The cultural lives of cetaceans

Part of Animal Cultures: Core Discoveries and New Horizons
(https://synergy.st-andrews.ac.uk/animalcultures-horizons/)

Photo courtesy J. Levenson

Luke Rendell @_lrendell

University of St Andrews

Centre for Social Learning and Cognitive Evolution

SMRU Sea Mammal Research Unit

BIOLOGY LETTERS

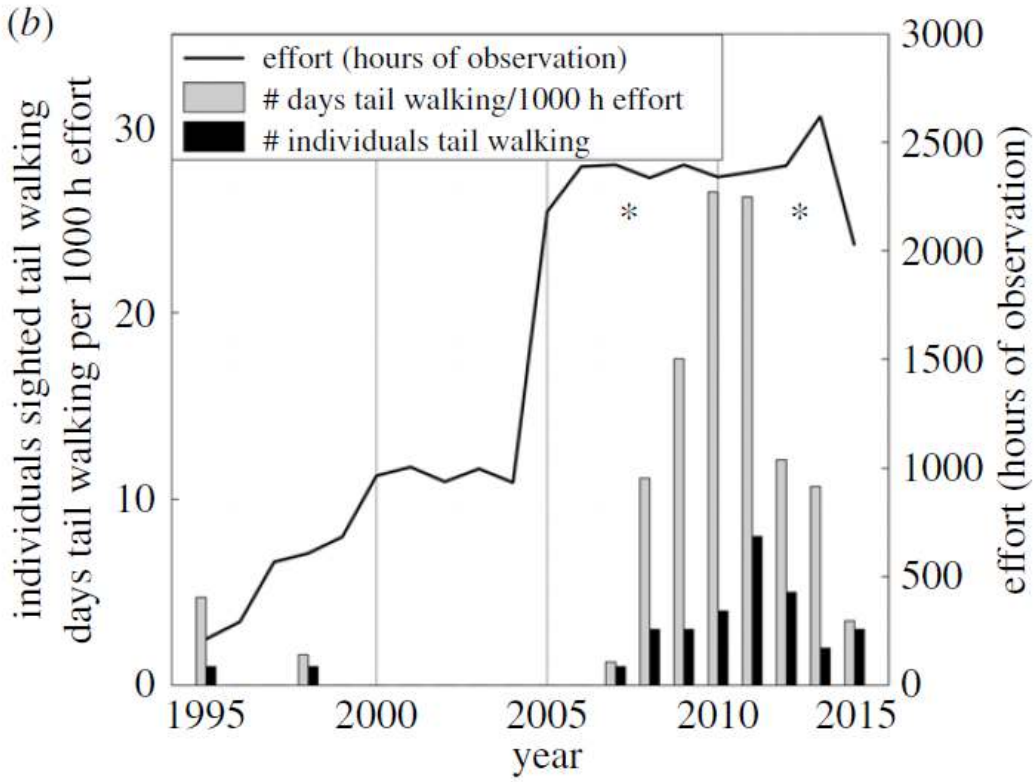
rsbl.royalsocietypublishing.org

Courtesy Mike Bossley

Animal behaviour

Tail walking in a bottlenose dolphin community: the rise and fall of an arbitrary cultural 'fad'

M. Bossley[1], A. Steiner[2], P. Brakes[1,3], J. Shrimpton[1], C. Foster[1] and L. Rendell[4]



ANIMAL BEHAVIOUR, 2006, 72, 1371–1378
doi:10.1016/j.anbehav.2006.03.014
Available online at www.sciencedirect.com
ScienceDirect

Synchrony, social behaviour and alliance affiliation in Indian Ocean bottlenose dolphins, *Tursiops aduncus*

RICHARD C. CONNOR*, RACHEL SMOLKER† & LARS BEJDER‡

Courtesy Richard Connor

ANIMAL BEHAVIOUR, 2006, 72, 1371–1378
doi:10.1016/j.anbehav.2006.03.014
Available online at www.sciencedirect.com
ScienceDirect

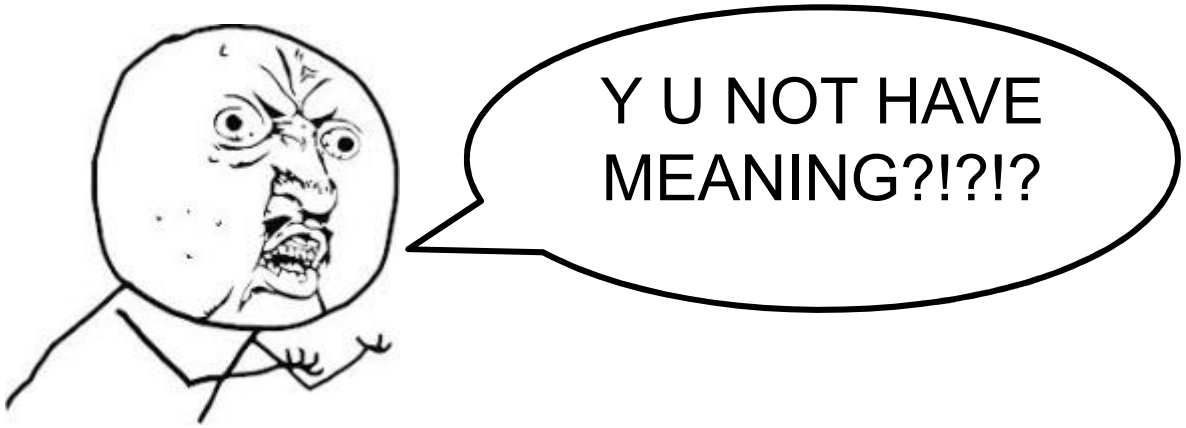
Synchrony, social behaviour and alliance affiliation in Indian Ocean bottlenose dolphins, *Tursiops aduncus*

RICHARD C. CONNOR*, RACHEL SMOLKER† & LARS BEJDER‡

Courtesy Richard Connor

Culture

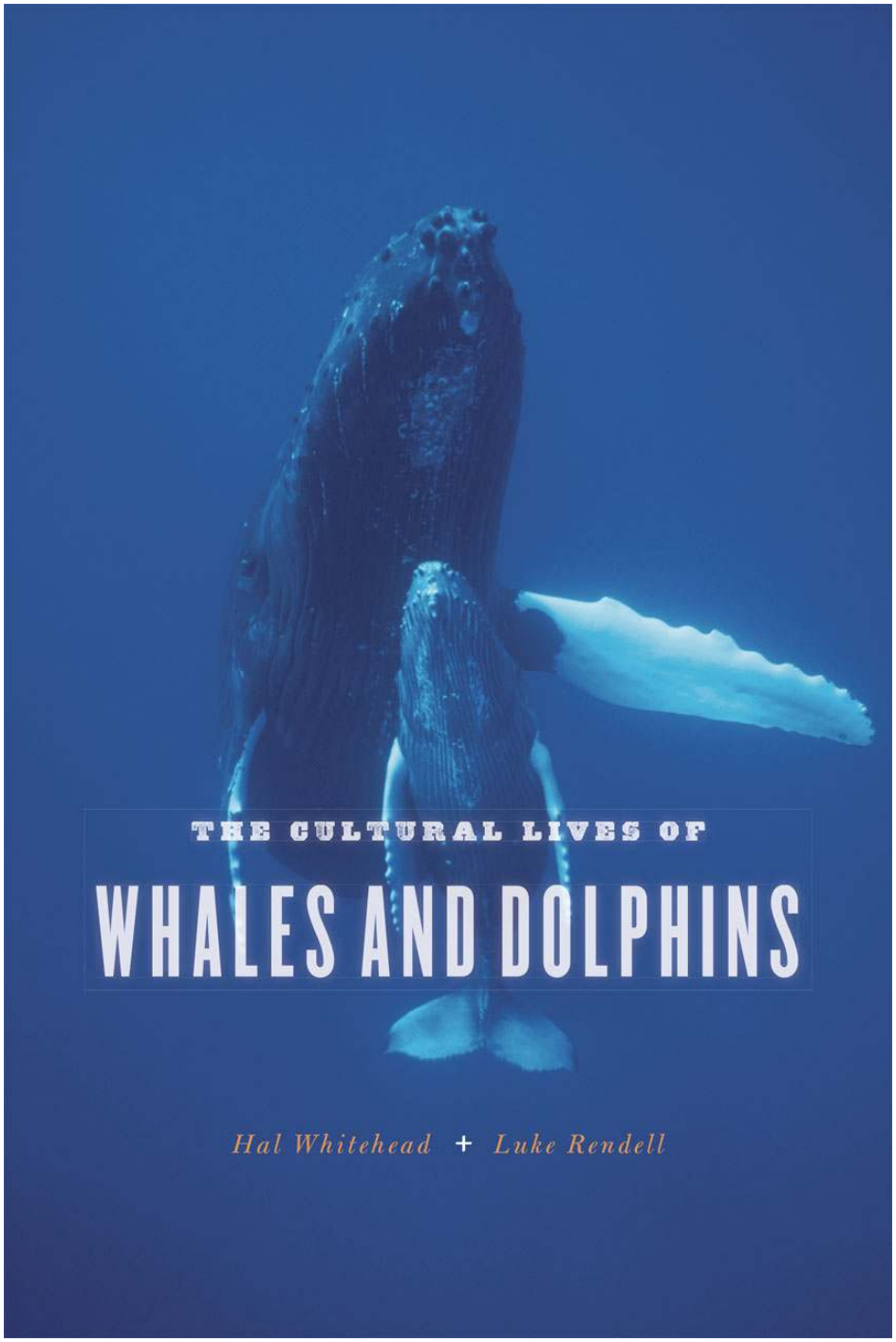
information or behavior – shared by a population or subpopulation – which is acquired from through some form of social learning



What we think:

In some species of whale and dolphin…

Culture is vital



Hal Whitehead

Ellen Garland

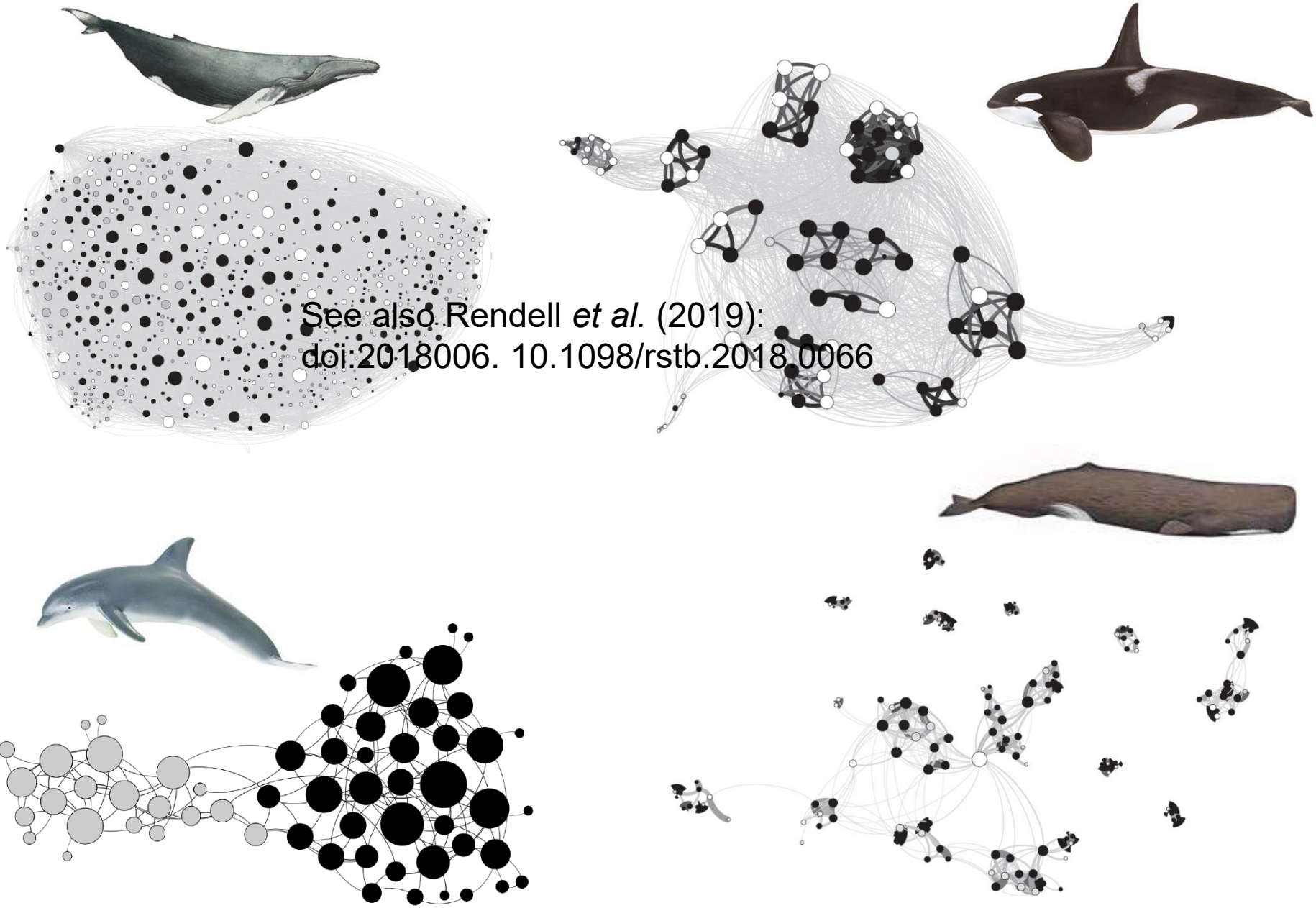
Shane Gero

Luca Lamoni

Mauricio Cantor

Jenny Allen

social structure – the shape of a community



See also Rendell *et al.* (2019): doi:2018006. 10.1098/rstb.2018.0066

Gero & Rendell (2015) in *Animal Social Networks;* Rendell *et al.* (2019): doi:2018006. 10.1098/rstb.2018.0066

OVERVIEW

- Small odontocetes: Foraging traditions and signature whistles

- Baleen whales: Humpback song and lobtail feeding

- Large odontocetes: Cultures in groups

Small odontocetes: Foraging traditions

- Huge diversity of foraging tactics in bottlenose dolphins:

