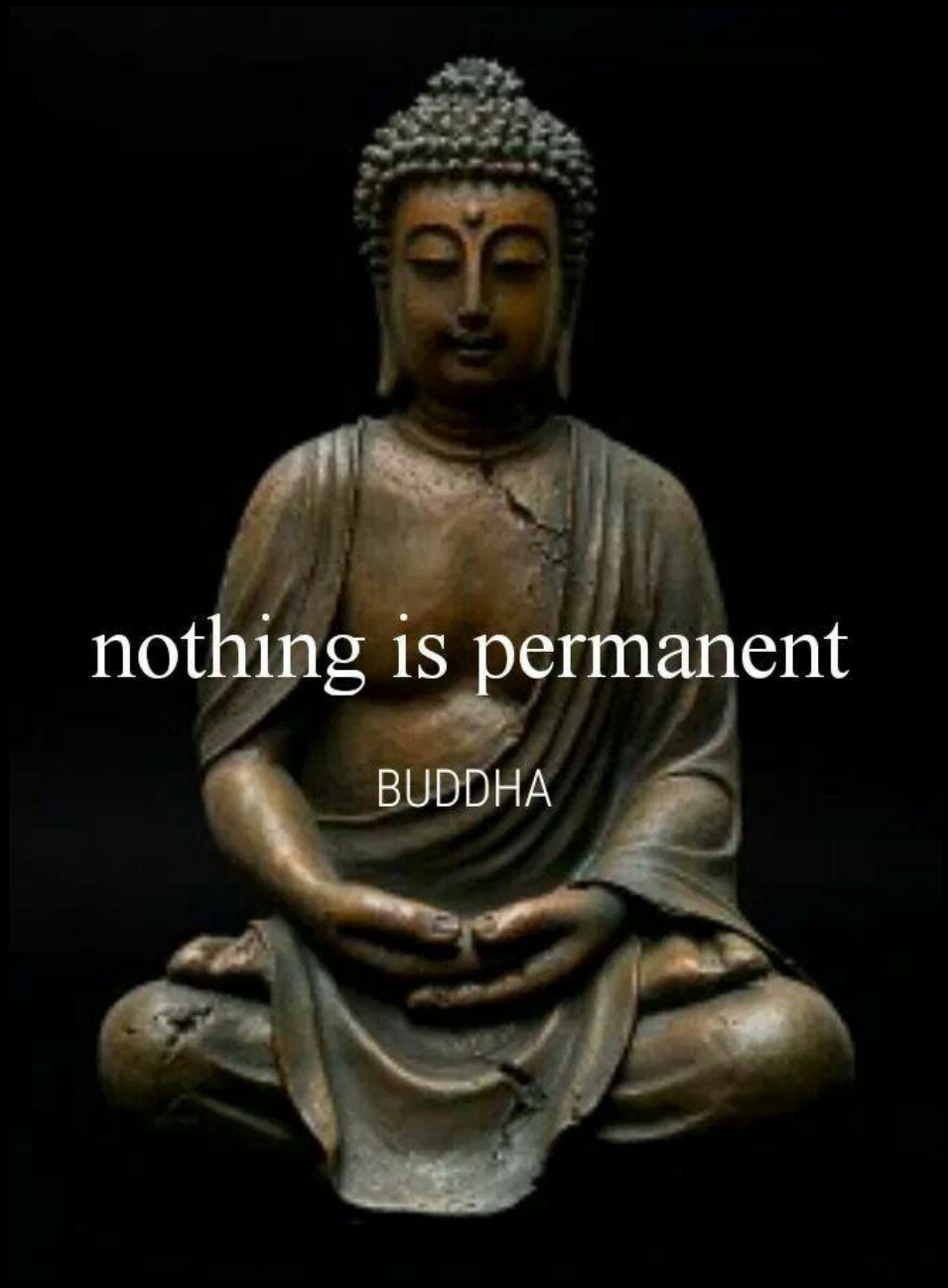
"ASPECTS OF HUMAN-TURTLE INTERACTIONS"

or

"MARINE TURTLES AND HUMAN DIMENSIONS"

THE FUNDAMENTAL ASSUMPTION

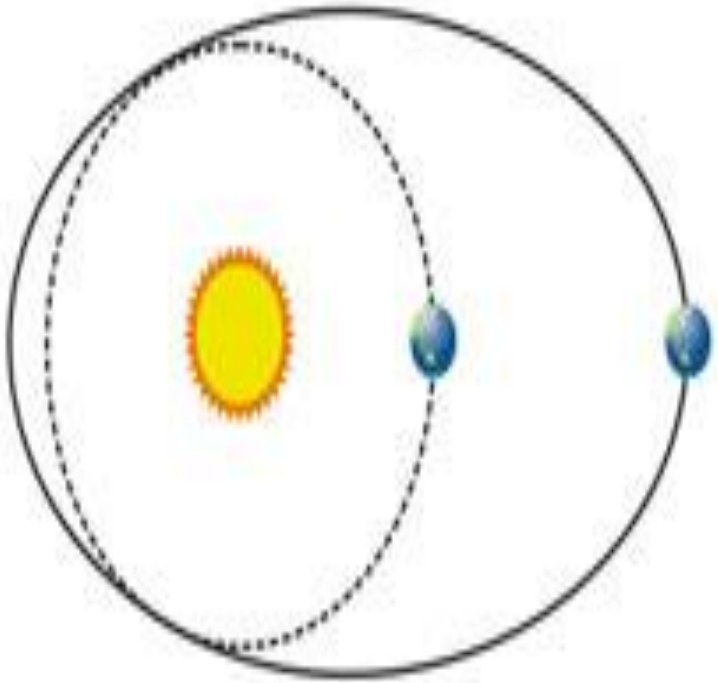
THE ONLY THING CONSTANT IS CHANGE


nothing is permanent
BUDDHA

SOME REASONS FOR CONSTANT CHANGE

THE WAY THE EARTH MOVES

Milankovitch Cycles



Eccentricity

100,000 years

Obliquity

41,000 years

Precession

23,000 years

PEAK OF LAST GLACIAL PERIOD ~ 20,000 YEARS AGO –

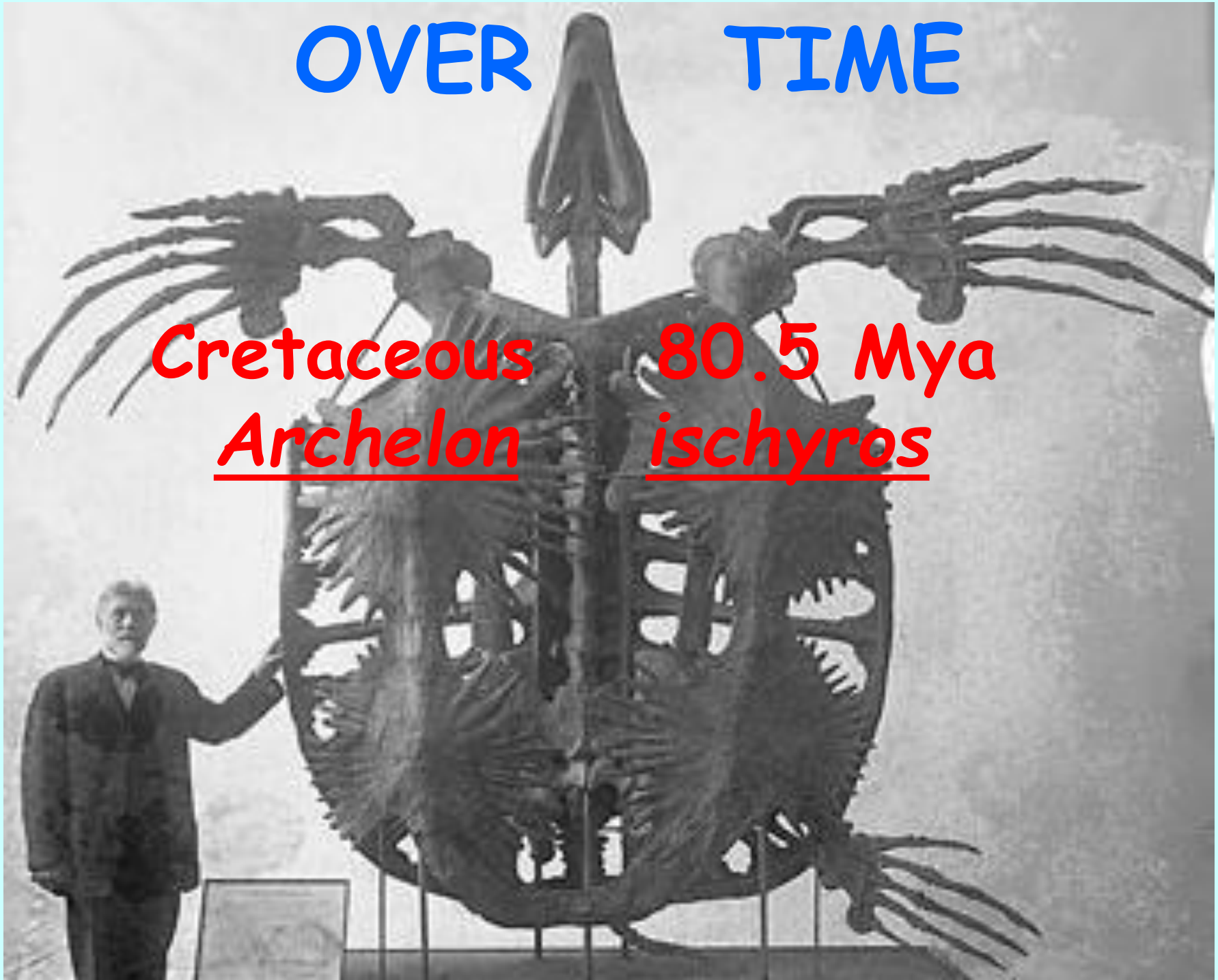
WORLD SEA LEVEL WAS 120 M LOWER THAN TODAY

PEAK OF LAST INTERGLACIAL PERIOD ~6,000 YEARS AGO –

WORLD SEA LEVEL WAS 4 TO 6 M HIGHER THAN TODAY

GLOBAL CHANGES IN SEA LEVEL - 120 M LOWER OR 6 M HIGHER - AFFECT MARINE TURTLES AND THEIR HABITATS

KINDS OF SEA TURTLES OVER TIME



Cretaceous 80.5 Mya

Archelon ischyros

SUMMARY

SEA TURTLE LINEAGE (simplified)

Sandownidae	3 genera; 3 species
Thalassochelydia	4 genera; 5 species
Protostegidae	8 genera; 9 species
Toxochelyidae?	1 genus; 1 species
Ctenochelyidae	4 genera; 6 species
Chelonioidea	
Dermochelyidae	3 genera; 3 species
Family?	1 genus; 1 species
Cheloniidae	6 genera; 7 species

TOTAL: 8 (super)families; 30 genera; 35 species

MORE TAXA (FAMILIES, GENERA, SPECIES) OF MARINE TURTLES HAVE GONE EXTINCT

THAN EXIST TODAY

Those extinctions occured long BEFORE humans evolved, ~300,000 years ago

ANCIENT ARCHAEOLOGICAL SITES

WIDE RANGING EVIDENCE OF HUMAN PREDATION ON MARINE TURTLES


Sibudu Cave, South Africa
15 km from the coast
HUMANS HAVE BEEN EXPLOITING MARINE TURTLES
SINCE THE MIDDLE STONE AGE
60,000 BP

ARCHAEOLOGICAL REMAINS SHOW THAT HUMANS HAVE BEEN CATCHING AND EATING MARINE TURTLES FOR AT LEAST 60,000 YEARS


ARABIAN/PERSIAN GULF
n
GULF OF OMAN
As-Sabiya
Abu Khamas
Bandar Siraf
Saar
Qala'at al Bahrain
Tell Abraq
Umm an-Nar
Dalma Island
Ghanda Island
Ras al Hamra RH 6
Ras al Jinz
Ras al Hadd HD 6
Ras al Hadd HD 1
Jebel Safiq, Masira
100%
Google
Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
IBCAO
Mapa GISrael