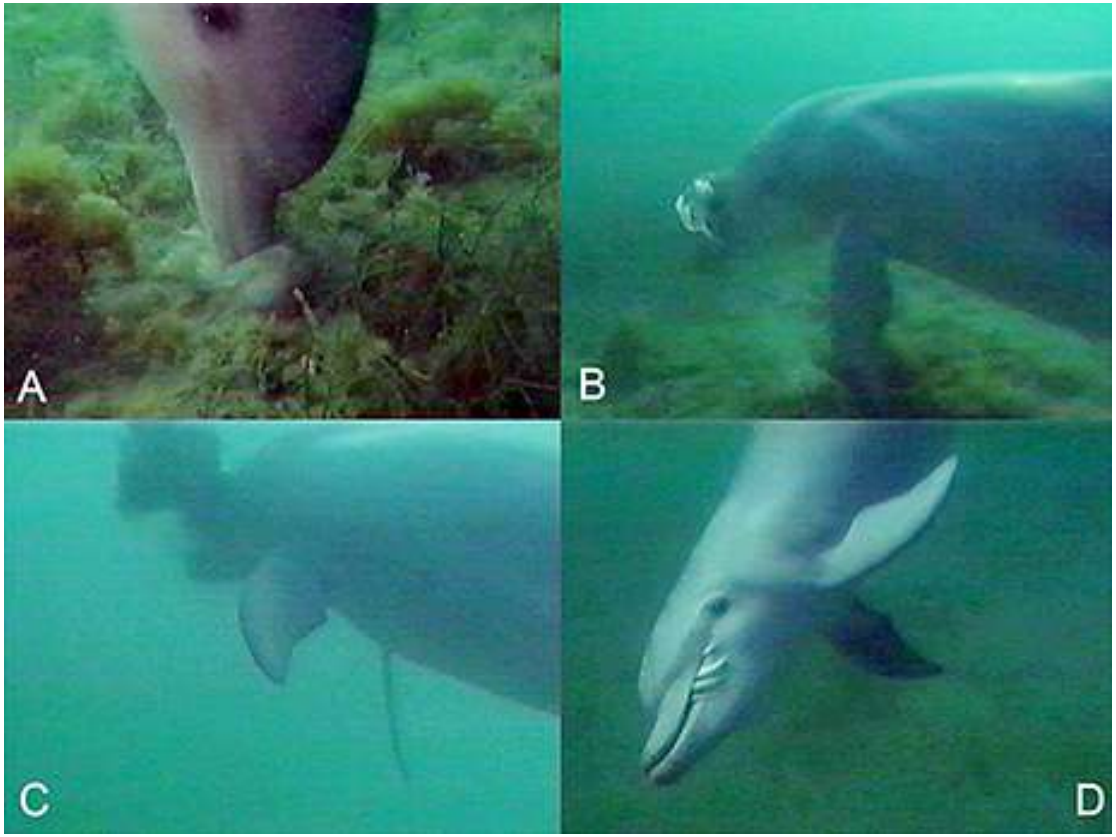
Beaching[1], 'kerplunking', mud-ring feeding[2], hydroplaning[3], herding, bottom-grubbing, sponging, cooperative fishing[4], cuttlefish processing

(1) http://www.youtube.com/watch?v=nyvDEerOV3E
(2) https://www.youtube.com/watch?v=bzfqPQm-ThU
(3) http://www.youtube.com/watch?v=j9fFkMyDsfY&feature=related
(4) http://www.youtube.com/watch?v=42MpfPqWkhk

B.L. Sargeant, J. Mann. "From social learning to culture: Intrapopulation variation in bottlenose dolphins." *The Question of Animal Culture,* edited by K.N. Laland, B.G. Galef Jr., 152-173. Harvard University Press, 2009.

Cuttlefish processing

(Finn et al. 2009 *PLoS ONE* 4(1))



Upper Spencer Gulf, Southern Australia

tail-walking (Port River)

Bossley et al 2018 *Biology Letters*

conch carrying (Shark Bay)

Allen et al 2010 *Marine Mammal Science*

synchrony in male alliances

Connor et al 2006 *Animal Behaviour*

See also Jaakkola et al 2018 *Proc Roy Soc B*

humpback lobtail feeding

Lobtail

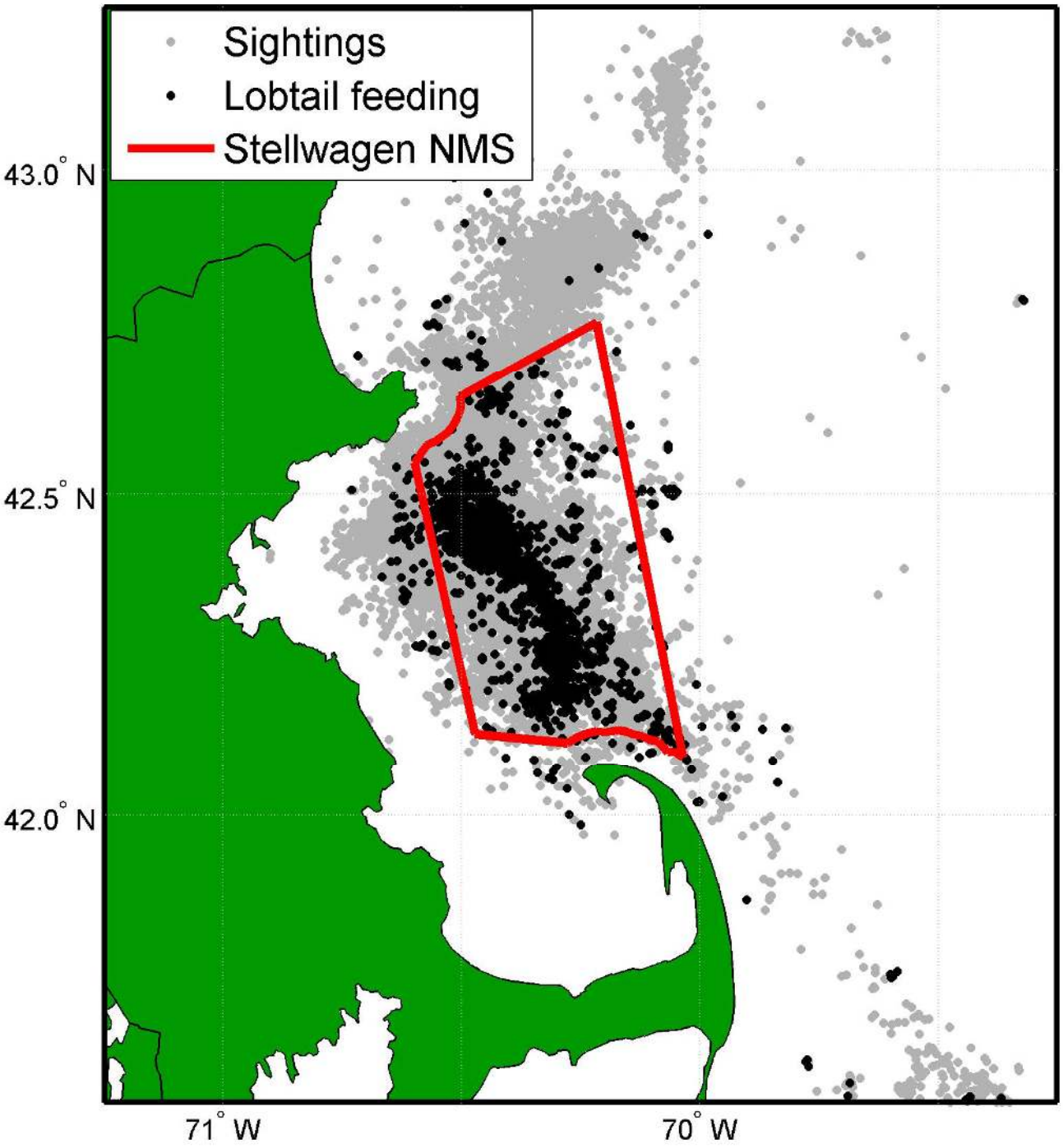
↓

Feeding bubbles

↓

Surface lunge

Allen *et al* (2013) *Science*


Sightings
Lobtail feeding
Stellwagen NMS
43.0° N
42.5° N
42.0° N
71° W
70° W

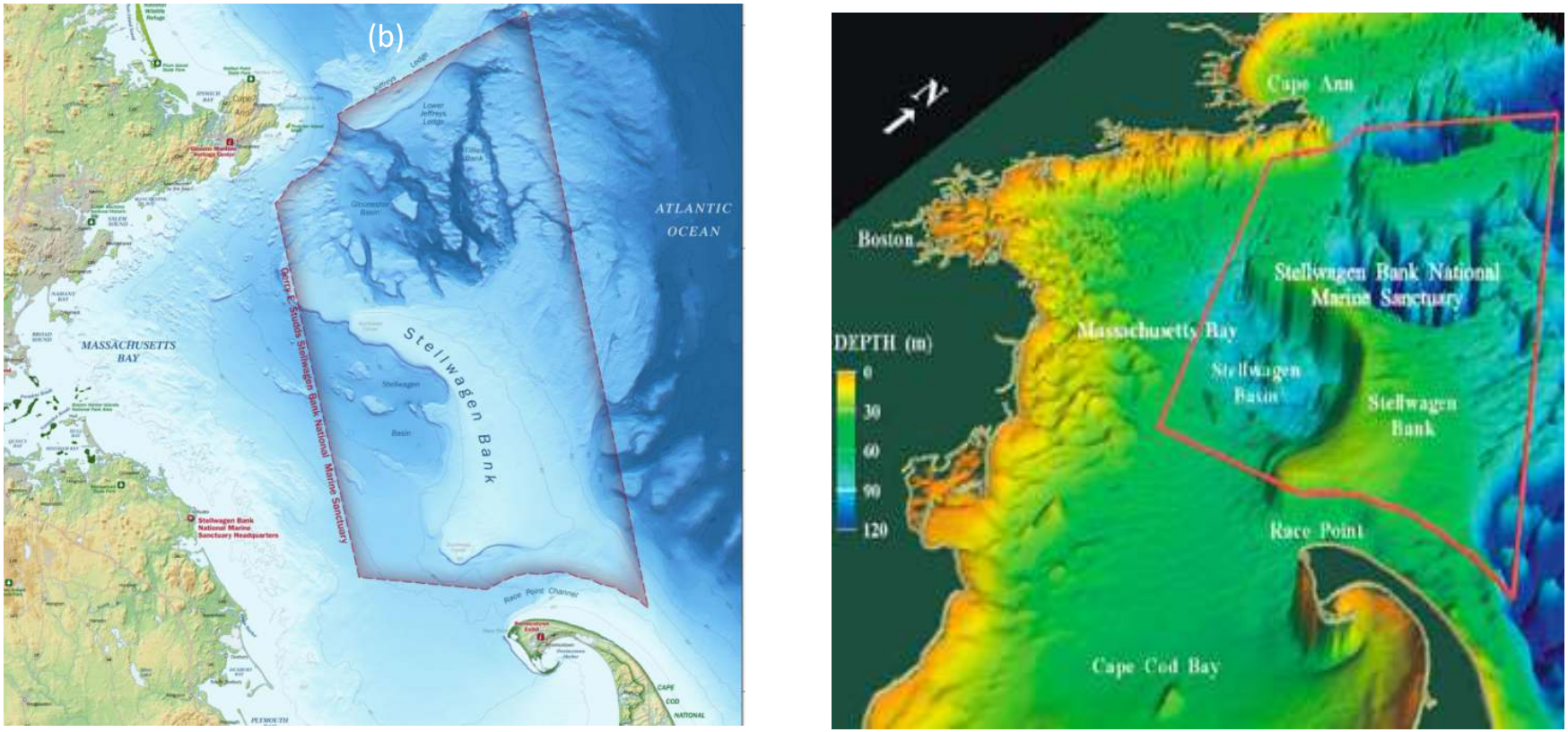
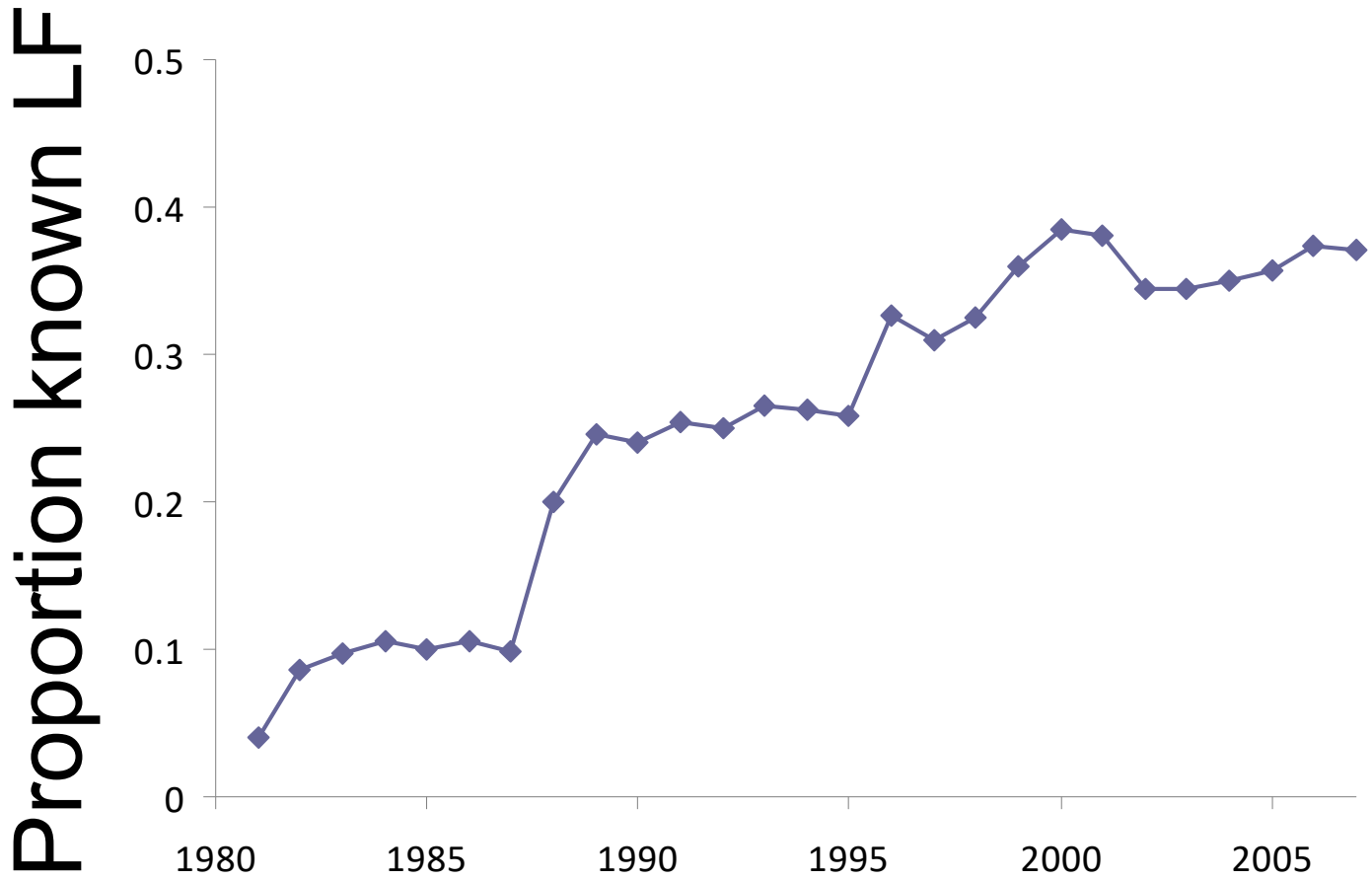


Figure 2: The study area (a) with the boundaries of the Stellwagen Bank National Marine Sanctuary (NOAA 2005) and (b) the bathymetry which makes it such an important feeding ground (NOAA 2006).

1980-2007: 73,790 sighting records of 653 individuals

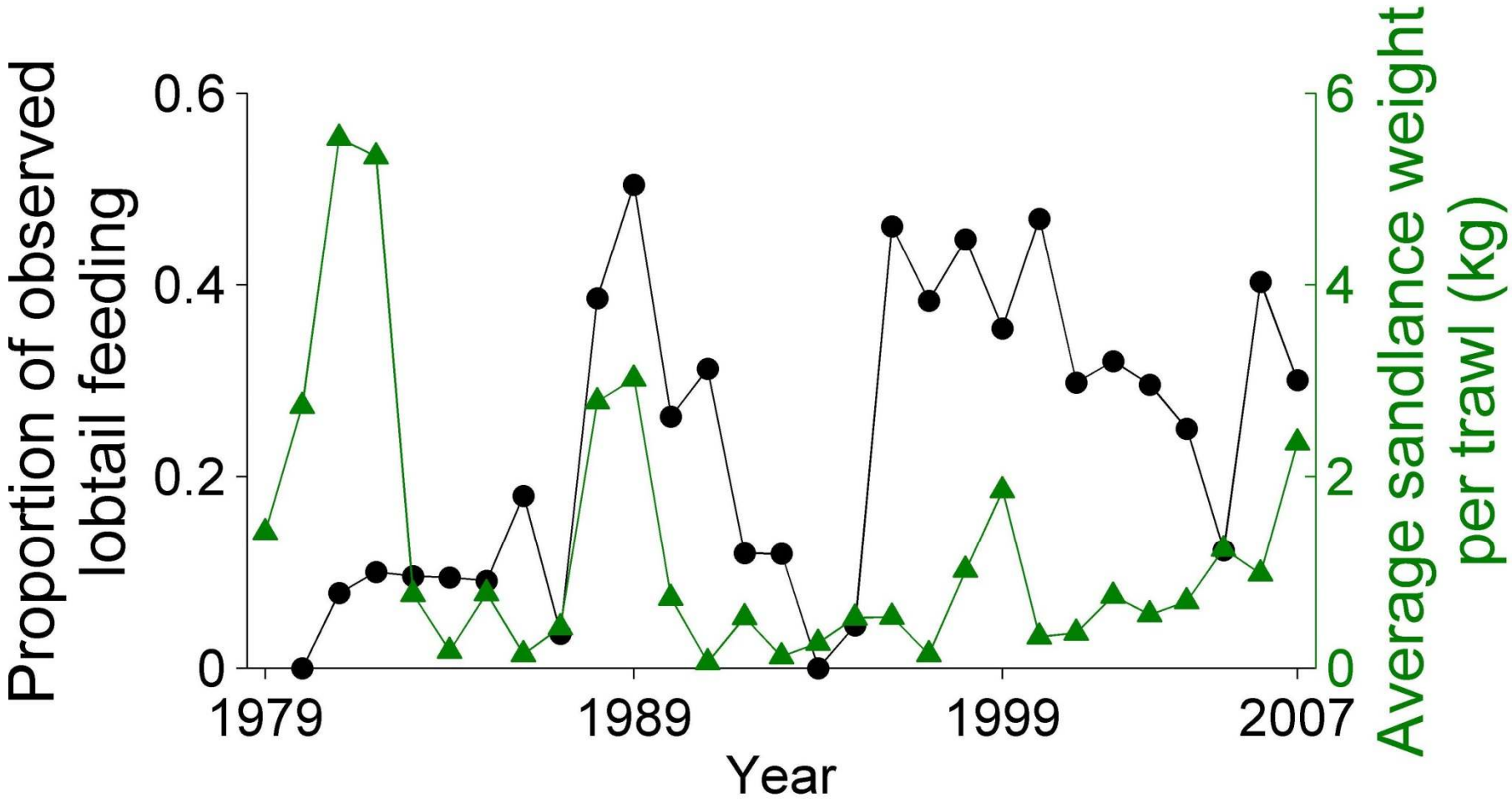



Mason Weinrich

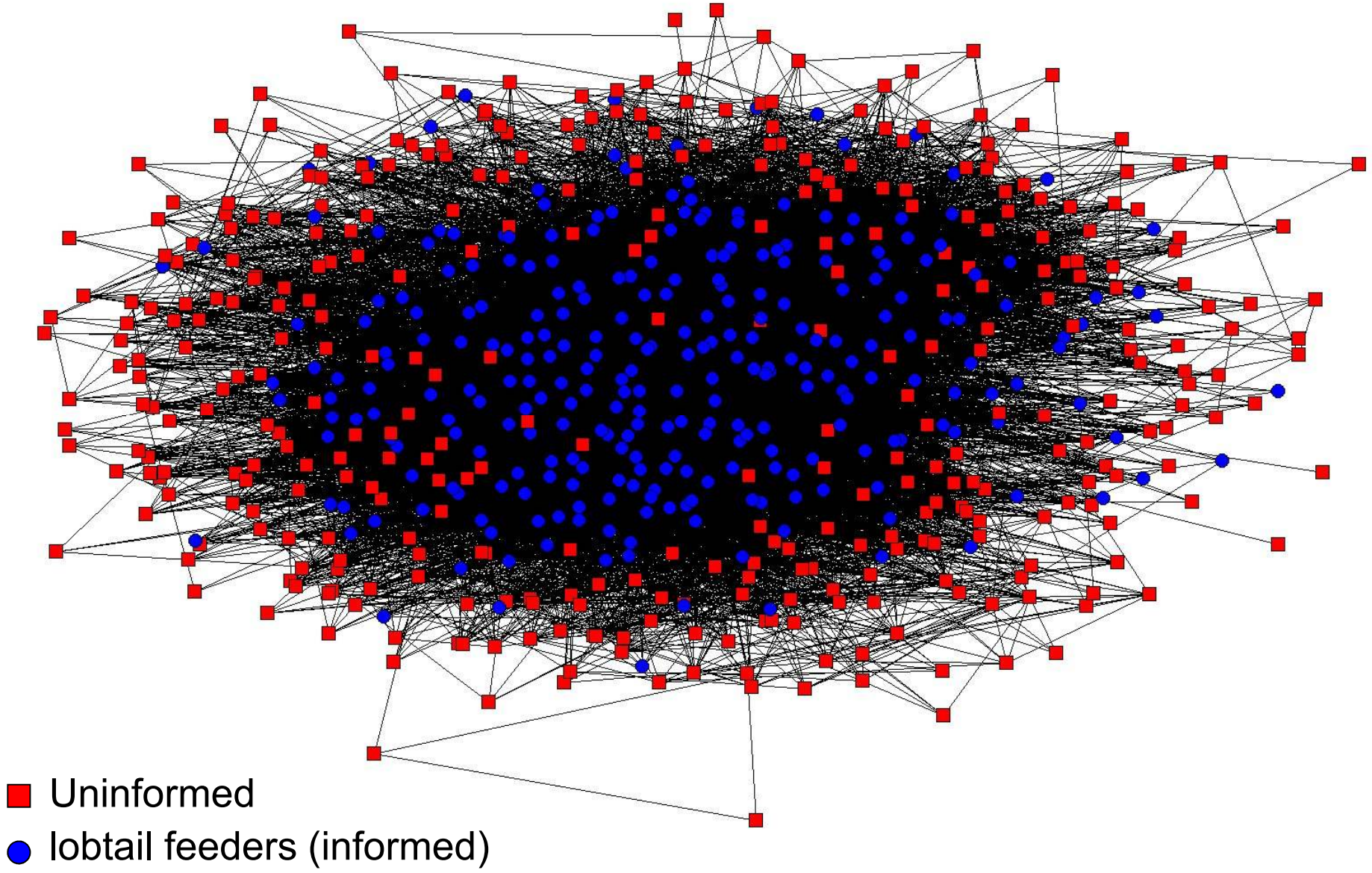

Will Hoppitt


Jenny Allen

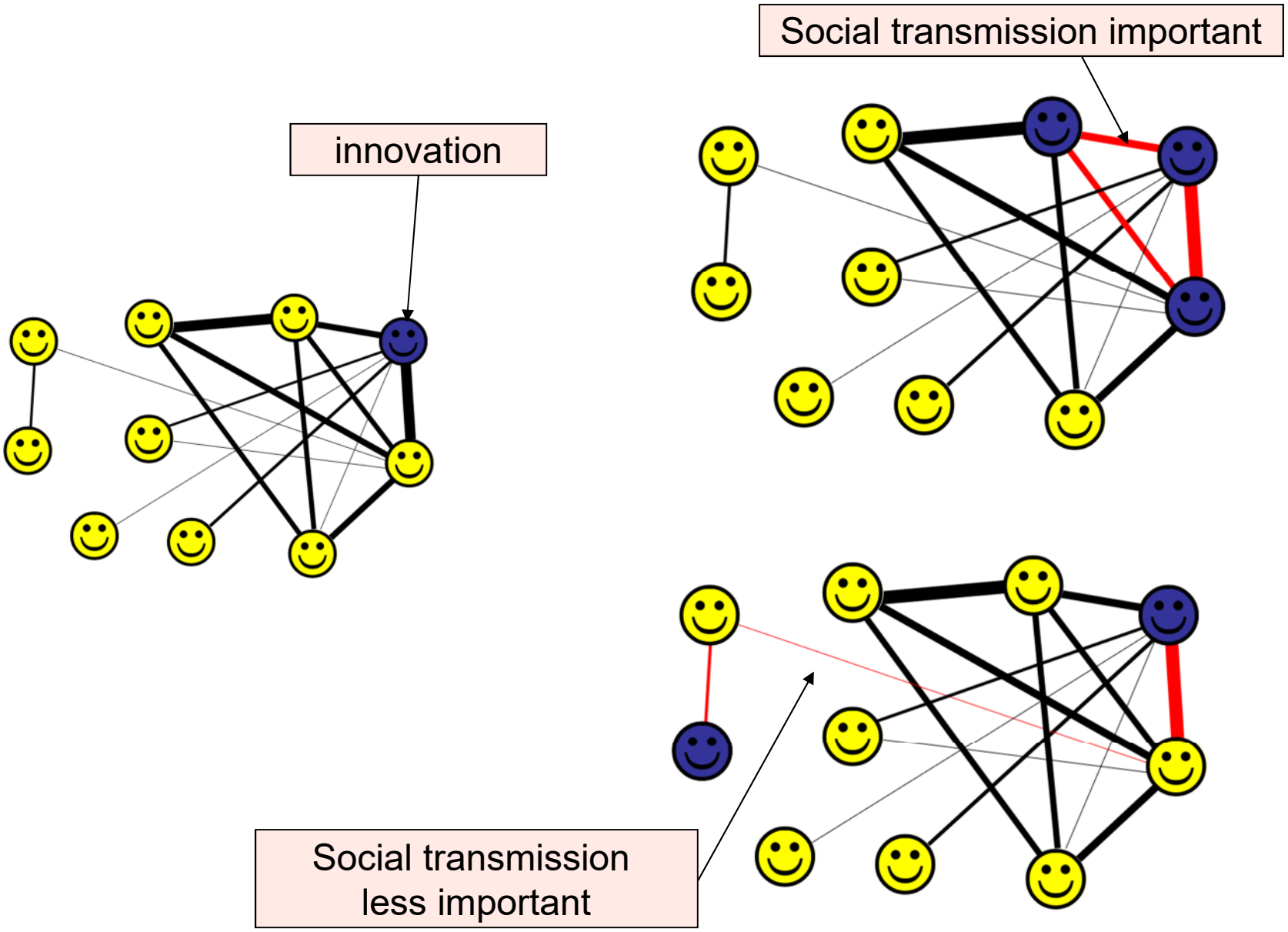
sand lance abundance (▲)
vs
frequency of lobtail feeding (●)