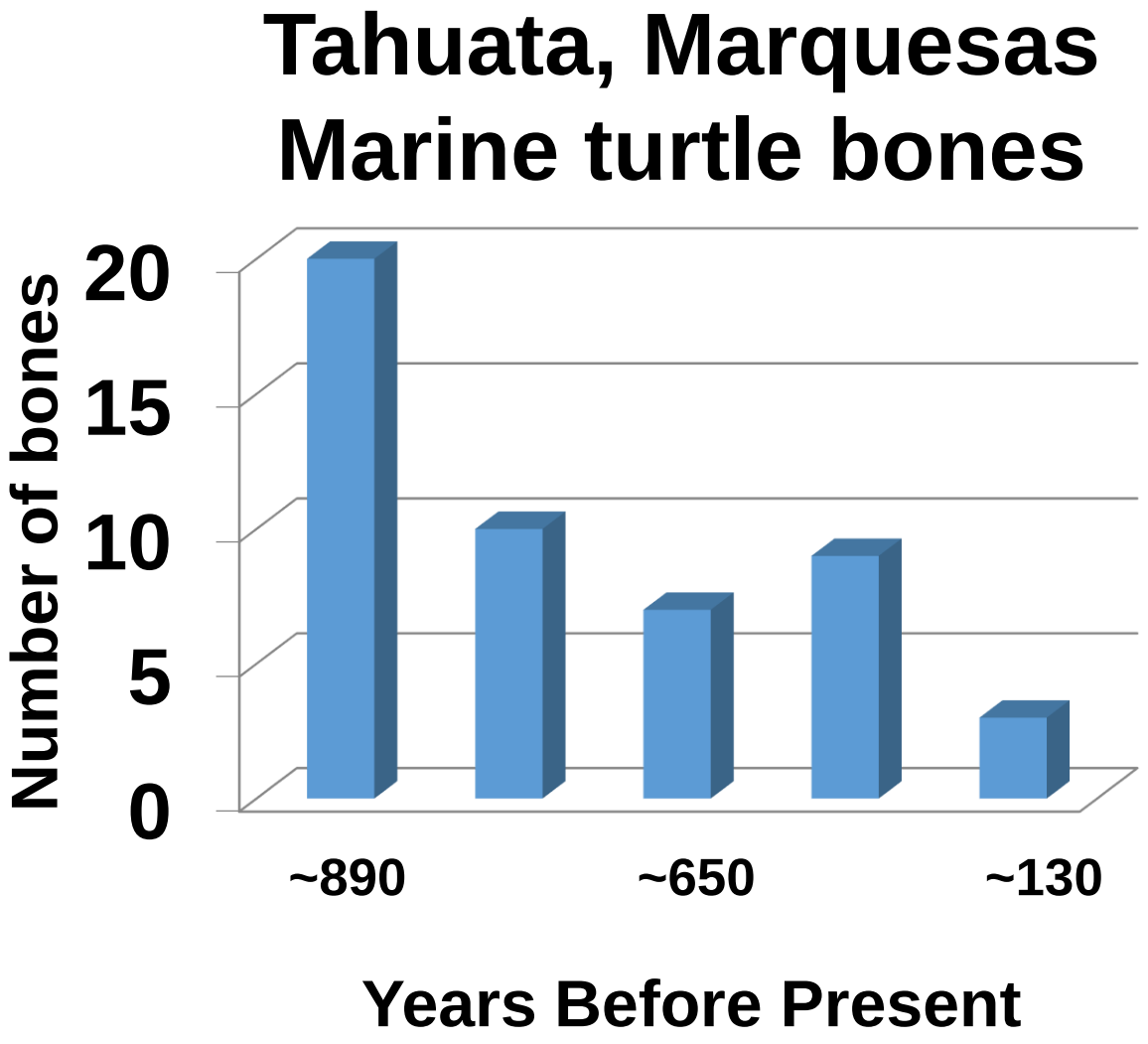

Ashkelon
Abu Shaʿar
Mons Claudianus
Myos Hormos
Sikait
Berenike
Berenike
EASTERN EGYPT
NW RED SEA


SE USA
CARIBBEAN


PACIFIC OCEAN


MAIN HAWAIIAN ISLANDS
Hanalei Bay
Wailua
Nualolo Kai
Anahola, Kauai
Kaneohe Bay, Oahu
Lili'uokalani Garden
Lolani Palace
Kanewai Fishpond
Bellows
Queen Street
Kahului
Hulopoe, Lanai
Kiakeana
Lapakahi, Hawaii
Wai'aha Bay
Kawaihae
South Point
Pahala, Hawaii

IN MANY CASES ANCIENT SOCIETIES HAVE OVEREXPLOITED TURTLES



from Rolett 1998: 111

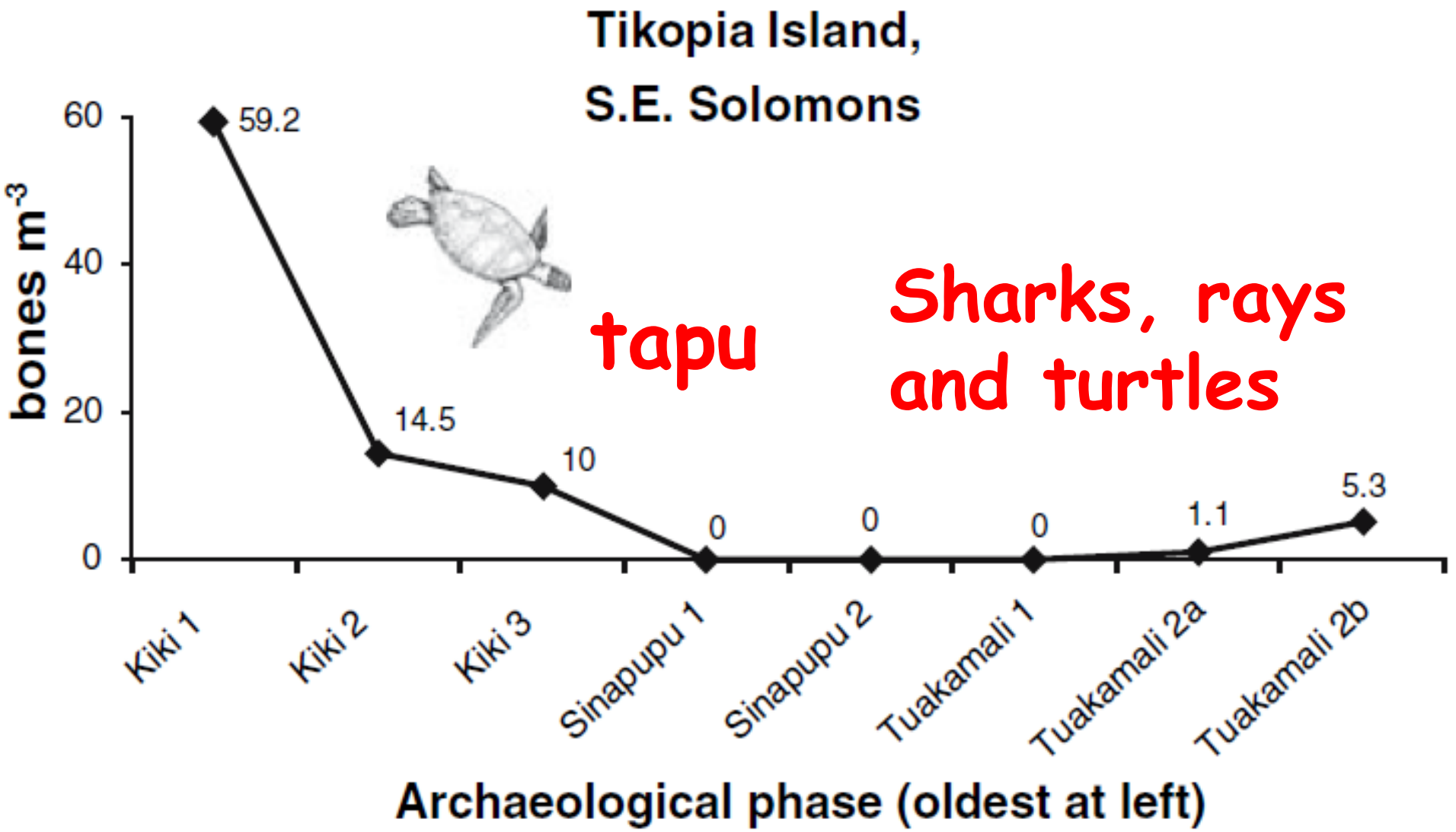


Fig. 2 Turtle bone abundance on Tikopia Island, southeast Solomons, from ca. 900 BC to AD 1800. (Data from Kirch and Yen 1982, 280, Table 40, p. 319; Kiki Phase: 900 BC–100 BC; Sinapupu Phase: 100 BC–AD 1200; Tuakamali Phase: AD 1200–1800)

(Allen 2007}

HUMAN-TURTLE RELATIONS INVOLVE MUCH, MUCH MORE THAN CAPTURING, KILLING, AND EATING TURTLES

MARINE TURTLES PROVIDE MATERIALS (OTHER THAN FOOD) THAT ARE USEFUL TO HUMAN SOCIETIES IN MANY PARTS OF THE WORLD

TORTOISE SHELL

HISTORIC DOCUMENTS

- **Egyptian maritime expeditions: 4000 BP**
- **Han Dynasty: 2,200 BP**
- **Greco-Roman trade: > 2000 BP**
- **Sung Dynasty: 960-1279 AD**
- **Ming Dynasty: 1368-1644 AD**

THE PERIPLUS OF THE ERYTHRÆAN SEA

TRAVEL AND TRADE IN THE INDIAN OCEAN BY A MERCHANT OF THE FIRST CENTURY

TRANSLATED FROM THE GREEK AND ANNOTATED

BY

WILFRED H. SCHOFF, A. M.

Secretary of the Commercial Museum, Philadelphia

PERIPLUS OF THE ERYTHREAN SEA

- AN EARLY TRADER'S MANUAL FROM THE 1st CENTURY AD
  - WHAT TO SELL AND WHAT TO BUY AT DIFFERENT PORTS OF CALL
- FROM THE RED SEA, DOWN THE EAST COAST OF AFRICA, TO ARABIA, INDIA, AND EAST INDIES
- TORTOISESHELL IS MOST COMMONLY MENTIONED COMMODITY (MORE THAN IVORY, FRANKINCENSE, SLAVES, ETC.)
- MANY DETAILS PROVIDED: WHERE TORTOISESHELL IS BEST QUALITY, HOW IT IS OBTAINED, ETC.

THERE WAS A WELL-ORGANIZED TRADE NETWORK IN TORTOISESHELL FOR AT LEAST 2,000 YEARS

HAKSBILL SCUTES (TORTOISESHELL)

- One of many ingredients used in traditional Indian medicine DHATUKRIYA (Dhatumanjari): "kurmaprstha"
  - (Meulenbeld 2000)

The occurrence of tortoiseshell on a pre-Hispanic Maya mosaic mask

Jack Frazier[1] & Reiko Ishihara-Brito[2]

The Dumbarton Oaks Maya mosaic m
is shown to have included tortoiseshell
an earlobe—remarkable since this is
only demonstrated use of this mate
in pre-Hispanic Mesoamerica. The aut
present diagnostic evidence for the prese
of tortoiseshell, account for its absence
pre-Hispanic artefacts because of decay,
propose its use (in the mask) as being symb
of the ocean.