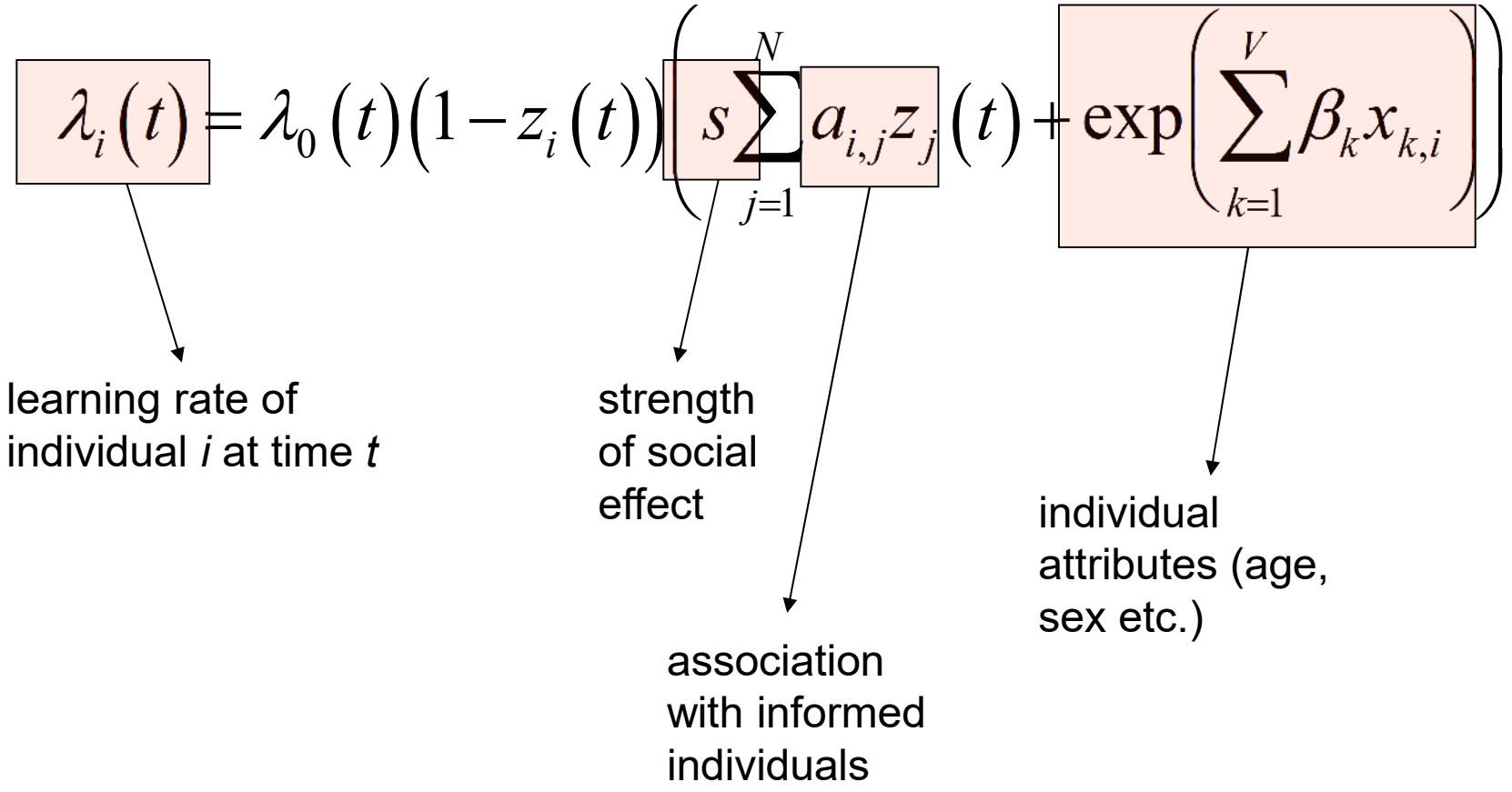
network-based diffusion analysis: humpback lobtail feeding



network-based diffusion analysis

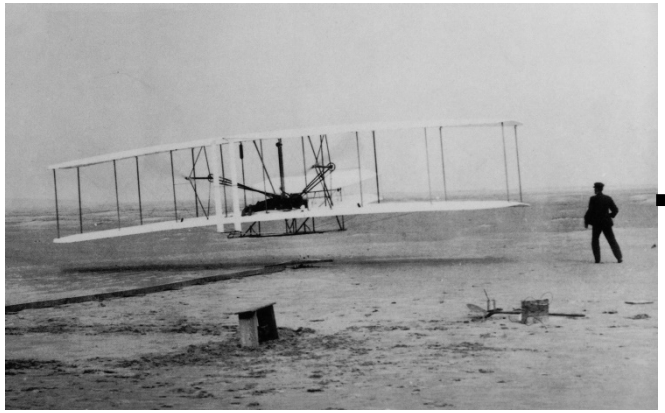


Order of acquisition analysis (OADA)



Analysis type	Social transmission model	$\sum \omega_i$	Social transmission parameter estimate	95% CI
Order of acquisition (OADA)	Multiplicative	0.84	30.9	[8.2 123.2]
	Additive	0.16	32.0	[11.3 96.6]
	No social transmission	1.8^{-23}	-	-
Time of acquisition (Discrete TADA)	Multiplicative	0.80	3.3	[0.9 6.8]
	Additive	0.20	2.6	[1.2 8.3]
	No social transmission	1.4^{-6}	-	-

models without social learning had no support




QANTAS
Spirit of Australia
A380

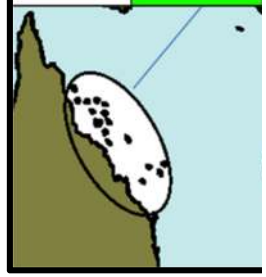

JUSTIN
BIEBER

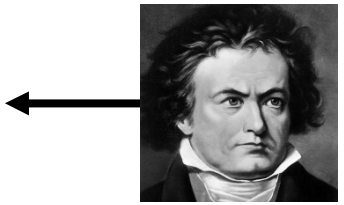
Ellen Garland

Mike Noad

Garland *et al* (2011)
Current Biology

Year	East Australia
1998	
1999	
2000	
2001	
2002	
2003	
2004	
2005	
2006	
2007	
2008	






Courtesy Flip Nicklin


3700


3701

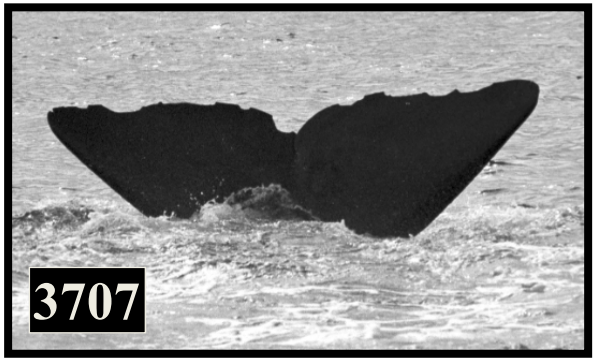

3702


3703


3704

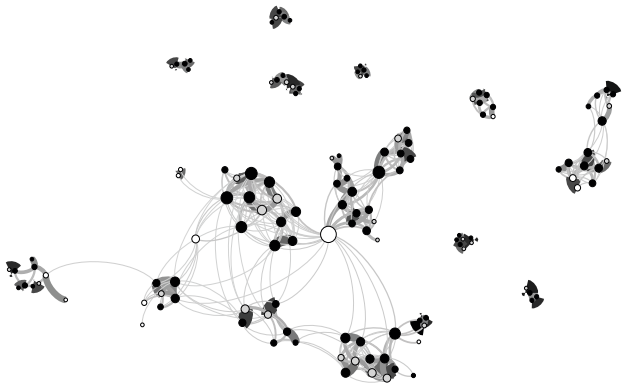

3705


3706

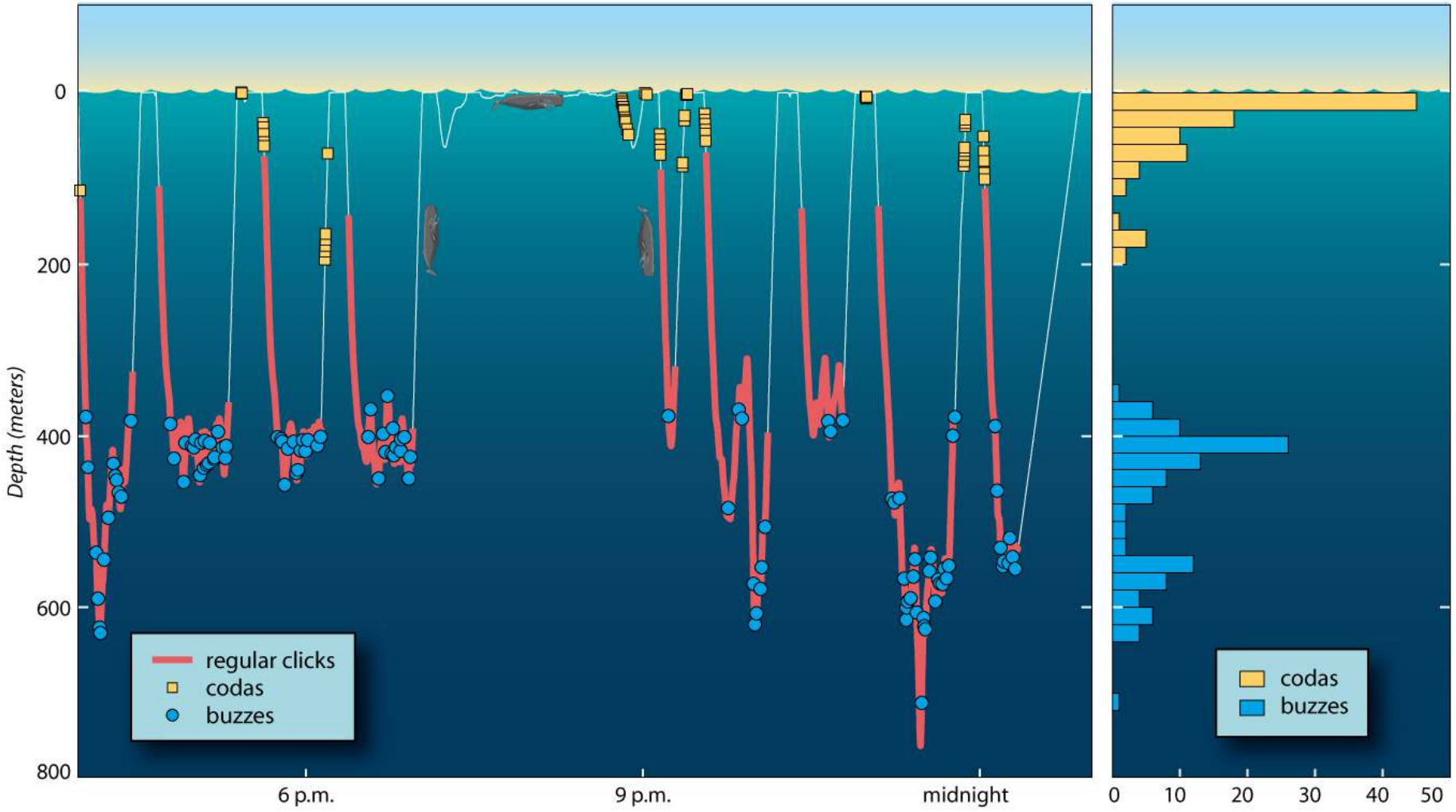

3707


3708

Sperm whale social structure

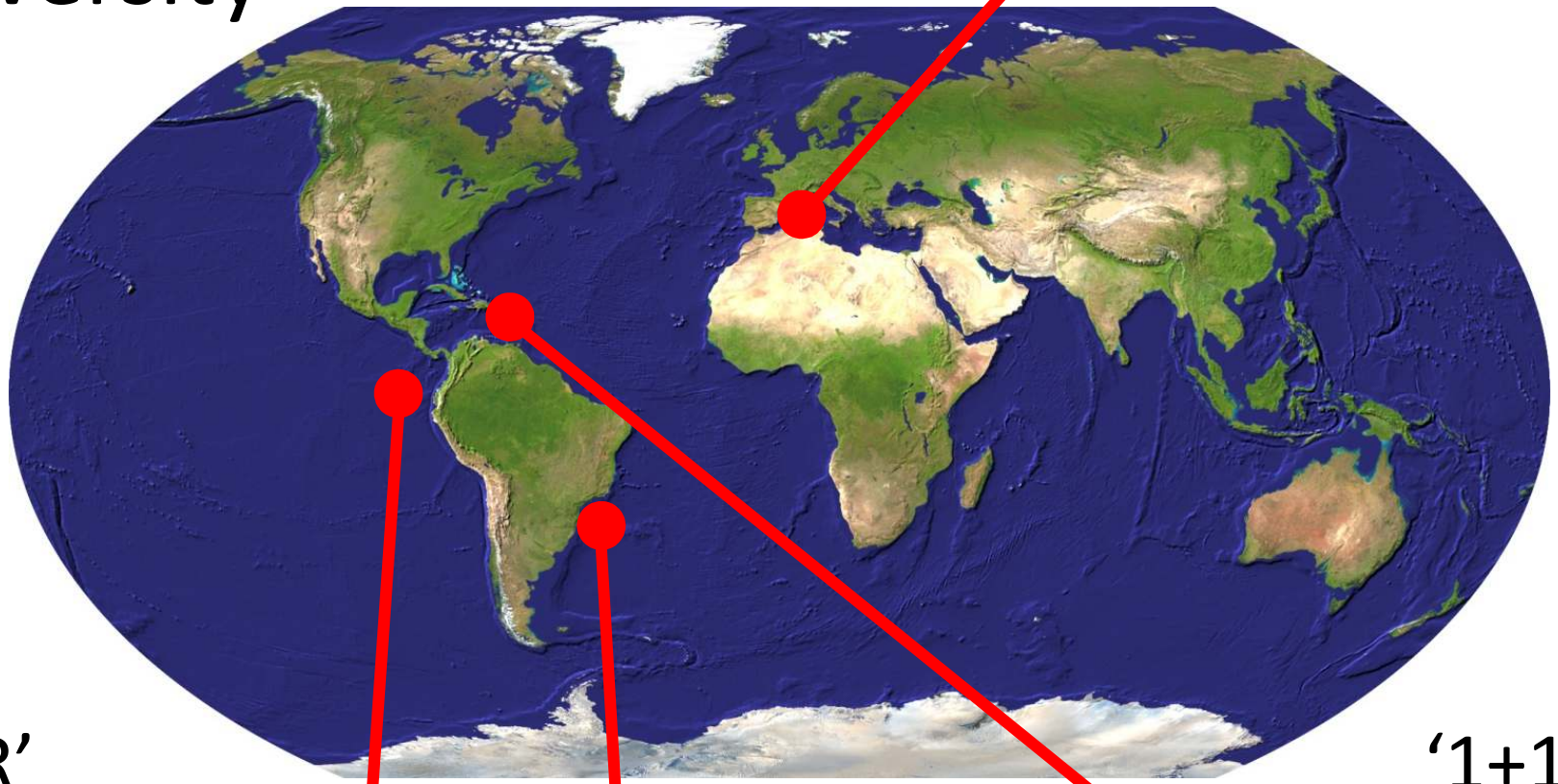


Gero & Rendell (2015) in *Animal Social Networks*



Courtesy of Stephanie Watwood, WHOI

Sperm whale coda diversity

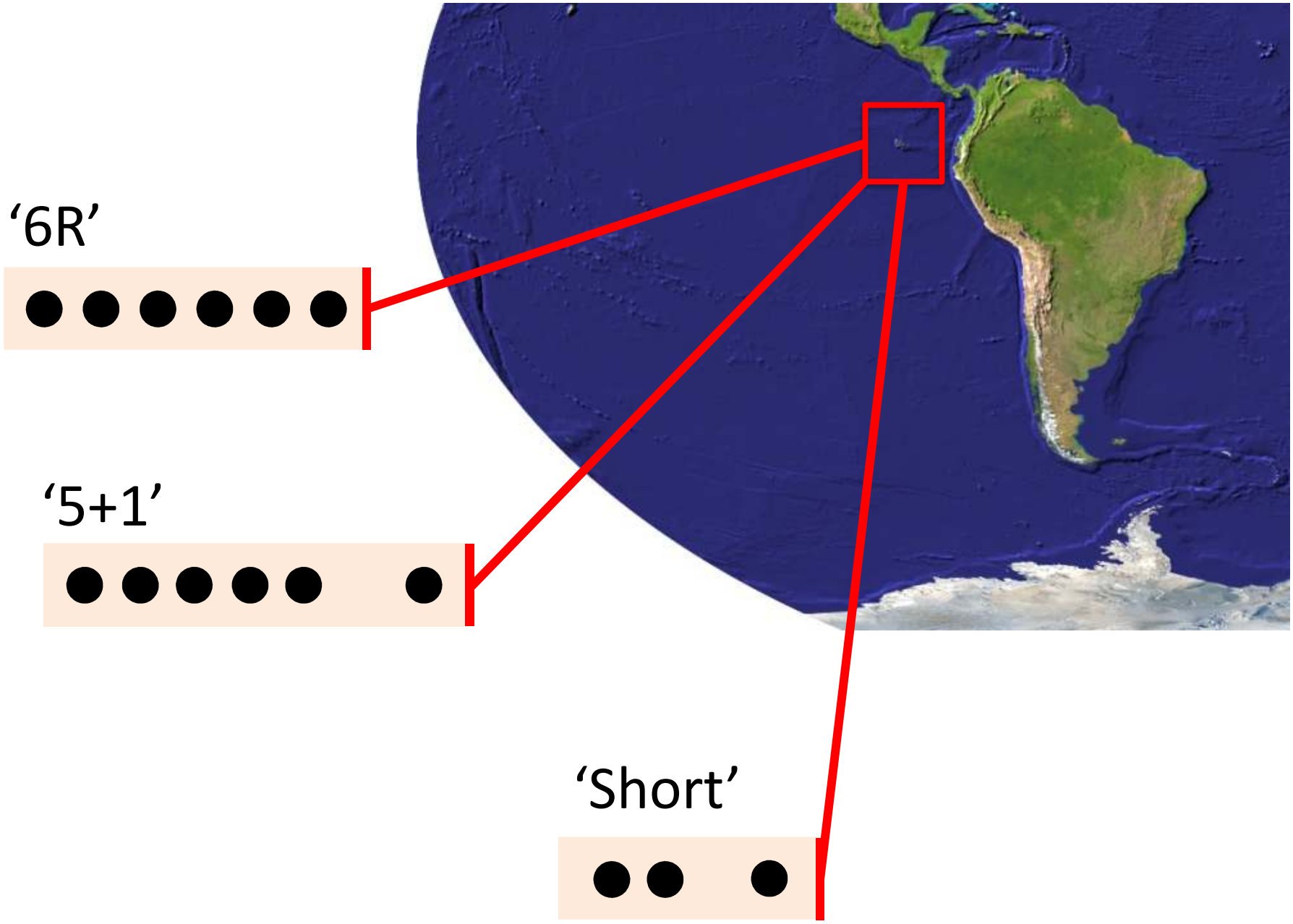


‘3+1’

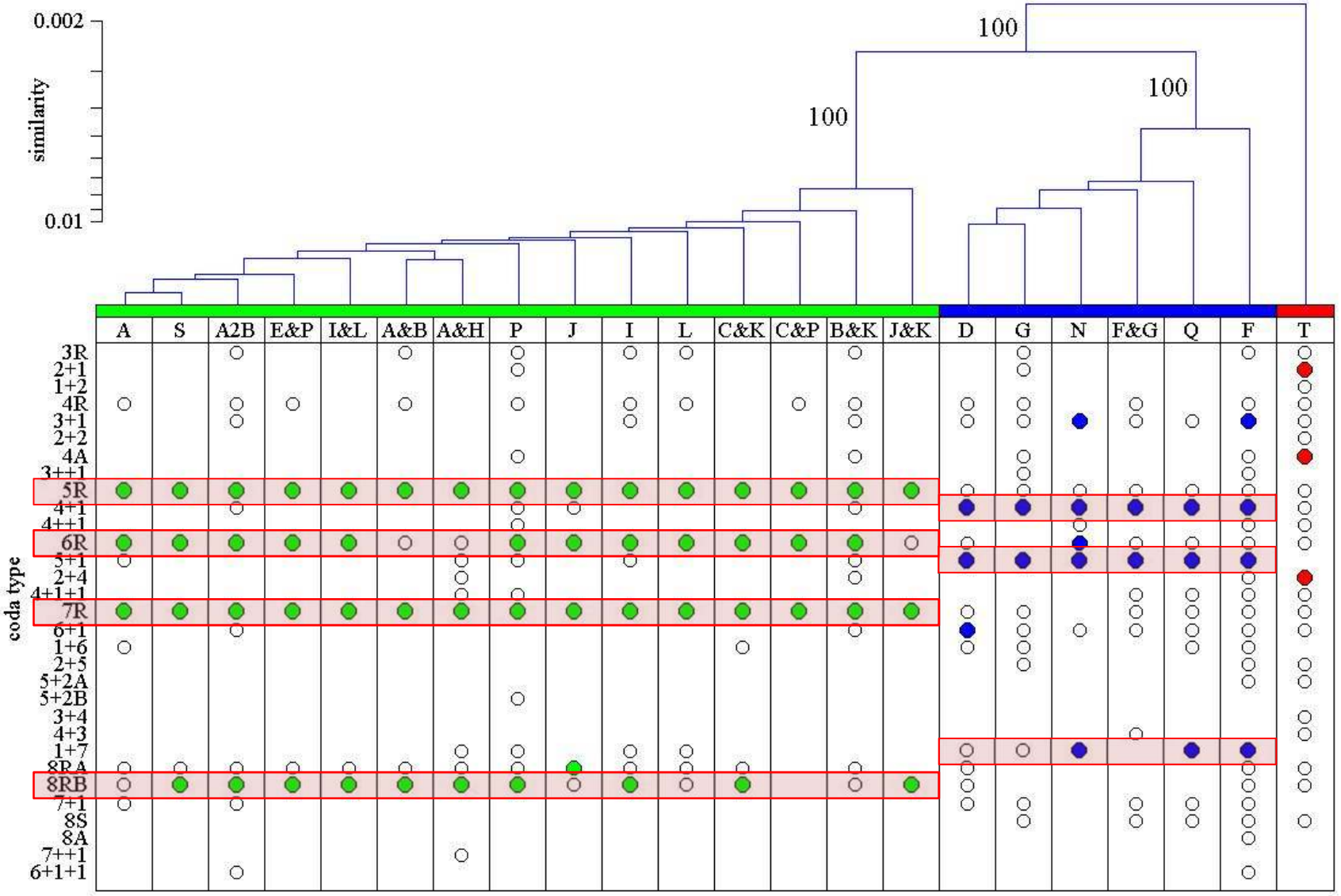
‘6R’

‘1+1+3’

‘Brazilian’

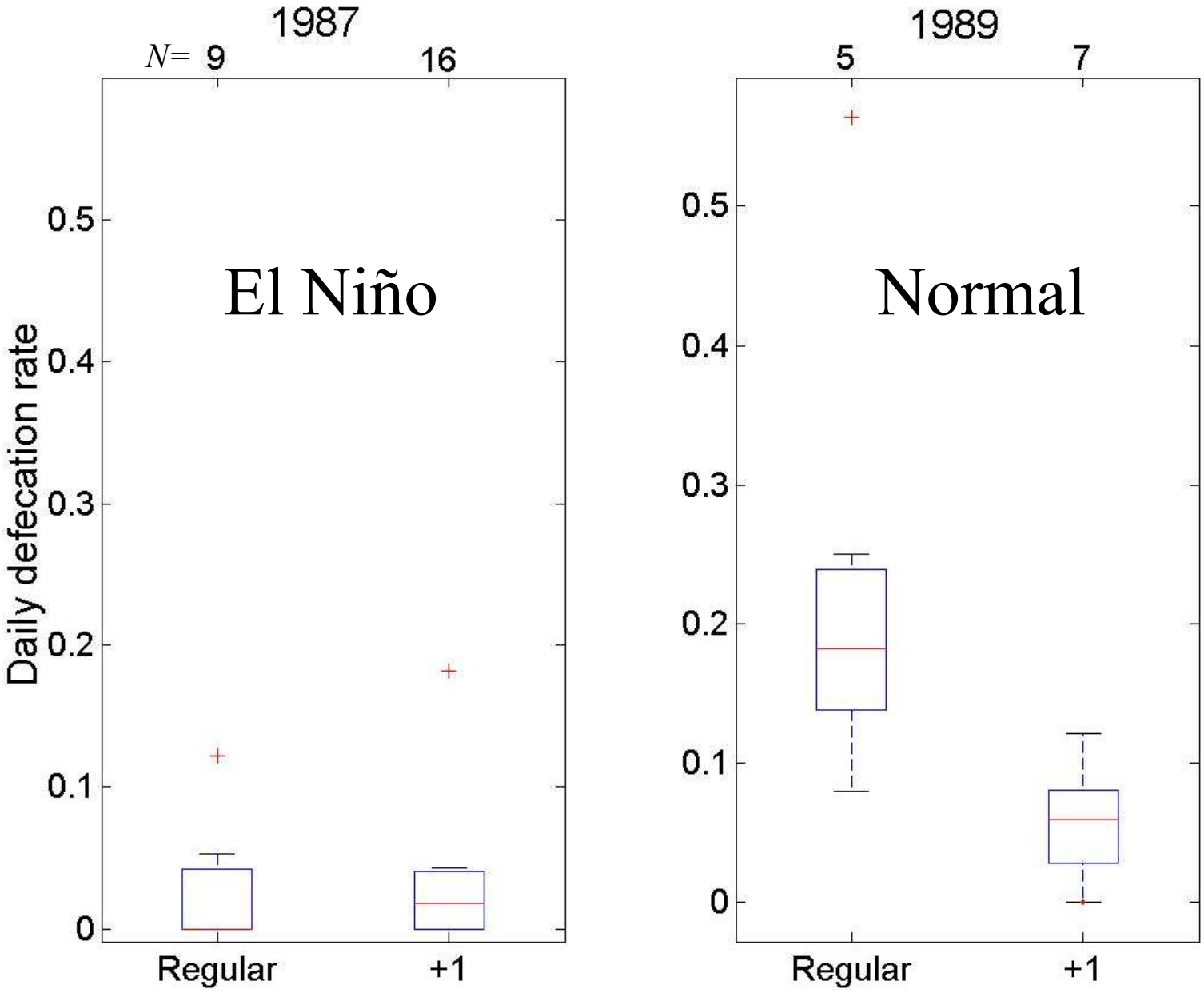

‘6R’
‘5+1’
‘Short’

Galápagos unit repertoires



Rendell & Whitehead (2003) *Proc Roy Soc B*

Clans have different foraging success…



Whitehead & Rendell (2004) *J. Anim. Ecol.*

encounter rates off Galápagos + s.e.