Mask - Maya sun deity “K’inich Ajaw”

~ 900 BP

Joe Mills, Dumbarton Oaks

ANCIENT HOPEWELL COMBS MADE OF TORTOISESHELL

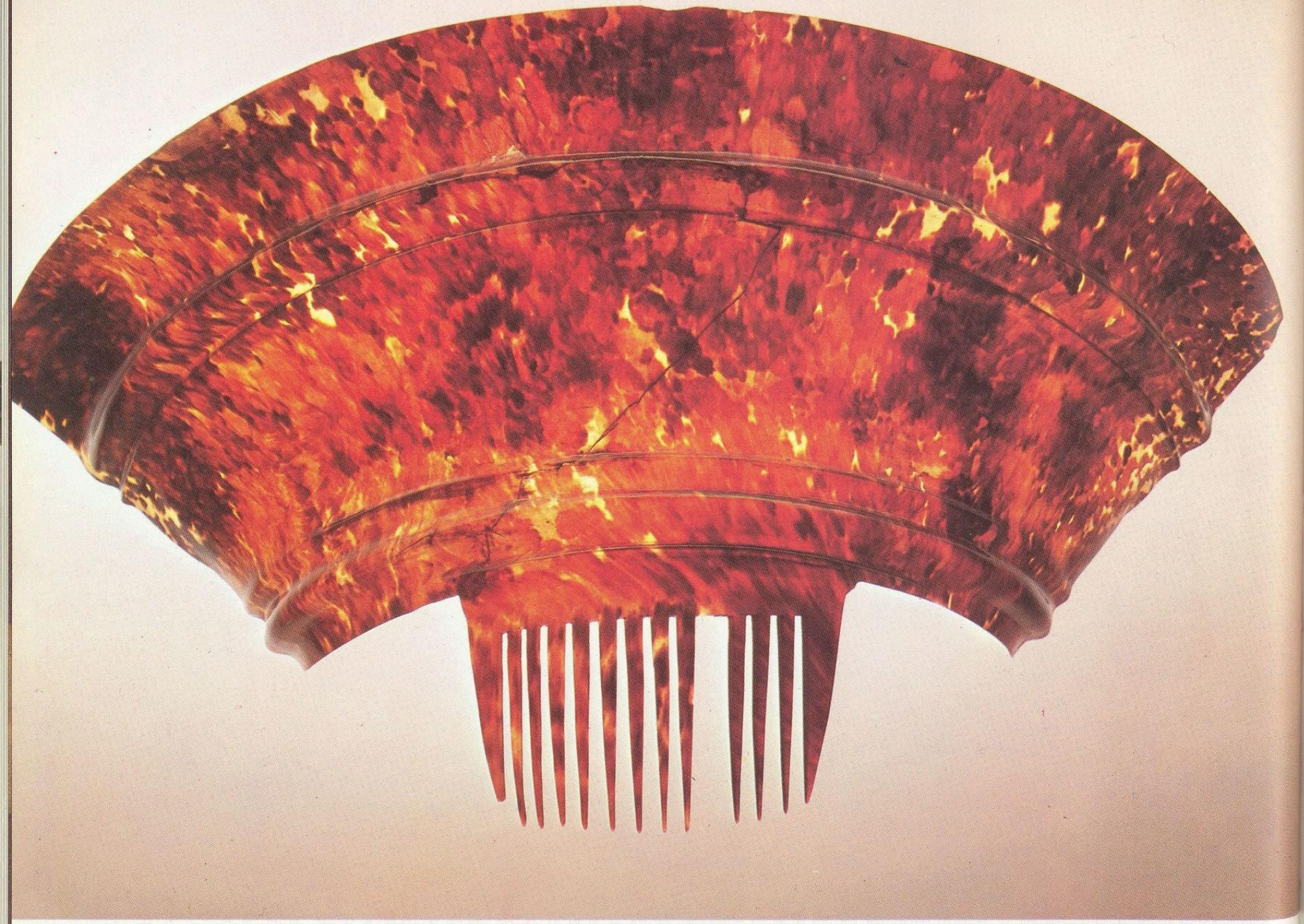

56414

THE HOPEWELL LIVED IN THE CONTINENT'S INTERIOR, NOT ON THE COAST. THEY HAD EXTENSIVE ANCIENT TRADE ROUTES

TORTOISESHELL COMBS OF LADIES FROM HIGH SOCIETY

FROM ARGENTINA – WHERE THERE ARE NO HAWKSBILLS

26 x 36 cm



25.5 x 43 cm

Peinetón
Carey moldeado 25,5 x 43 cm
Col.: Museo de Arte Hispanoamericano Isaac Fernández Blanco

MARINE TURTLES ARE USED AS SYMBOLS FOR DIVERSE HUMAN ACTIVITIES IN MANY PARTS OF THE WORLD

EARLY DILMUN SEALS FROM SAAR

EARLY DILMUN SEALS FROM SAAR

Art and Commerce in Bronze Age Bahrain

Harriet Crawford

Registration No. 6538:01

Dimensions: 2.2 x 1.2 (estimated).

(Crawford 2001)

REGISTRATION NO. K16:29:08

Dimensions: Diam. 2.47, extant height 0.75.

(Crawford 2001)

FIGURE 1.2 A Dilmun Period stamp seal, found in a grave at Hamad Town, Bahrain. (From Vine, P. (ed.) 1993. *Bahrain National Museum*. Immel Publishing; London. p. 53. With permission.)

(Frazier 2003)

DILMUN SEALS FROM SAAR, BAHRAIN & OTHER PLACES

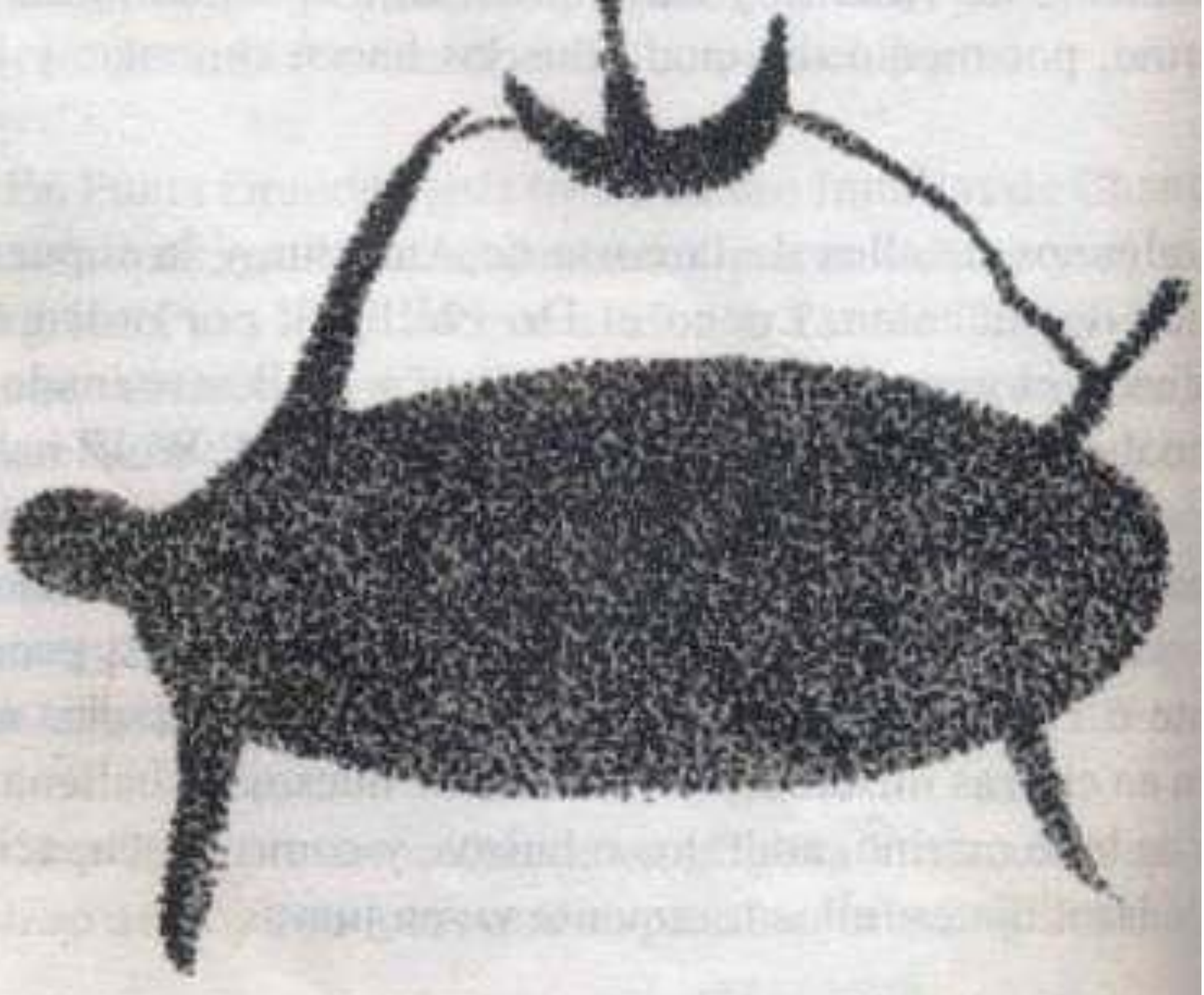
- ARE GENERALLY DISTINCTIVE
- WERE ASSOCIATED WITH TRADE (BRONZE AGE GLOBALIZATION)
- BUT NEITHER THEIR USE NOR THEIR ICONOGRAPHIC SIGNIFICANCE ARE UNDERSTOOD

MOCHE CULTURE: Perú
(200 BC - AD 700)

PARACAS, Perú

QUEBRADA EL MEDANO, TALTAL, ANTOFAGASTA, CHILE

- PICTOGRAPHS!!!!!
- ca. 500-1,500 AD
- >1,000 IMAGES, RED COLORED
- INCLUDE WHALES, SEA LIONS, SHARKS, SWORD FISH, AND MARINE TURTLES
- FISHERS ON TINY BOATS CAPTURING ENORMOUS PREY

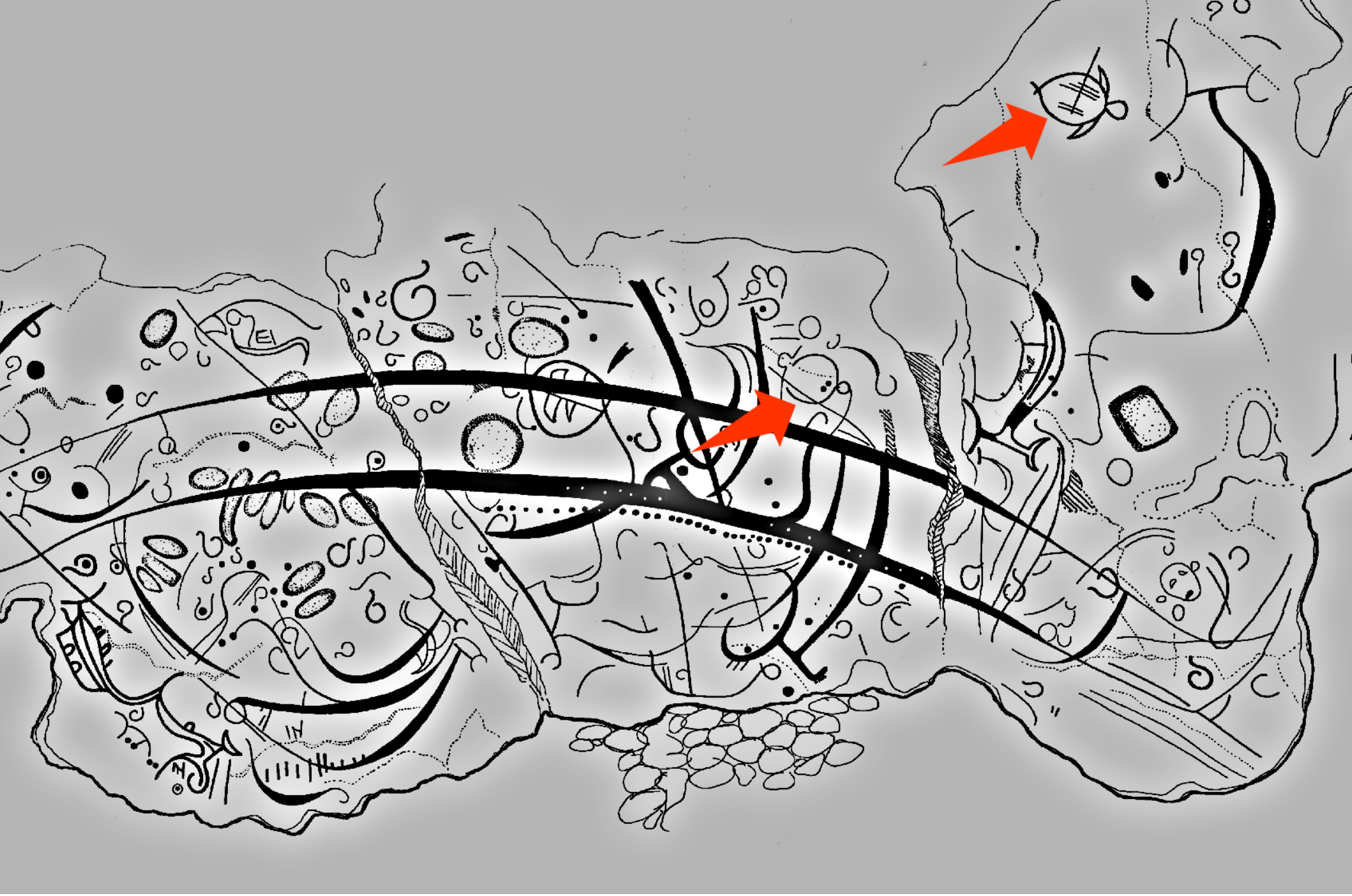


QUEBRADA EL MEDANO

- WHAT MOTIVATED PEOPLE TO VENTURE INTO THE STEEP, ARID, ISOLATED RAVINE?
- WHAT MOTIVATED THEM TO WORK SO HARD TO CREATE SO MANY PICTOGRAPHS?
- WHAT IS THE SIGNIFICANCE OF THE PICTOGRAPHS?
- WERE MARINE TURTLES SO IMPORTANT TO THEM?