0.075

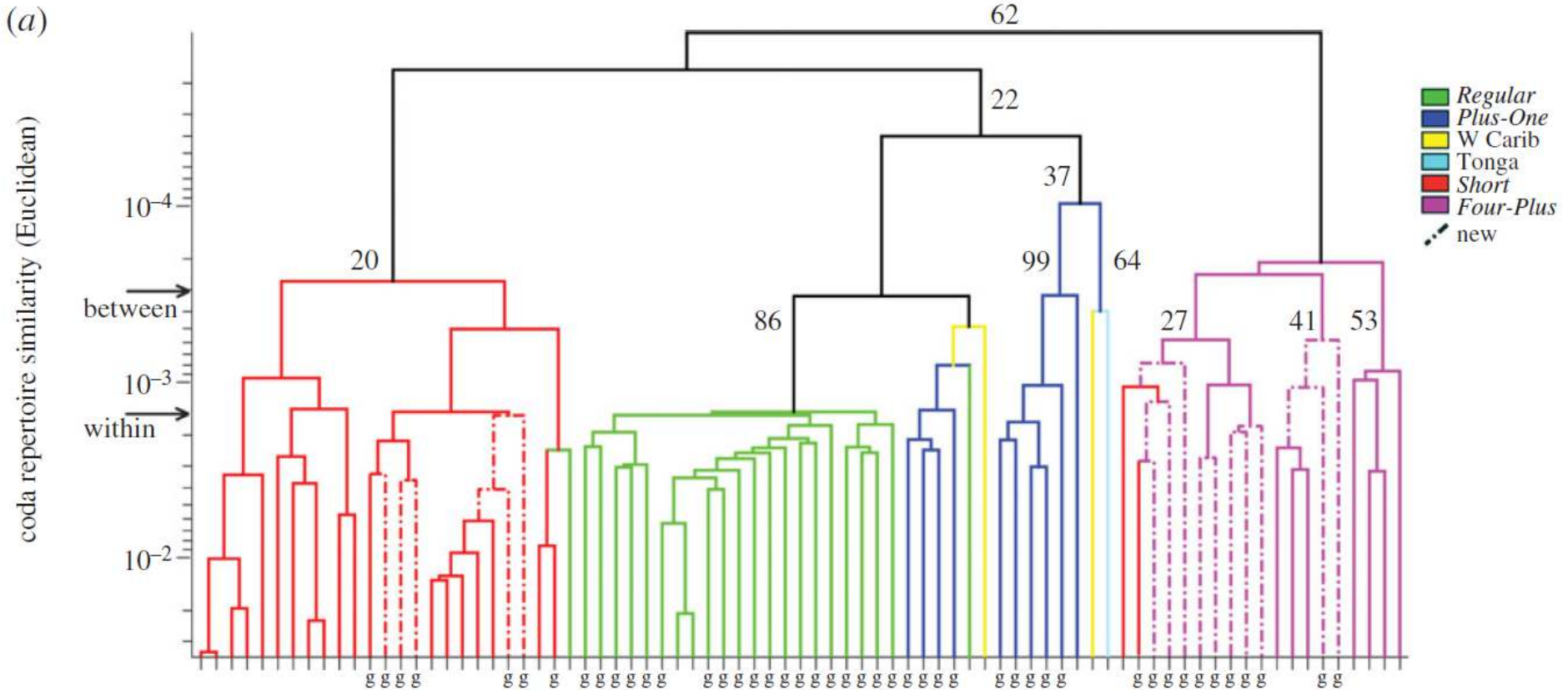
0.050

0.025

0

clans
Regular
Plus-One
Short
Four-Plus

1985 1990 1995 2000 2005 2010 2015



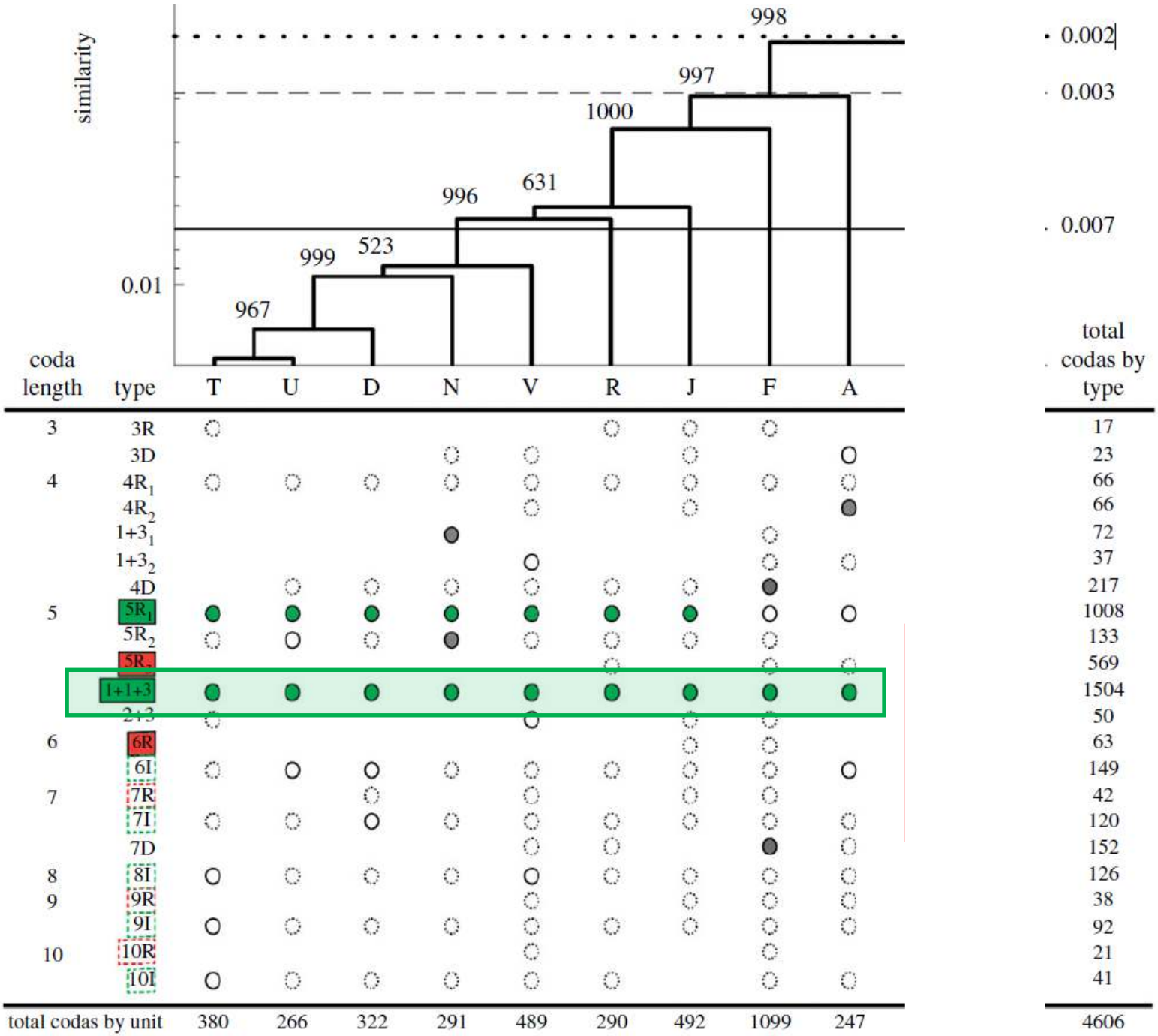
Cultural turnover among Galápagos sperm whales

Mauricio Cantor[1], Hal Whitehead[1], Shane Gero[2] and Luke Rendell[3]

ROYAL SOCIETY OPEN SCIENCE

Shane Gero

Dominica
Sperm
Whale
Project


similarity
998
997
1000
631
996
523
999
967
0.01
0.002
0.003
0.007
coda length
type
T
U
D
N
V
R
J
F
A
total codas by type
3
3R
17
3D
23
4
4R1
66
4R2
66
1+31
72
1+32
37
4D
217
5
5R1
1008
5R2
133
5R3
569
1+1+3
1504
2+3
50
6
6R
63
6I
149
7
7R
42
7I
120
7D
152
8
8I
126
9
9R
38
9I
92
10
10R
21
10I
41
total codas by unit
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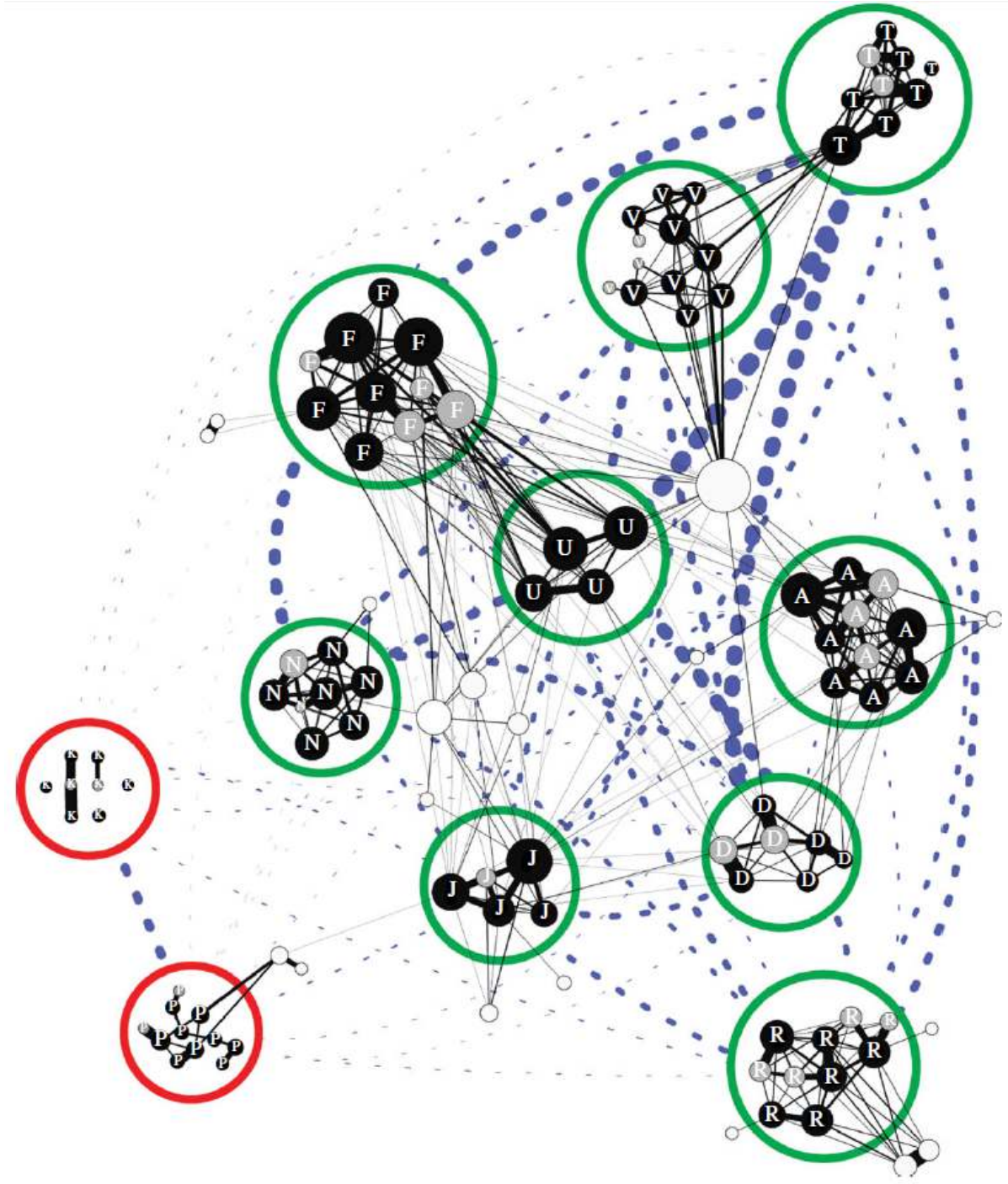
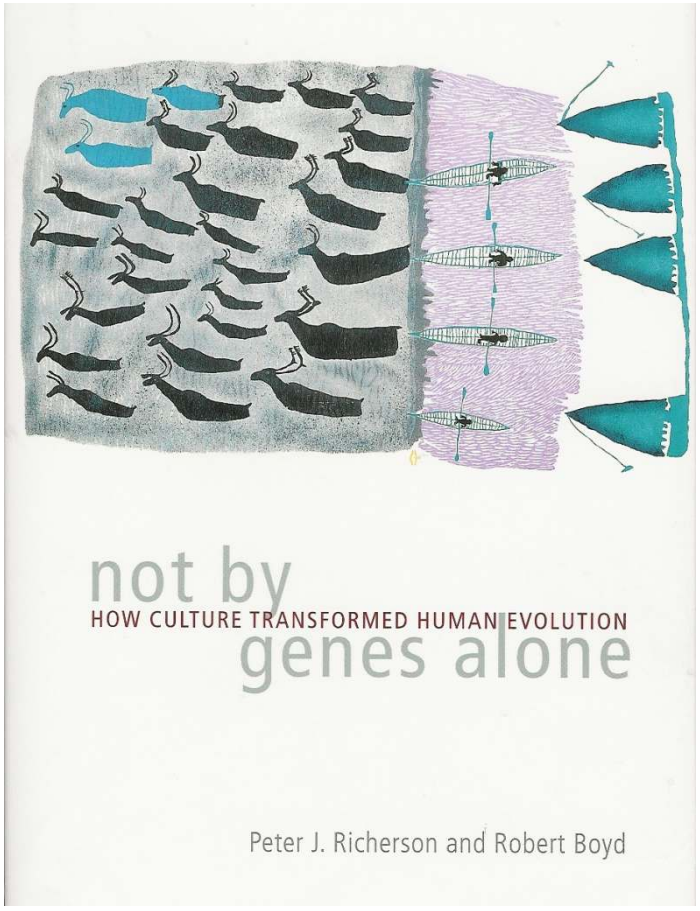
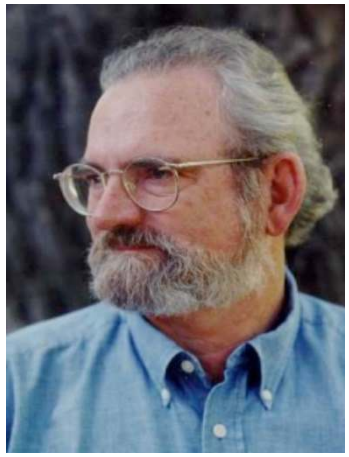
489
290
492
1099
247
4606



Gero et al. (2016)
Royal Society Open Science

“Culture has led to fundamental changes in the way that our species responds to natural selection”

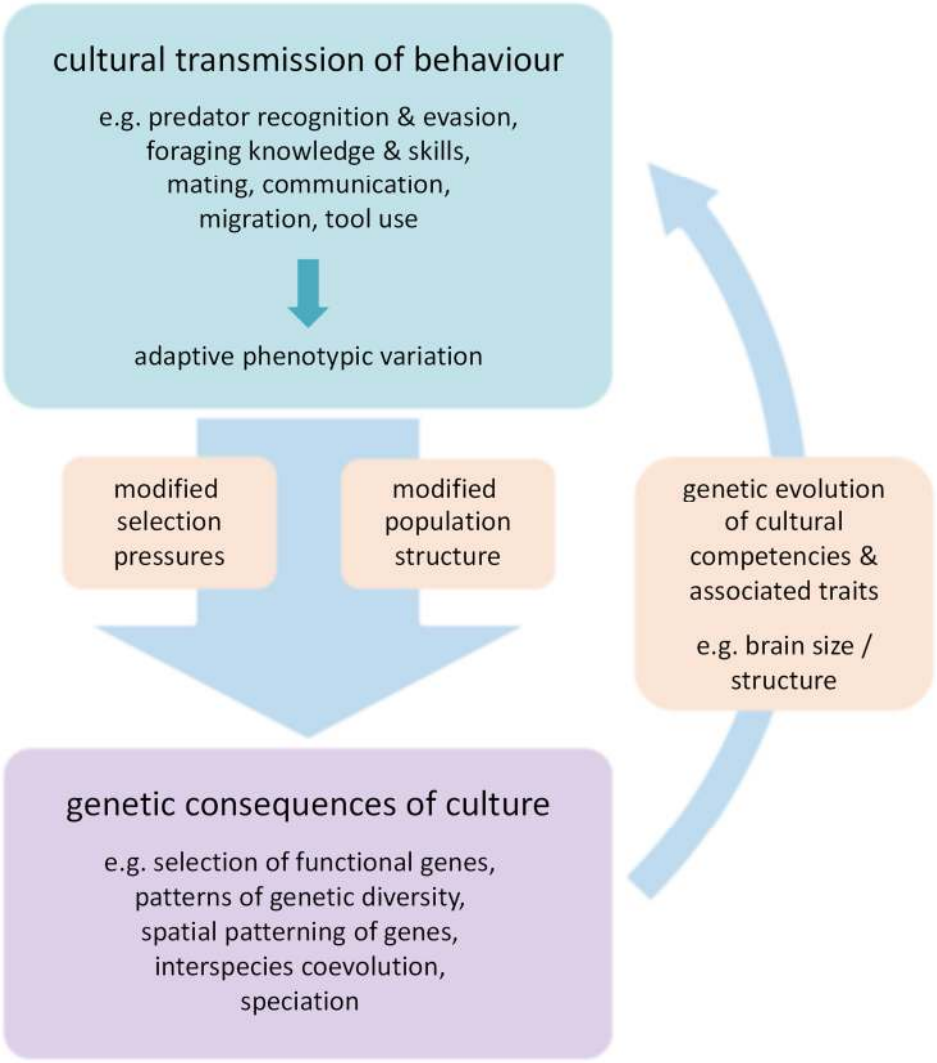




The reach of gene-culture coevolution in animals

Hal Whitehead[1*], Kevin N. Laland[2], Luke Rendell[2], Rose Thorogood[3,4,5], Andrew Whiten[6]

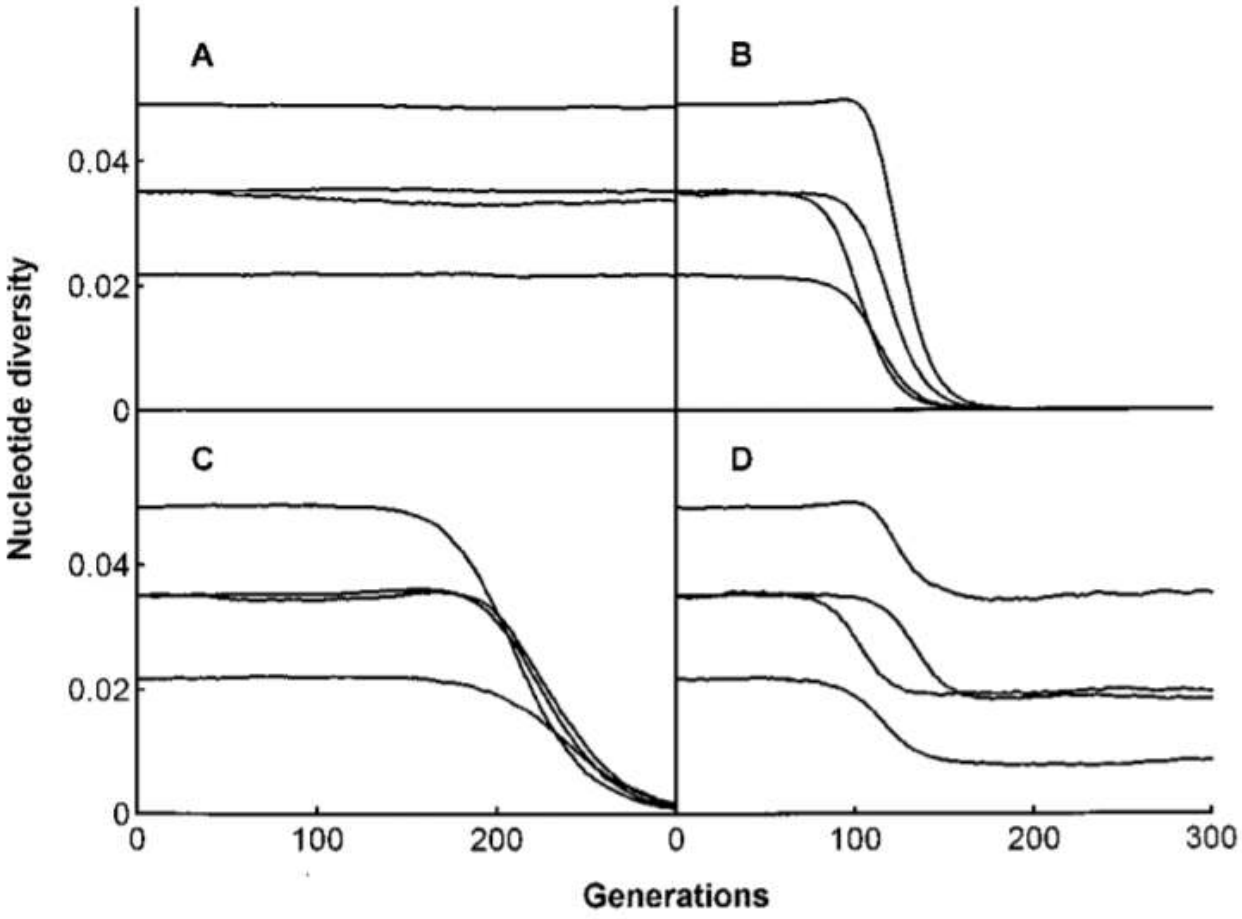
Nature Communications (2019)



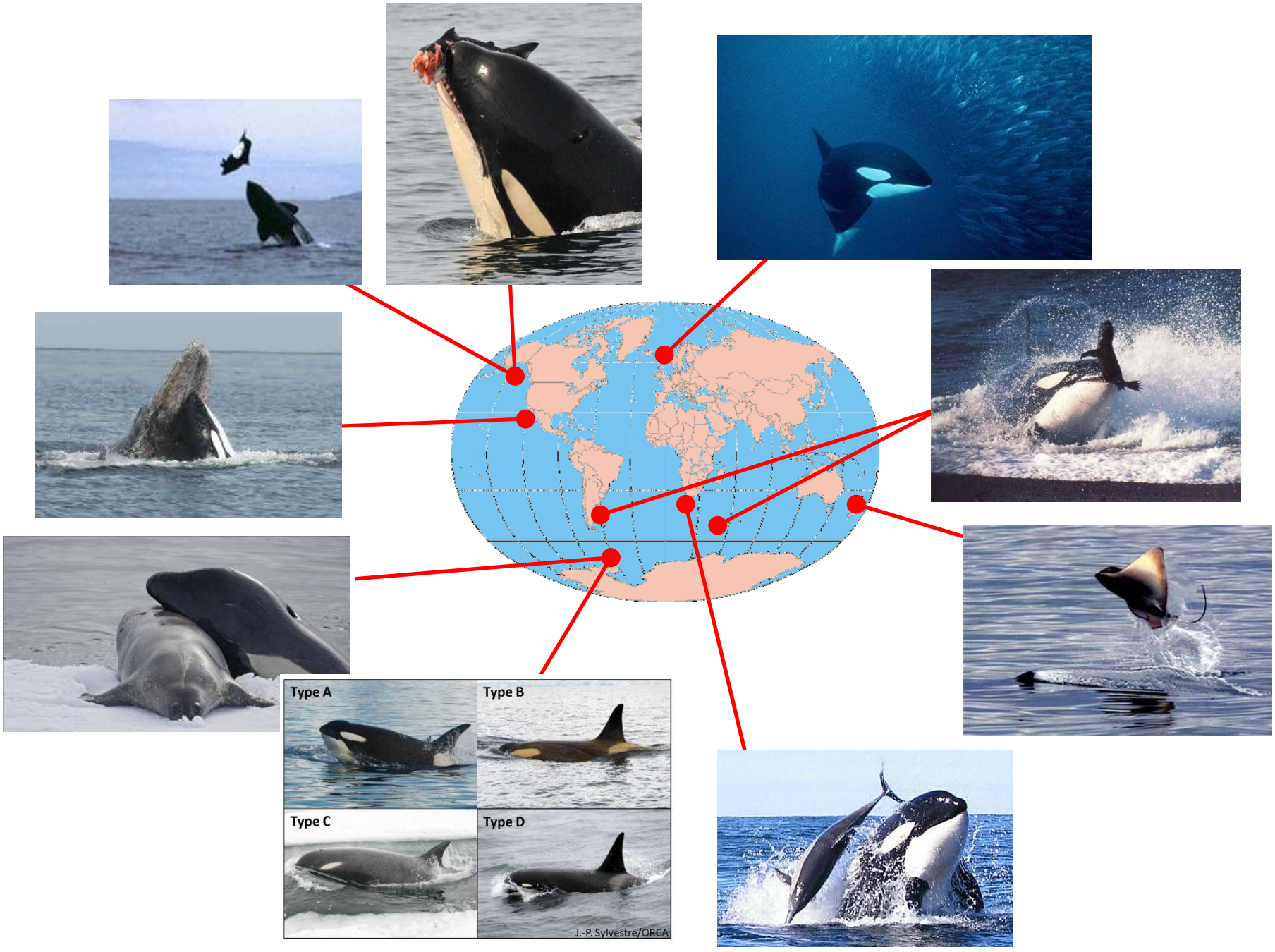
Cultural Selection and Genetic Diversity in Matrilineal Whales

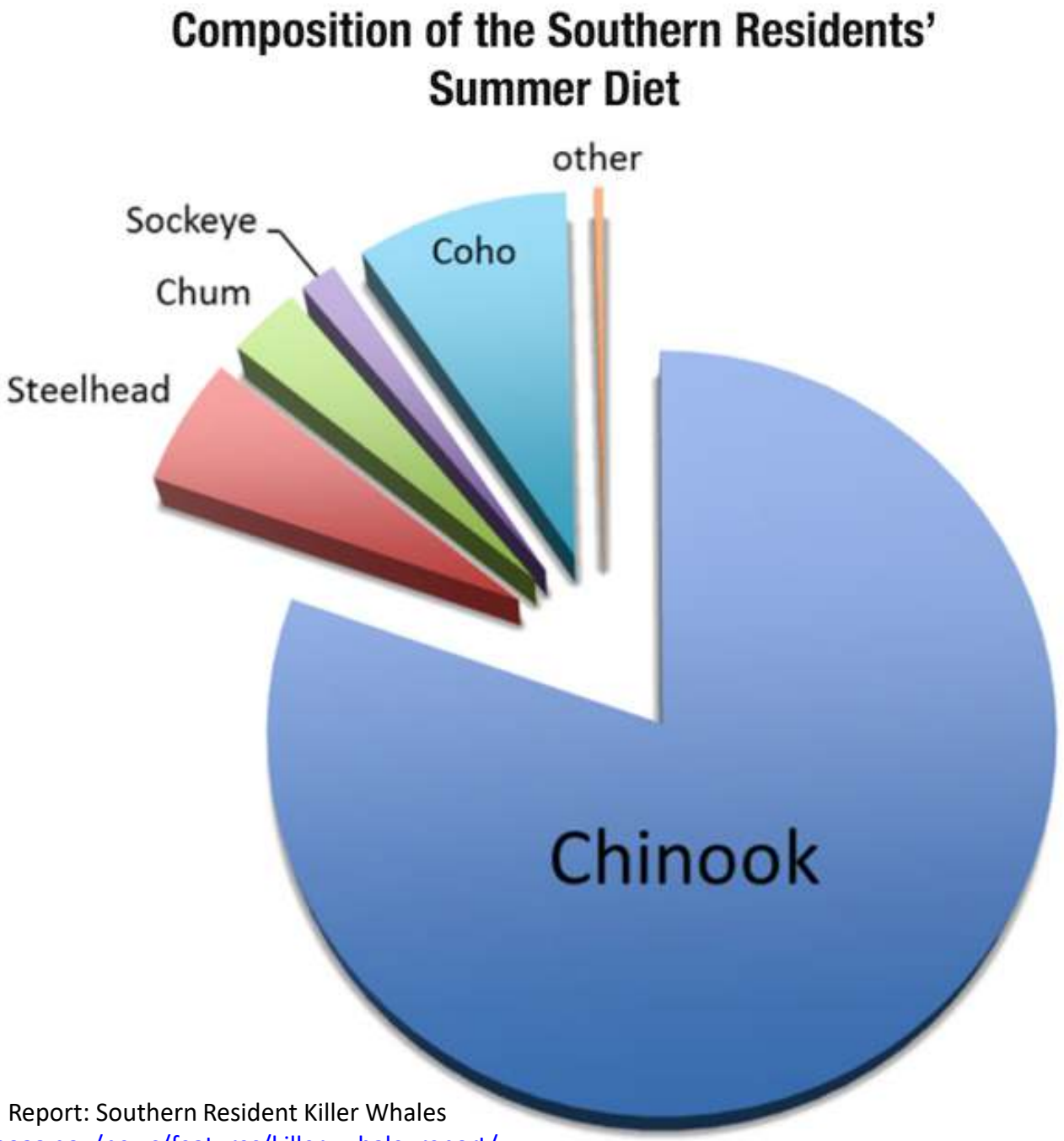
Hal Whitehead

Fig. 1. mtDNA nucleotide diversity trajectories of four simulated populations of 200,000 females