RAPA NUI \ EASTER ISLAND

SCHMIDT& OTTO 2001



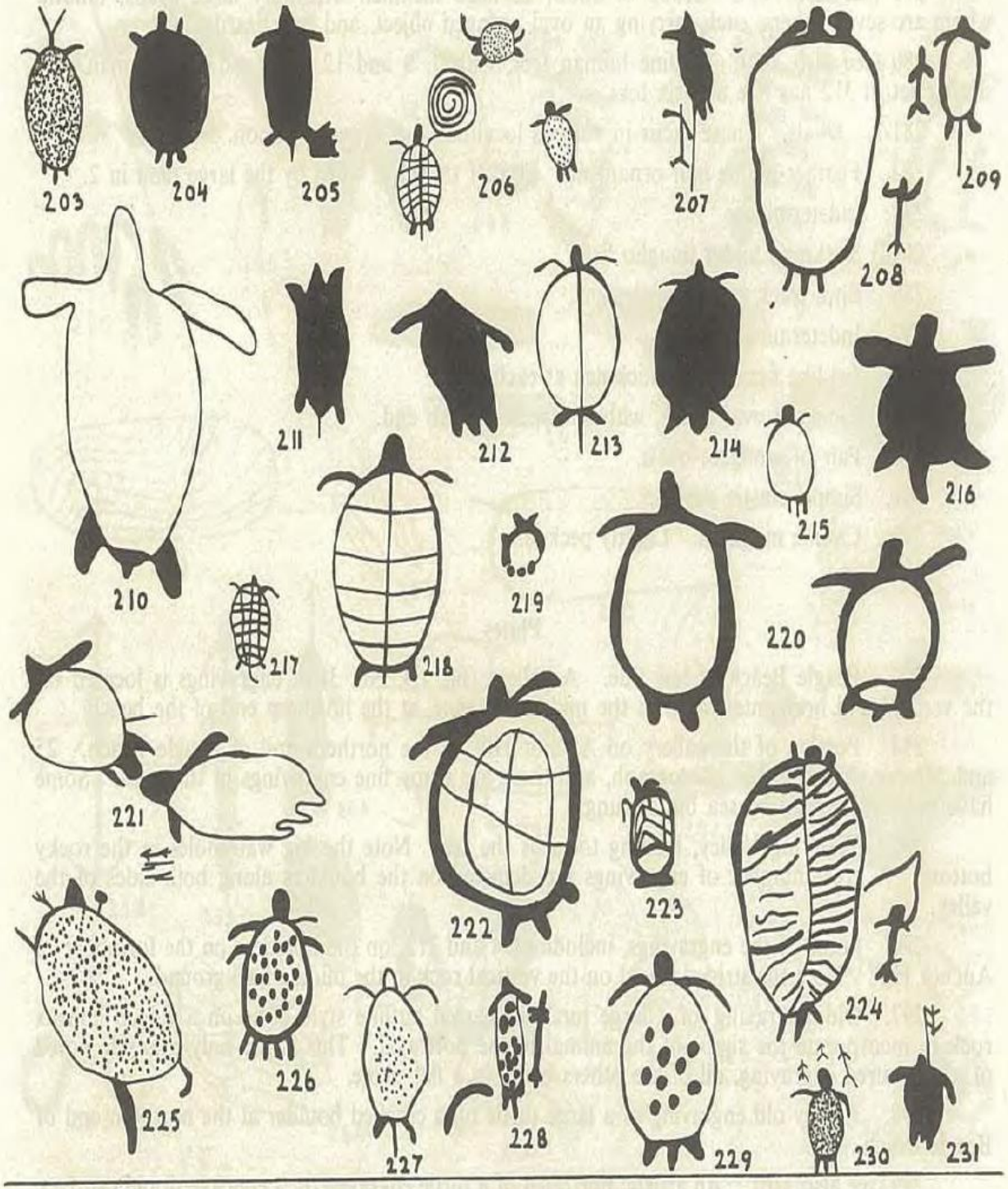
SCHMIDT & OTTO 2001

SCHMIDT & OTTO 2001

AUSTRALIA: IMMENSE AMOUNT OF ROCK ART SHOWS MARINE TURTLES

ROCK ART,
DEPUCH ISLAND,
NW AUSTRALIA

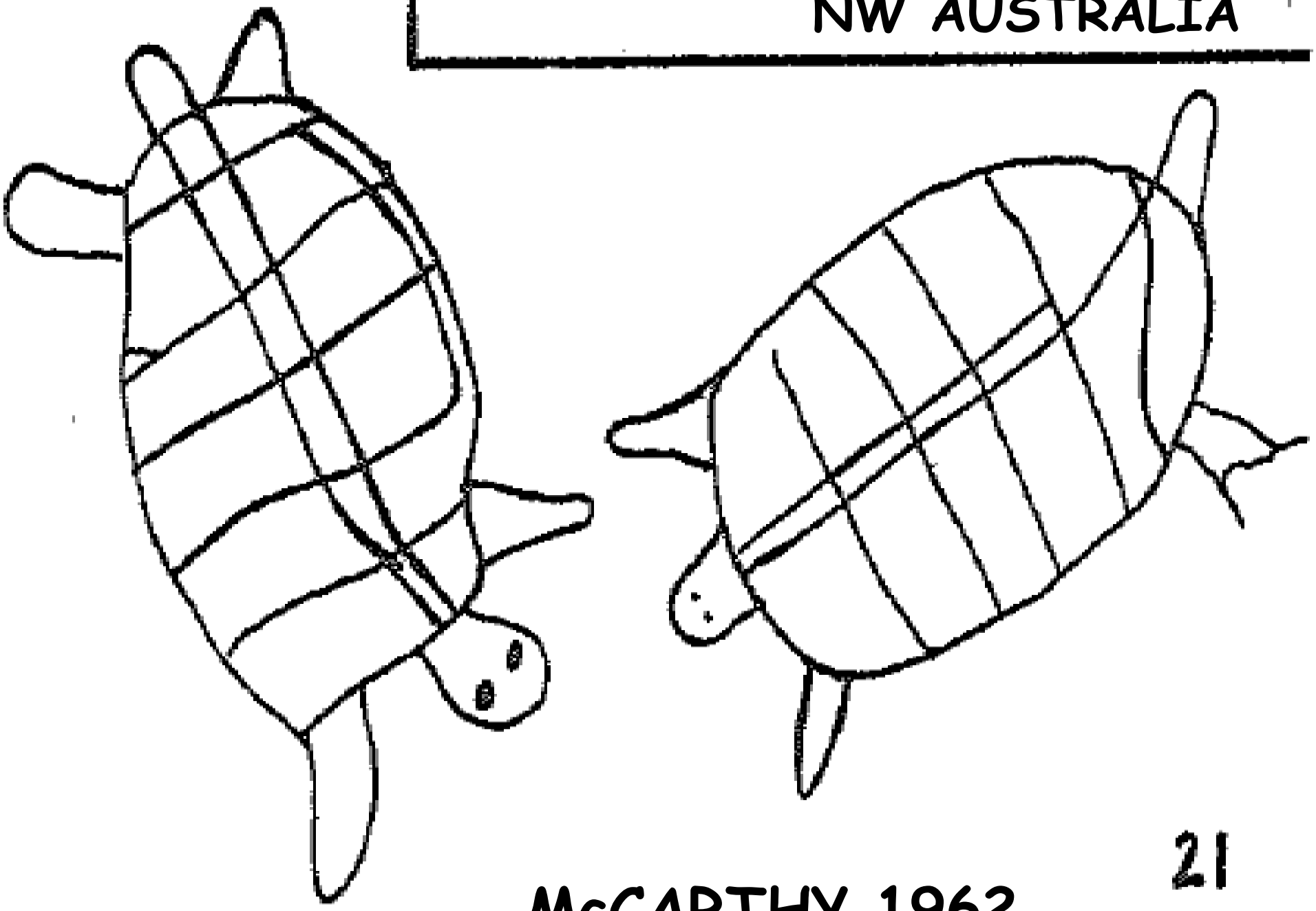
McCARTHY 1961



ROCK ART, DEPUCH ISLAND, NW AUSTRALIA

McCARTHY 1961

ROCK ART, PORT HEDLAND, NW AUSTRALIA



21

McCARTHY 1962

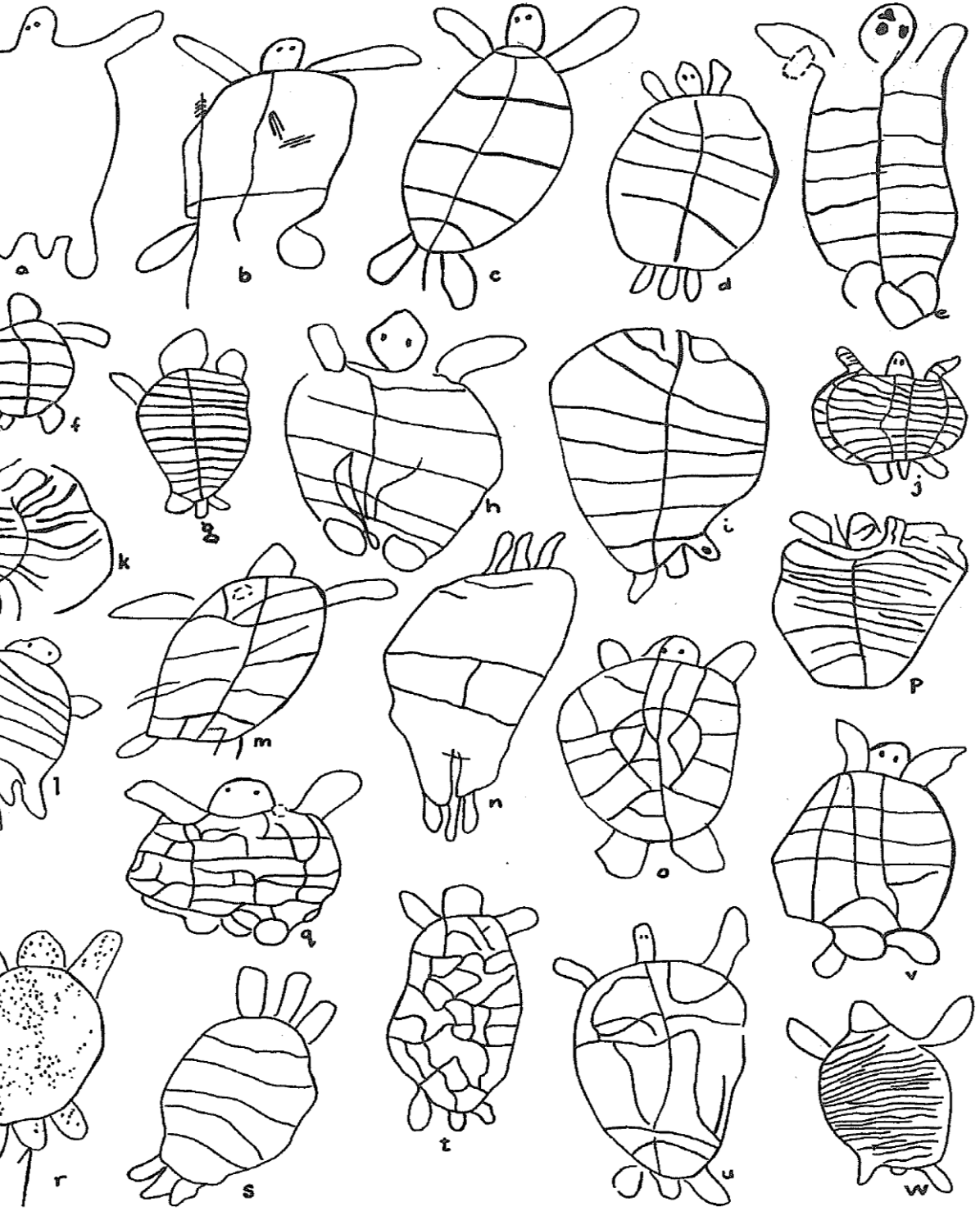


Figure 75

ROCK ART, PORT HEDLAND, NW AUSTRALIA

McCARTHY 1962

MARINE TURTLE BONES HAVE HAD UNIQUE SIGNIFICANCE TO DIFFERENT SOCIETIES AT DIFFERENT TIMES

MARINE TURTLE BONES ARE ASSOCIATED WITH HUMAN BURIALS, IN MANY PLACES, AT MANY TIMES

Table 2. *Preliminary summary of marine turtles bones found in association with human burials.*

Site	Taxon α	Estimated date	Bony element	Type of modification	Source
ARABIAN PENINSULA AND ASIA					
Ra's al-Hamra, Oman	*Cm*	3800–3300 BC	crania, carapace, shell β	associated with human burials	Potts 1990, 71; Salvatori 1996, 207–209; in press a; in press b
Khok Phanom Di, Thailand	turtle [large size]	2390–1225 BC	carapace, shell	hole in carapace, ornament, pendant	Higham & Bannanurag 1990, 39 ff.
Nil Kham Haeng, Thailand	Sea turtle, ['turtle'] ?	700 BC [various]	carapace [carapace]	over skull & thorax of burial [ornament, carved, bangle]	Higham & Thosarat 1998, 98, 118; V. Piggot pers. com. [55, 56, 62, 80, 81, 125]
AMERICAN (Caribbean, Yucatan, Florida, South America)					
Malmok site, Aruba	***Cm***	200 BC–1000 AD	carapace	human burials directly over or under turtle γ	Versteeg 1990, 14–18, 32
Cenote Xlach, Dzibilchaltun, Mexico	*Cm*	?	entire skull	found in cenote	Wing & Steadman 1980, 328
Tutu, St. Thomas, US Virgin Islands	*Cm*	300–700 AD	carapace & axial skeleton in 'hearth'	used as vessel?	Righter 2002, 42, 65–66, Figs.1.17c, 1.19, 1.27d
Golden Rock site, St. Eustatius	*Ei*	500 AD	entire skeleton (upside-down), cranium fragmented; cranium + vertebrae	'cache' 'cache'	Van der Klift 1992, 74–75, 79 Schinkel 1992, 171
Playa Vicente Mena, Chile	chl	600–1000 AD	2 carapaces	each covers a large funerary urn	Frazier & Bonavia 2000
Tanki Flip, Aruba	*Sea turtle*	1000–1250 AD		2 caches in pottery	Bartone & Versteeg 1997, 48, 49, 63, Fig. 94
Offshore Island, Sao Paulo, Brazil	chl	?	Bones	associated with human burial	B. Gallo Nieto *in litt.* 2003
Campotón, Campeche, Mexico	*Cm; Ei;* chl *Ei*	?	radius; entoplastron & marginals; ulna epiplastron	associated with cranium of burial 4; near body; near body, ulna has tooth marks; vertical behind cranium of burial 5	Götz 2004, 3–5

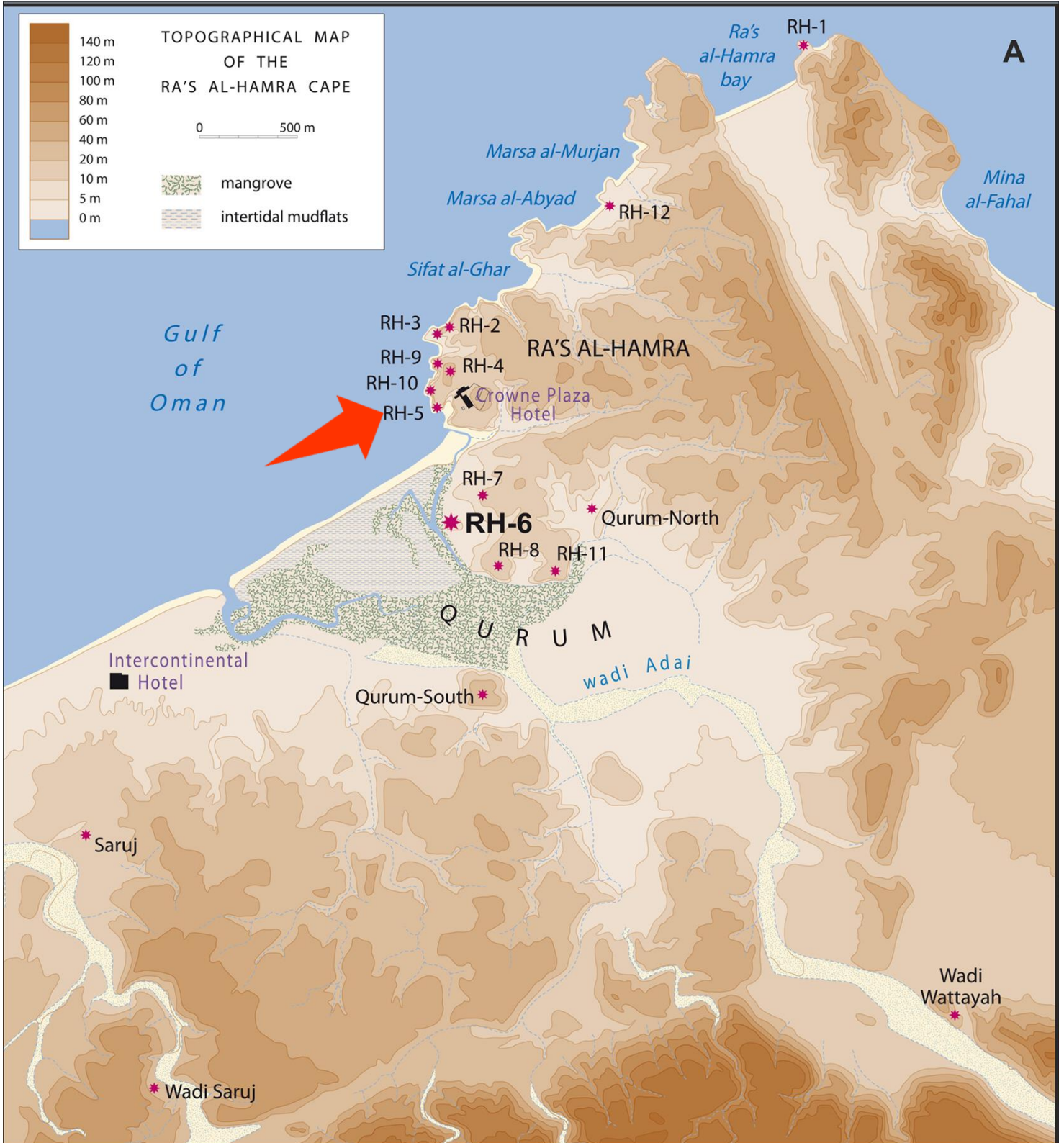
THE MOST REMARKABLE ARCHAEOLOGICAL SITE WHERE MARINE TURTLE BONES WERE ASSOCIATED WITH HUMAN BURIALS

RA'S AL HAMRA "RH-5"

COAST OF OMAN

NEOLTHIC:
ca. 7,000-5,000 BP


As-Sabiyah
Persian Gulf
Umm al-Quwain
Akab
Kalba
Dalma
Umm an-Nar
Jebel Buhais
ABU DHABI
Gulf of Oman
Daymaniyat Islands
Ra's al-Hamra
Ra's al-Hadd
Ra's al-Jinz
Ra's al-Khabbah
As-Suwayh
Masirah Island
Gulf of Masirah
6000 m
5000 m
4000 m
3000 m
2000 m
1500 m
1000 m
500 m
200 m
Neolithic site
Early Bronze Age site


TOPOGRAPHICAL MAP
OF THE
RA'S AL-HAMRA CAPE
140 m
120 m
100 m
80 m
60 m
40 m
20 m
10 m
5 m
0 m
0
500 m
mangrove
intertidal mudflats
A
Ra's
al-Hamra
bay
RH-1
Marsa al-Murjan
Marsa al-Abyad
RH-12
Mina
al-Fahal
Sifat al-Ghar
Gulf
of
Oman
RH-3
RH-2
RH-9
RH-4
RH-10
RH-5
RA'S AL-HAMRA
Crowne Plaza
Hotel
RH-7
RH-6
Qurum-North
RH-8
RH-11
QURUM
wadi Adai
Intercontinental
Hotel
Qurum-South
Saruj
Wadi
Wattayah
Wadi Saruj

Ra's al-Hamra-RH5, 148 graves studied:

- ≥54% graves had remains of marine turtles inside grave or in grave covering
- ≥13% graves had ≥1 turtle cranium in contact with the human skeleton

Munoz 2014

Grave 31, RH-5 Ra's al-Hamra, Oman, ~ 5500 BP
Cranium of *Chelonia mydas* beside human cranium ,
Salvatori 2007: 27

Grave N° 411 remains of marine turtles include

- 8 complete crania

Delfino 2009

Grave N° 411 RH-5; Munoz 2014

Grave N° 410

marine turtle remains include:

- 29 crania,
- 35 mandibles,
- 30 hyoid fragments,

Delfino 2009

Grave N° 410 RH-5; Munoz 2014

Interpretation of grave 411, RH-5; Munoz 2014

MARINE TURTLES HAVE INSPIRED MANY PEOPLE FROM MANY SOCIETIES

FROM MANY PLACES

AT MANY TIMES

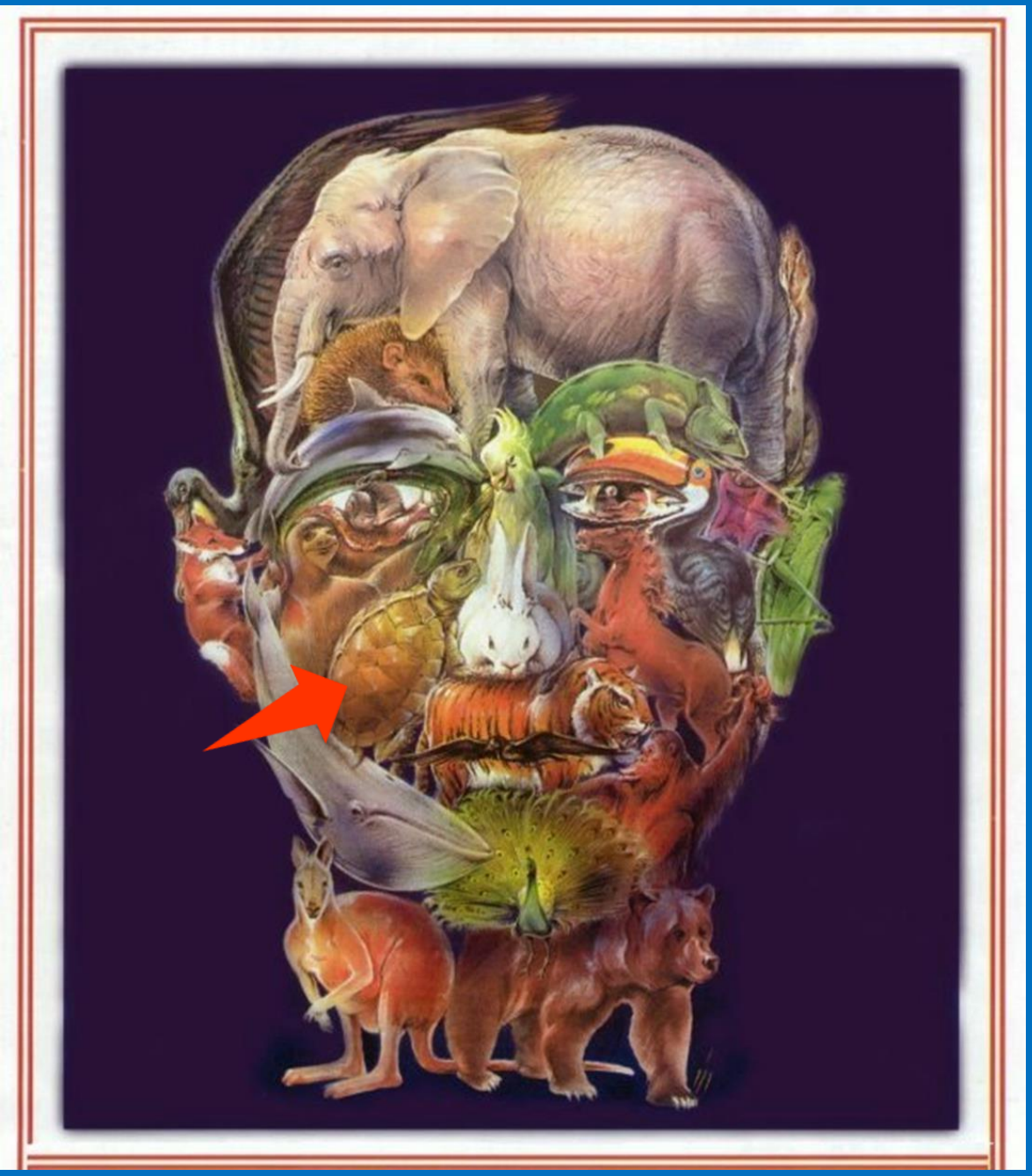
IN MANY WAYS

FISHERMEN STRAIN TO RELEASE LEATHERBACK ALIVE

SACRED RED CLOTH TIED TO THE NECK


COMUNIDAD ECOLOGICA PESQUERA
EL ÑURO
CASETA DE BOMBEO
HUIZAGA
NO TOCAR
LAS TORTUGAS
DON'T TOUCH THE TURTLES

SOME CLOSING THOUGHTS



ARE HUMANS PART OF,

OR APART FROM,

"NATURE"?

WHAT WE STUDY AND CONSERVE IS A ***LEGACY OF THE PAST***

UNDERSTANDING PAST, AND PRESENT, INTERACTIONS BETWEEN HUMAN SOCIETIES AND MARINE TURTLES IS ESSENCTIAL FOR UNDERSTANDING AND EXPLORING THESE QUESTIONS

WHAT WE STUDY AND CONSERVE IS A ***LEGACY OF THE PAST***

I DO NOT WANT TO BORE YOU,


2005 2 1

BUT I MUST ASK A FEW SIMPLE QUESTIONS

MY MOTIVATION IS TO TRY TO CONSERVE MARINE TURTLES AND THEIR HABITATS IN THE MOST EFFICIENT WAY

WE MUST UNDERSTAND TURTLES AND PEOPLE TOGETHER

HOW HARD ARE WE REALLY TRYING TO UNDERSTAND - AND THEN SOLVE - MARINE TURTLE CONSERVATION PROBLEMS?

WHERE DO WE OBTAIN OUR INFORMATION?

DO WE READ THESE KINDS OF JOURNALS:

- *Journal of Applied & Environmental Microbiology*
- *Journal of Hazardous Materials*
- *Frontiers in Psychology*
- *Environmental Education Research*
- *Water*
- *Education Sciences*
- *Science Education*
- *Journal of Research in Science Teaching*
- *Australian Journal of Environmental Education*

WHAT ABOUT THESE

- *Environmental Science*
- *Annual Review of Resource Economics*
- *Society & Animals*
- *Research in Science Education*
- *Restoration Ecology*
- *Studies in Educational Evaluation*
- *International Journal of Learning and Teaching*
- *Eurasia Journal of Mathematics, Science & Technology Education*
- *Conservation Science and Practice*
- *Natural Sciences Education*

DO WE READ THESE KINDS OF PUBLICATIONS:

- *Viewpoints about Educational Language Policies*
- *Engaging with Contemporary Challenges through Science Education Research*
- *Classifying Educational Programmes*
- *A review of Research on Outdoor Learning*
- *Assessment of Higher Education Learning Outcomes*

IF WE READ SOME OF THOSE, WE'D LEARN ABOUT MICROPLASTICS, A MAJOR CONCERN FOR TURTLES

- **Biodegradation of Synthetic and Natural Plastic by Microorganisms**
- **Microplastic degradation as a sustainable concurrent approach for producing biofuel and obliterating hazardous environmental effects**
- **Plastic pollution challenges in marine and coastal environments: from local to global governance**

AND MORE MICROPLASTICS:

- **Creating an Interactive Environment for Learning Microplastics VIA a Board Game at the Museum**
- **Public Health Knowledge and Perception of Microplastics Pollution: Lessons from the Lagos**
- **Lagoon Public awareness, knowledge, attitude and perception on microplastics pollution around Lagos Lagoon**

IF WE READ FROM THOSE, JOURNALS WE ALSO WOULD LEARN ABOUT:

- **Informal Earth Education: Significant Shifts for Environmental Attitude and Knowledge**
- **Education for strategic environmental behavior**
- **The perceived effect of environmental and sustainability education on environmental literacy of Czech teenagers**
- **Measuring Students' School Motivation**
- **Longitudinal Impact of an Inquiry-Based Science Program on Middle School Students' Attitudes**

AND THESE:

- **Co-Constructing Inquiry-Based Science withTeachers: Essential Research for Lasting Reform**
- **Improving the Evaluation of Conservation programs**
- **An Instrument for Measuring Environmental Attitudes in Middle Childhood**
- **Spillovers from Conservation Programs**
- **Practical Work at School Reduces Disgust and Fear of Unpopular Animals**
- **Research on outdoor learning**

AND ALSO THESE:

- **The relevance of school self-concept and creativity for CLIL outreach learning**
- **The Effect of Environmental Values on German Primary School Students' Knowledge on Water Supply**
- **Testing Creativity and Personality to Explore Creative Potentials in the Science Classroom**
- **Assessment of Higher Education Learning Outcomes**
- **Cognitive and emotional evaluation of an Amphibian conservation program for elementary School students**

AND THESE ALSO:

- **Effectiveness of a marine conservation education program in Okayama, Japan**
- **Integrating Authentic Scientific Research in a Conservation Course–Based Undergraduate Research Experience**

BUT THERE IS NO MENTION OF TURTLES!

WHAT IS THE USE OF ALL THAT?

TURTLE CONSERVATIONISTS MUST WORK WITH EDUCATORS, TO LEARN HOW EDUCATION PROGRAMS CAN BE MORE EFFECTIVE

THE SAME GOES FOR ANTHROPOLOGISTS, ARCHAEOLOGISTS, ECONOMISTS, ETHNOLOGISTS, GEOGRAPHERS, HISTORIANS,

SOCIOLOGISTS,& MORE

UNDERSTANDING MARINE TURTLES IS FAR MORE THAN UNDERSTANDING CLUTCH SIZE, HATCHLING SURVIVAL, TAG RETURNS AND MIGRATION, POPULATION SIZE, GENETIC STOCK, EVOLUTIONARY HISTORY, PREDATION RATES…

WE MUST UNDERSTAND HOW HUMANS AND TURTLES INTERACT,

IN DIFFERENT WAYS,

AT DIFFERENT PLACES,

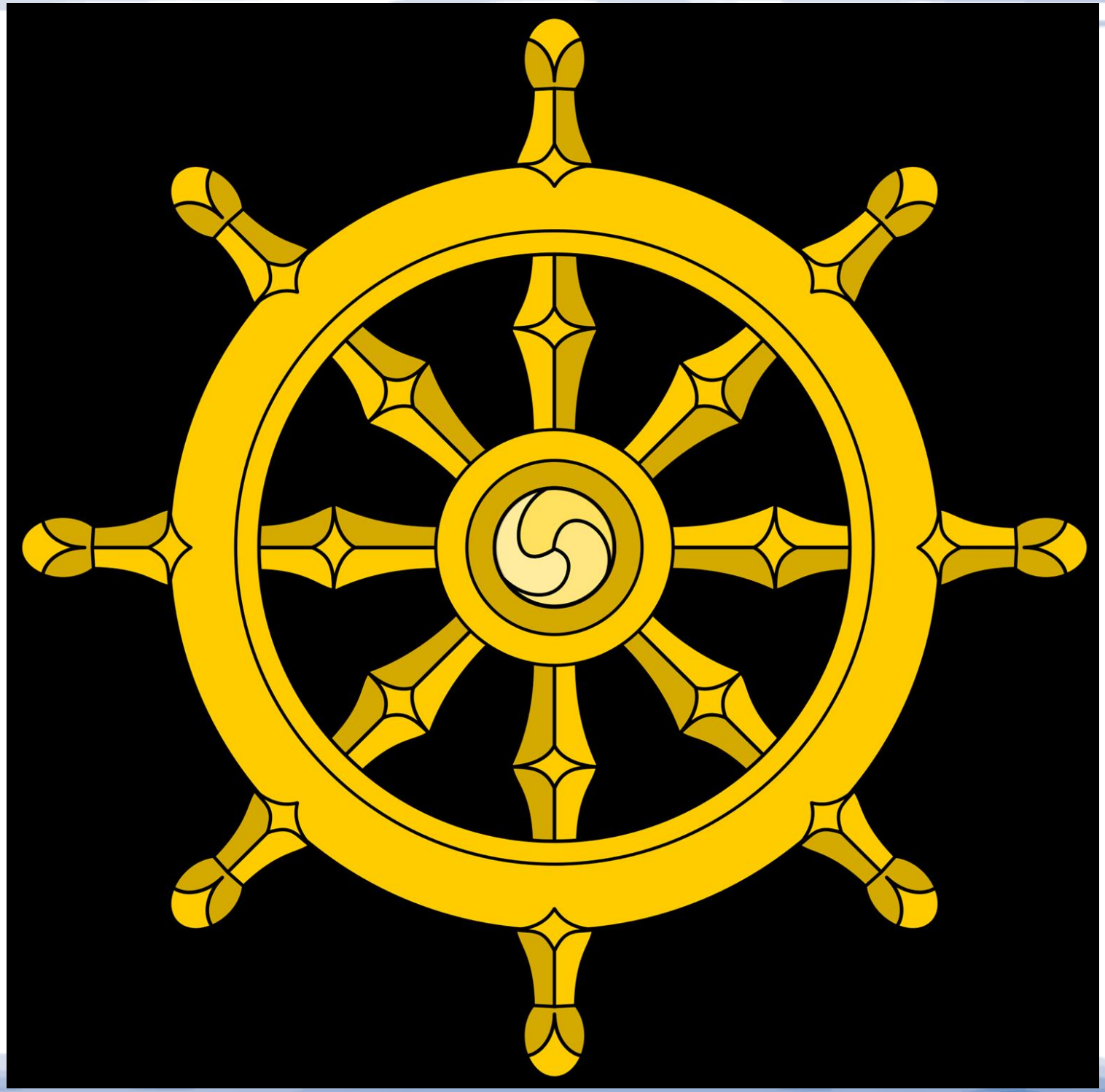
AT DIFFERENT TIMES,

FOR DIFFERENT REASONS

AND TO UNDERSTAND THOSE INTERACTIONS WE MUST UNDERSTAND HUMANS:

HOW, WHEN, WHERE, WHY THEY DO CERTAIN THINGS –

WE MUST COLLABORATE WITH PEOPLE WHOSE STUDY ANIMAL IS *HOMO SAPIENS*



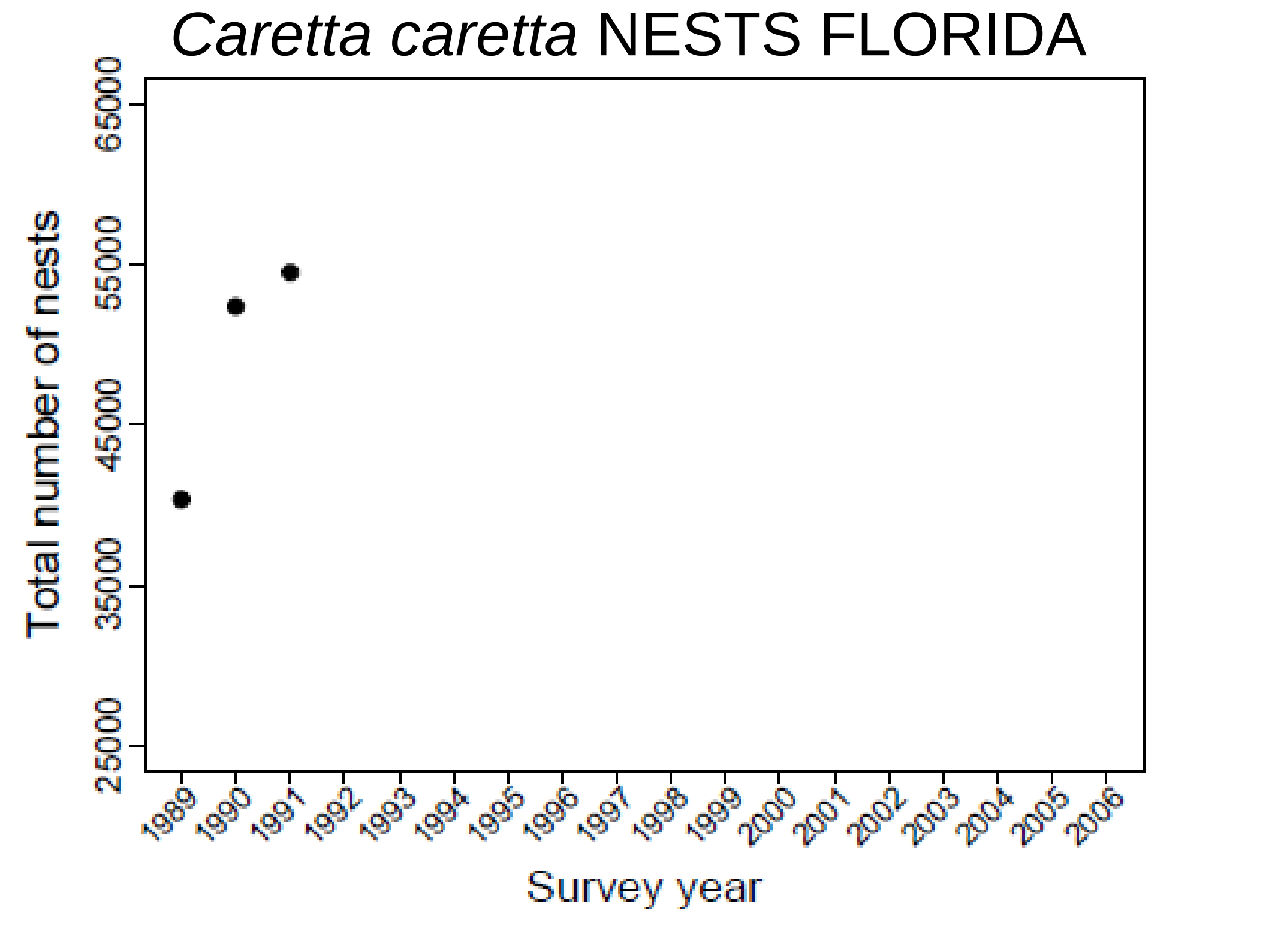
XTRA IDEA IF USEFUL

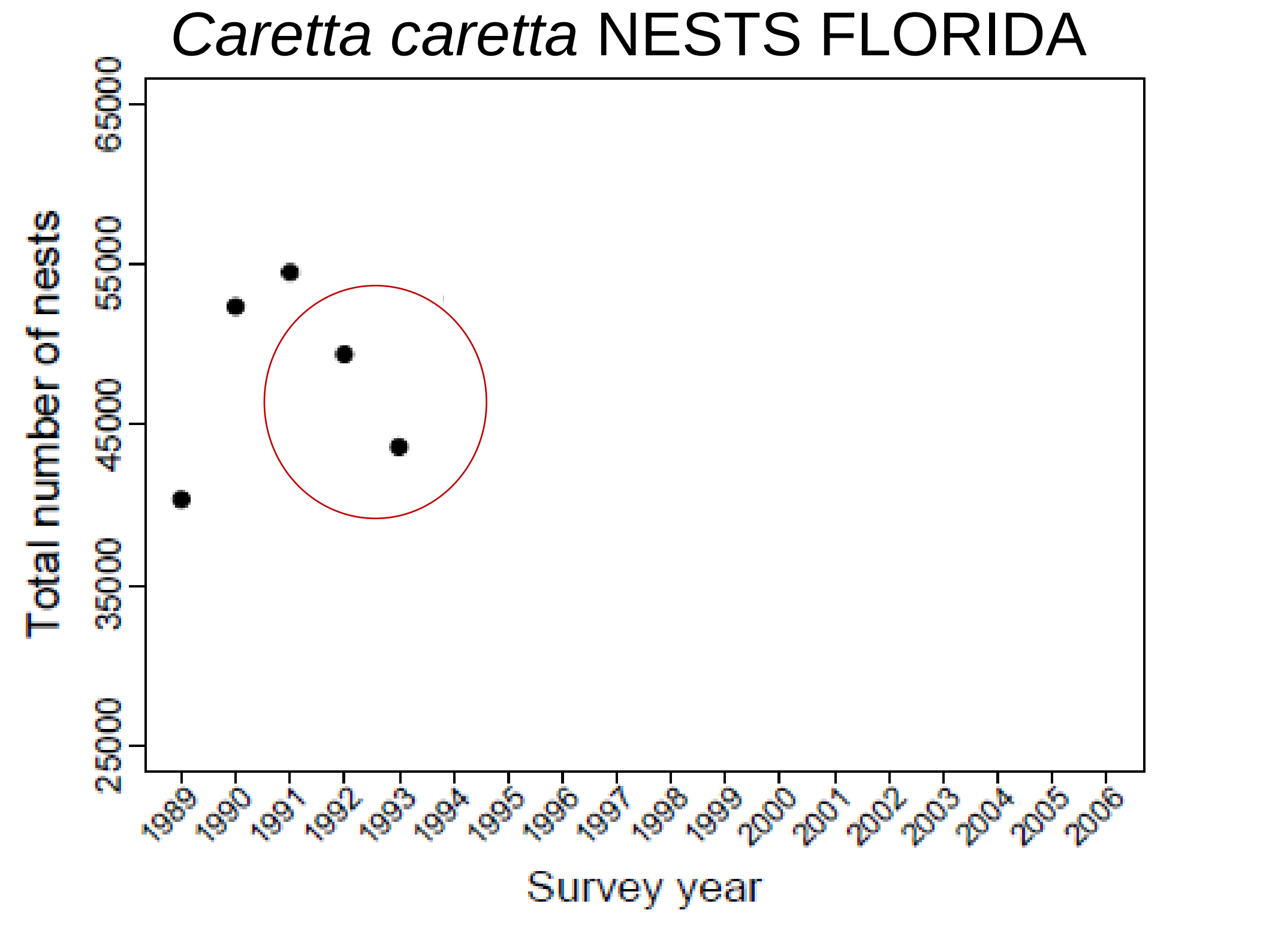
IN MARINE TURTLE CONSERVATION MUCH IS DISCUSSED ABOUT BASELINES

A THOUGHT ON THE "*SHIFTING BASELINE SYNDROME*"

ALL BASELINES SHIFT

AN EXAMPLE: THE SAME TURTLE POPULATION SEEN AT DIFFERENT TIMES


Caretta caretta NESTS FLORIDA
Total number of nests
25000
35000
45000
55000
65000
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Survey year


Caretta caretta NESTS FLORIDA
Total number of nests
25000
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45000
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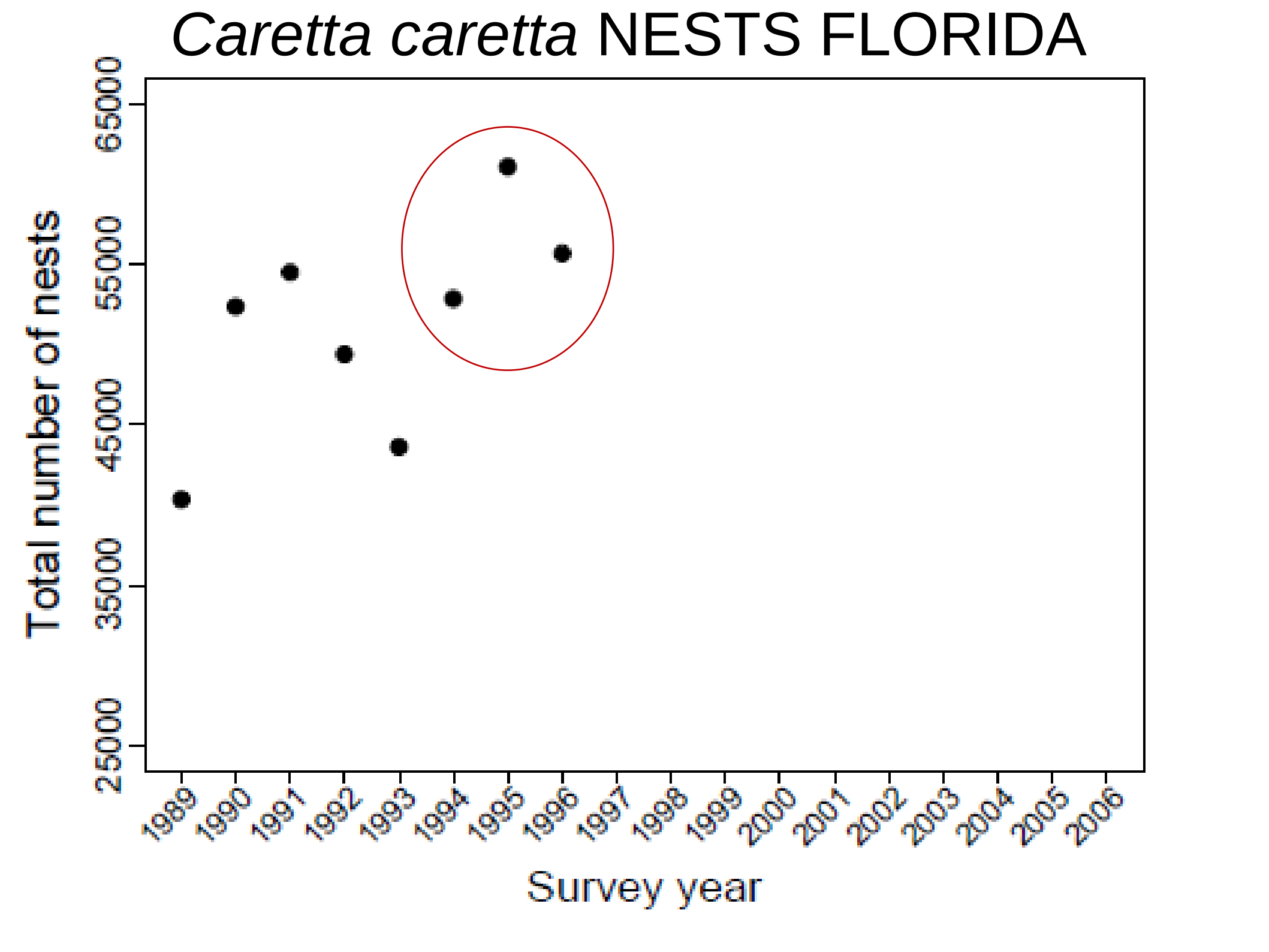
65000
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Survey year


Caretta caretta NESTS FLORIDA
Total number of nests
25000
35000
45000
55000
65000
1989
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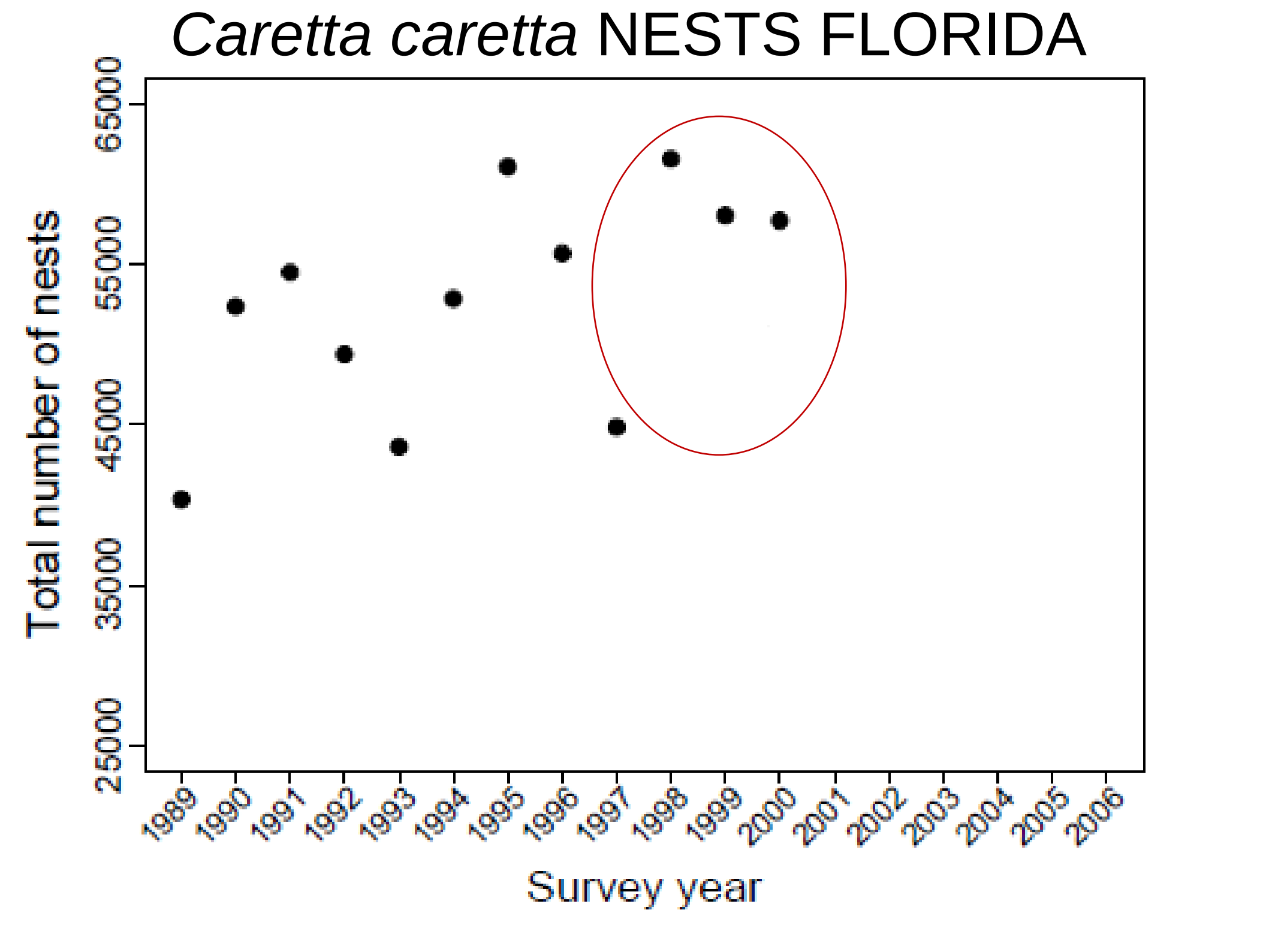
2006
Survey year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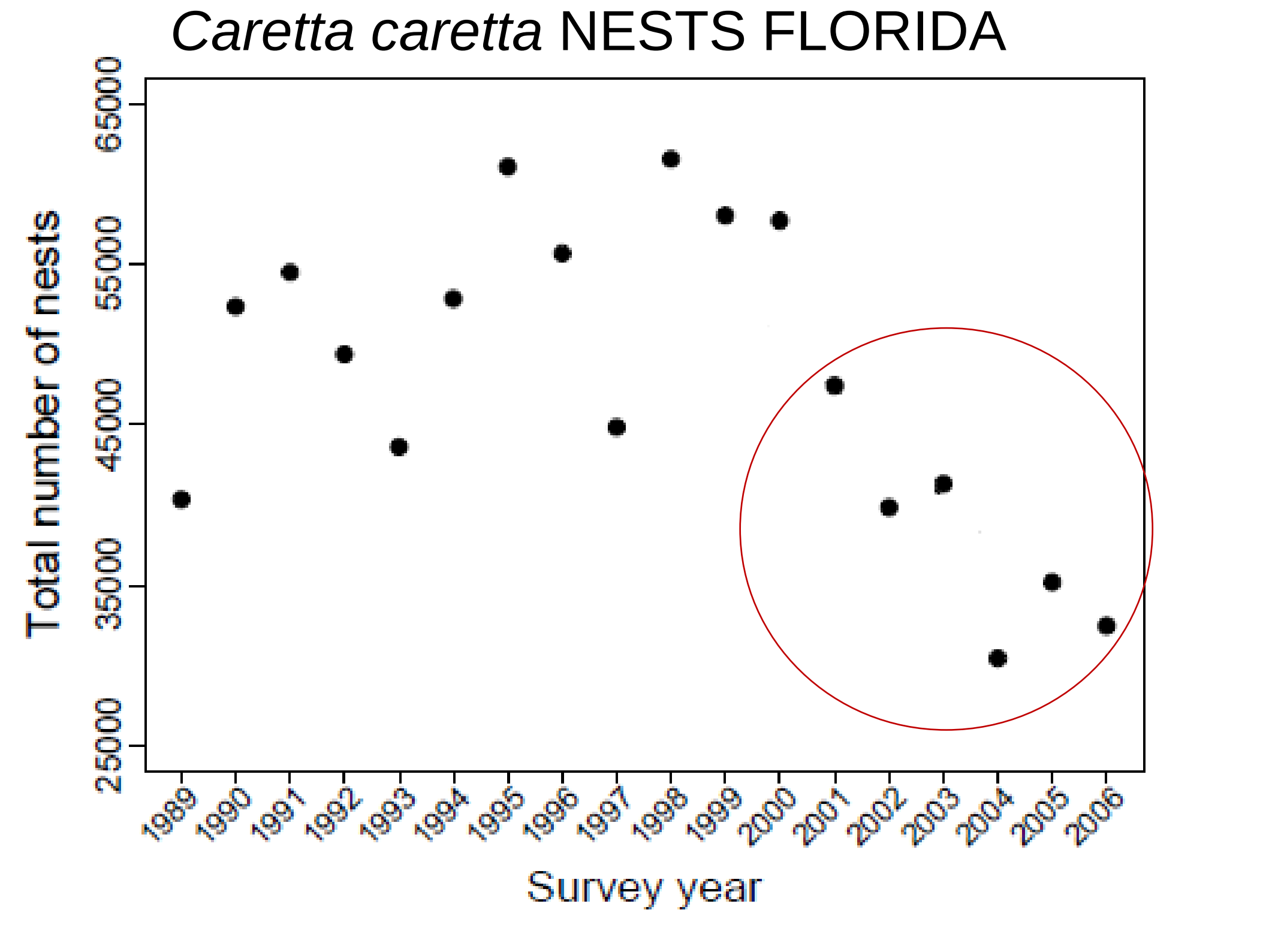
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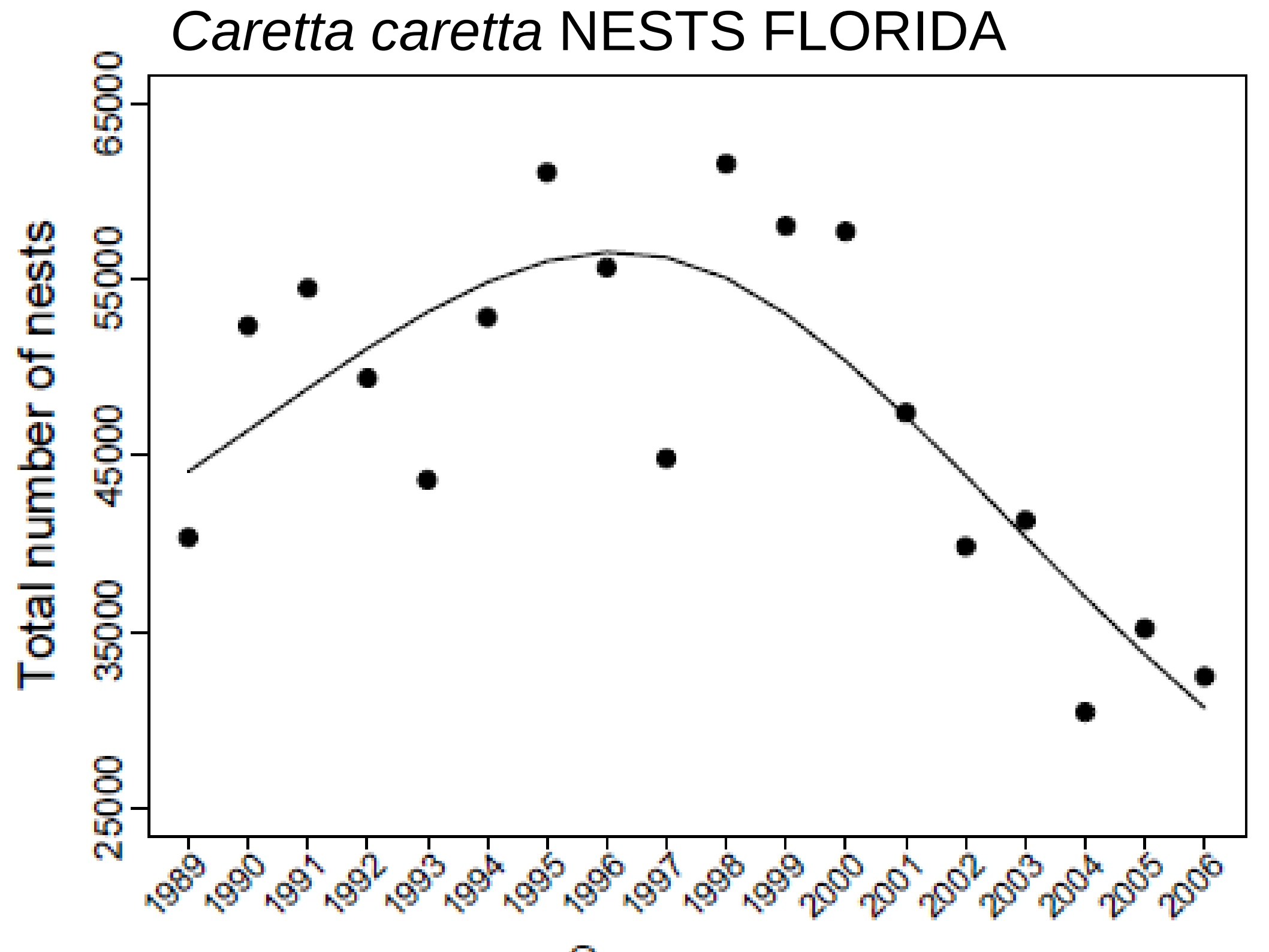
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2005
2006

WHERE IS THE BASELINE AT EACH OF THESE TIMES?

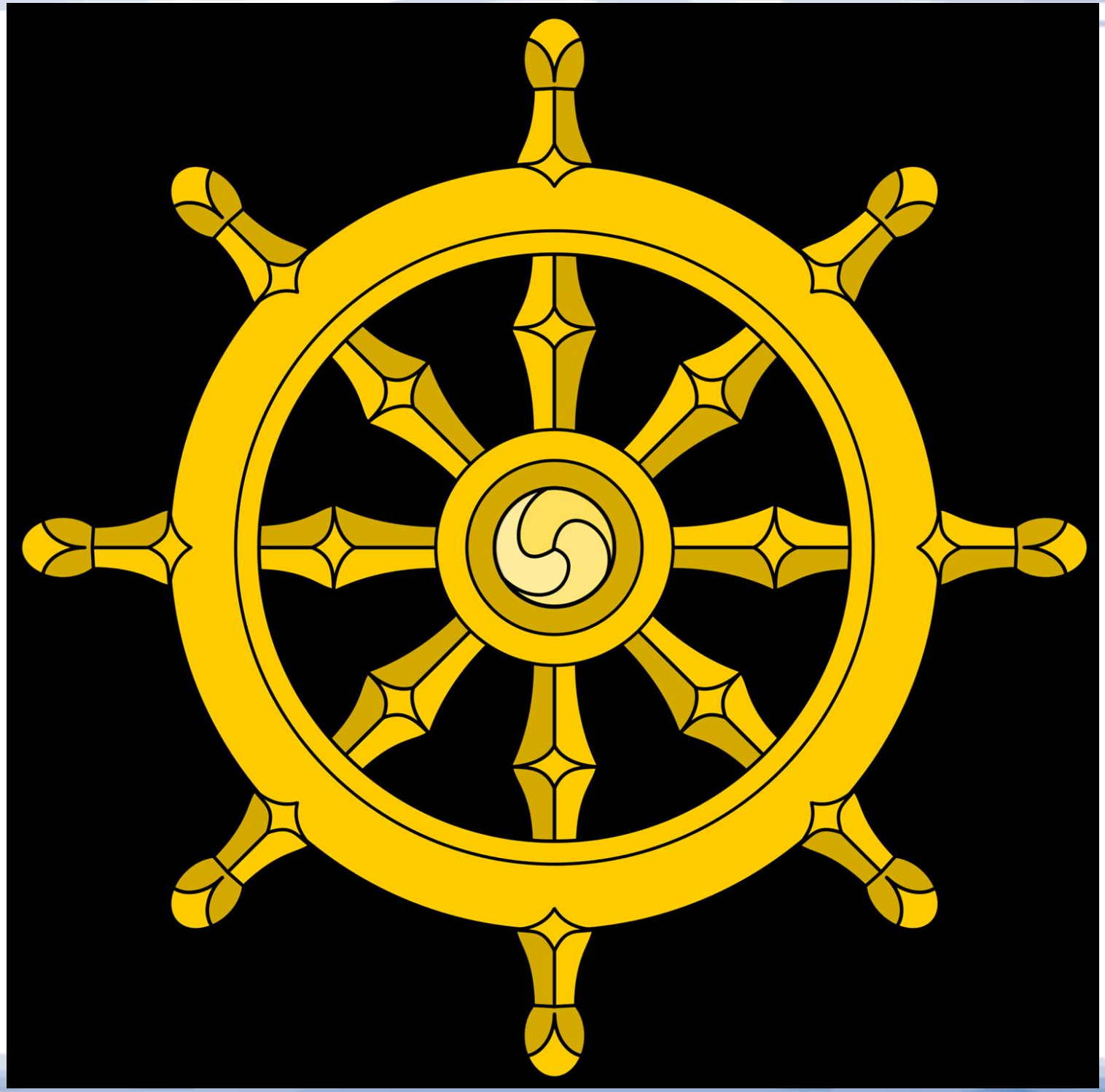
THERE IS NO "ORIGINAL" STATE OF "NATURE"

JACK BROUGHTON

(photo Jim Reed, Guardian)

Eyjafjallajokull (photo Ragnar Th Sigurdsson, Guardian)

Eyjafjallajokull (photo Ragnar Th Sigurdsson, Guardian)



XTRA IDEA IF USEFUL

JOB ANNOUNCEMENT ON CTURTLE EDUCATION COORDINATOR

"Responsibilities for this full-time position include curriculum development, developing partnerships with schools, and teaching programs for **students of all ages**. Minimum 2 years experience with informal education and 1 year experience with formal education required."

***Lhamo Thondup*, 14th Dalai Lama, *Tenzin Gyatso*, IS ONLY 87 YEARS OLD; HE WOULD BE AN EXCELLENT STUDENT**