Whitehead (1998) *Science*


Type A
Type B
Type C
Type D
J.-P. Sylvestre/ORCA

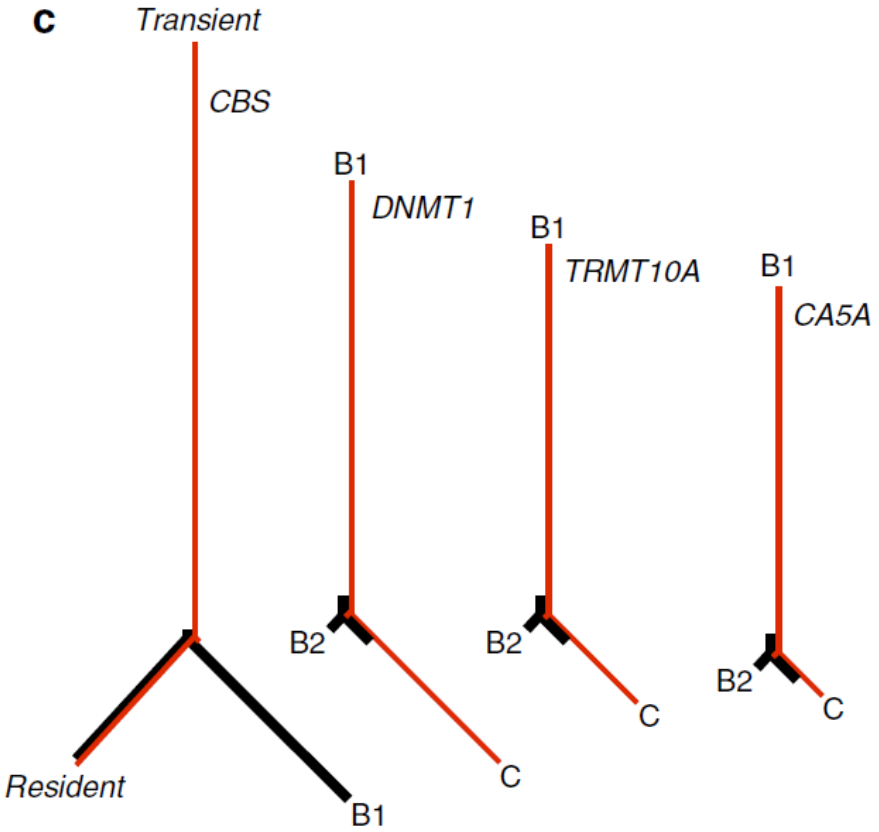


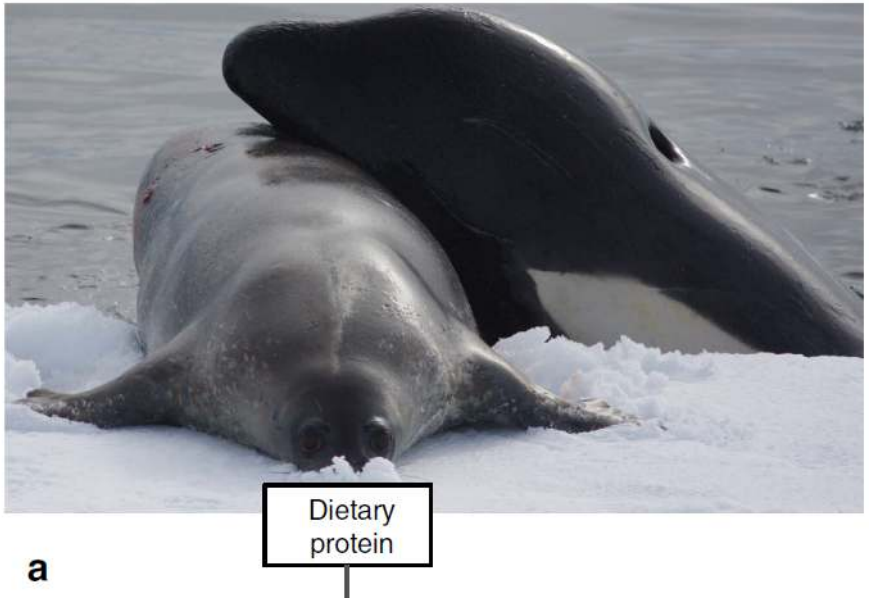
NOAA (2014) Special Report: Southern Resident Killer Whales
https://www.nwfsc.noaa.gov/news/features/killer_whale_report/

nature COMMUNICATIONS

Genome-culture coevolution promotes rapid divergence of killer whale ecotypes

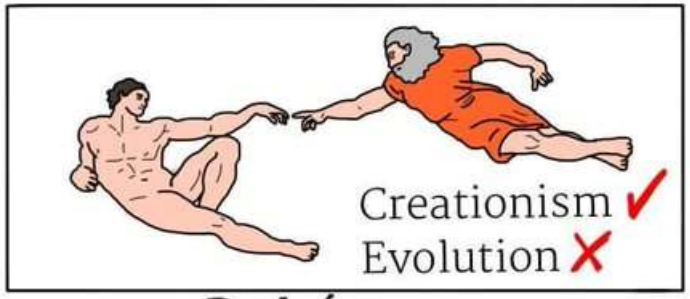
Foote et al. (2016)



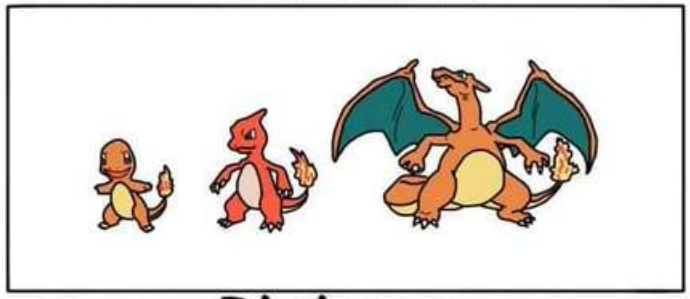


Evolution according to...

Religion

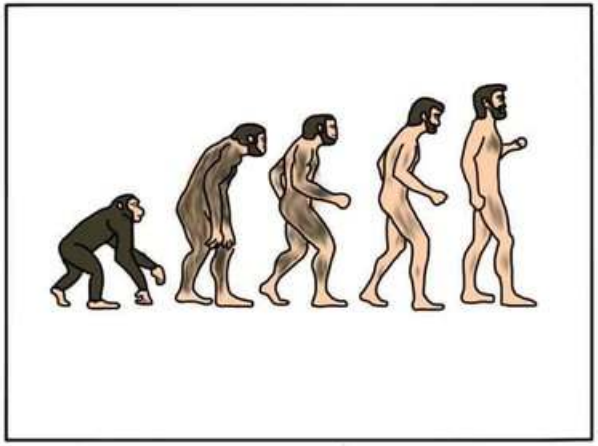


Pokémon

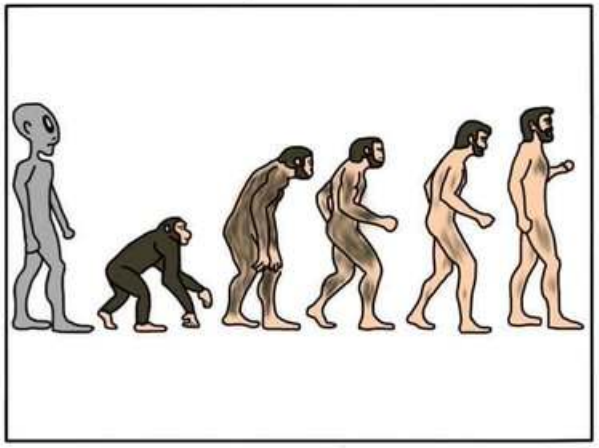


Digimon

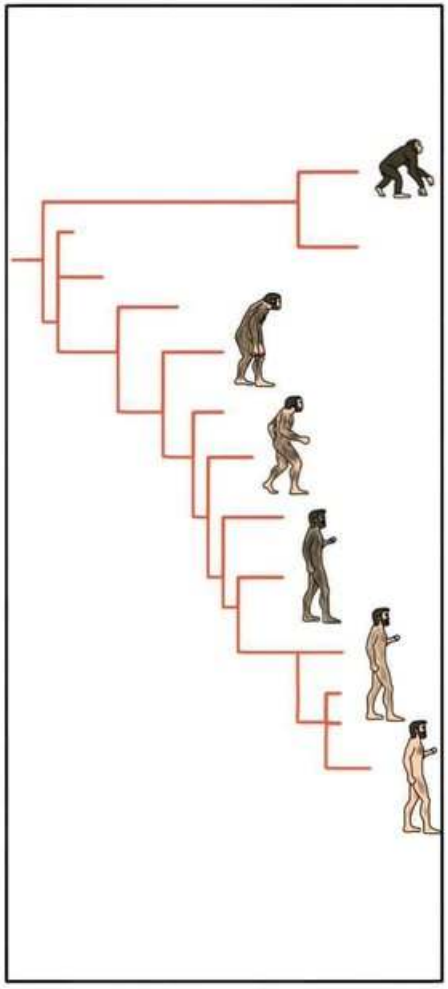
People



History channel



Science



Sketching Science

Evolution according to...

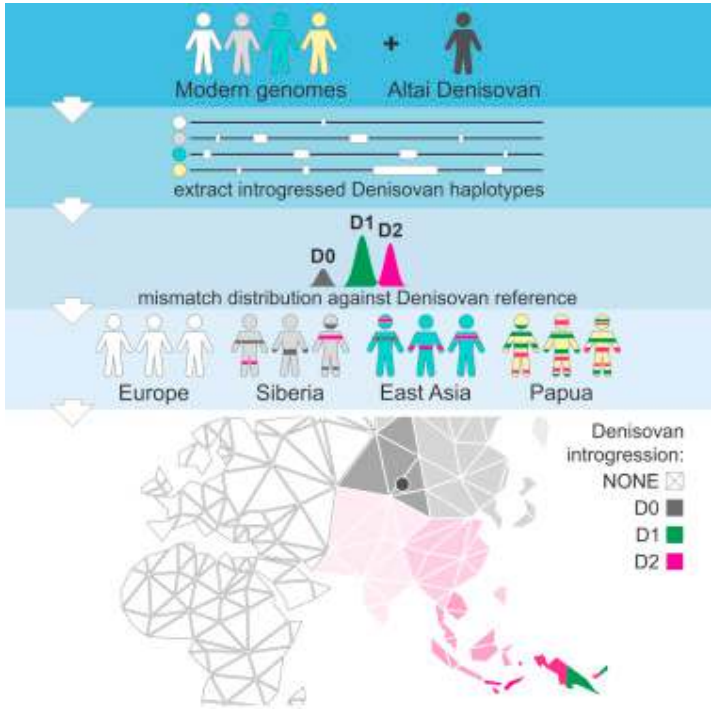
Cell

1010 Cell 177, 1010–1021, May 2, 2019 © 2019 Elsevier Inc.

Article

Multiple Deeply Divergent Denisovan Ancestries in Papuans

Guy S. Jacobs,[1,14] Georgi Hudjashov,[2,3,14,*] Lauri Saag,[3] Pradiptajati Kusuma,[1,4] Chelzie C. Darusallam,[4] Daniel J. Lawson,[5] Mayukh Mondal,[3] Luca Pagani,[3,6] François-Xavier Ricaut,[7] Mark Stoneking,[8] Mait Metspalu,[3] Herawati Sudoyo,[4,9,10] J. Stephen Lansing,[11,12,13] and Murray P. Cox[2,15,*]



nature
International journal of science

Article | Published: 10 April 2019

A new species of *Homo* from the Late Pleistocene of the Philippines

Florent Détroit, Armand Salvador Mijares, Julien Corny, Guillaume Daver, Clément Zanolli, Eusebio Dizon, Emil Robles, Rainer Grün & Philip J. Piper

Nature **568**, 181–186 (2019) | Download Citation

nature
International journal of science

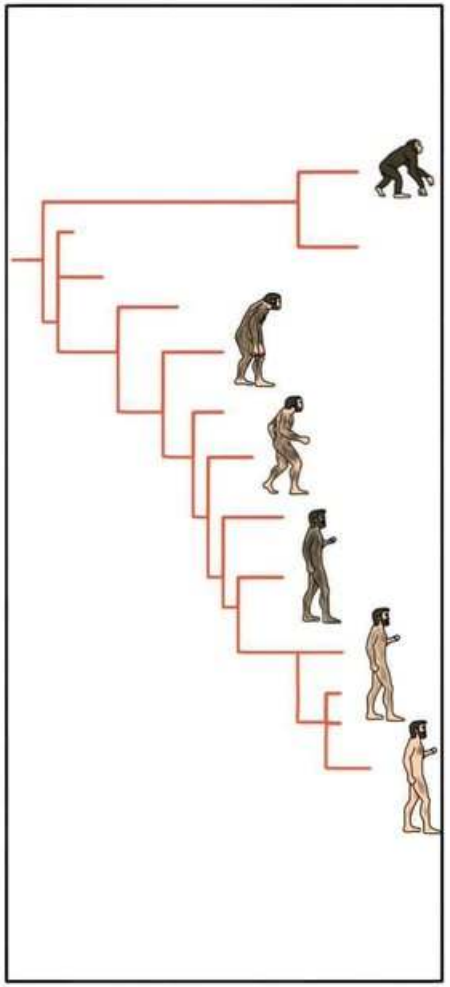
Letter | Published: 14 October 2015

The earliest unequivocally modern humans in southern China

Wu Liu, María Martinón-Torres, Yan-jun Cai, Song Xing, Hao-wen Tong, Shu-wen Pei, Mark Jan Sier, Xiao-hong Wu, R. Lawrence Edwards, Hai Cheng, Yi-yuan Li, Xiong-xin Yang, José María Bermúdez de Castro & Xiu-jie Wu

Nature **526**, 696–699 (29 October 2015) | Download Citation

Science



Sketching Science

PROCEEDINGS OF THE ROYAL SOCIETY B

Proc. R. Soc. B (2010) **277**, 3765–3771
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The evolution of menopause in cetaceans and humans: the role of demography

Rufus A. Johnstone[1,*] and Michael A. Cant[2]

Adaptive Prolonged Postreproductive Life Span in Killer Whales

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SCIENCE

Ecological Knowledge, Leadership, and the Evolution of Menopause in Killer Whales

Brent et al., 2015, Current Biology *25*, 746–750

Reproductive Conflict and the Evolution of Menopause in Killer Whales

Croft et al., 2017, Current Biology *27*, 298–304

RESEARCH ARTICLE

Postreproductive killer whale grandmothers improve the survival of their grandoffspring

Stuart Nattrass, Darren P. Croft, Samuel Ellis, Michael A. Cant, Michael N. Weiss, Brianna M. Wright, Eva Stredulinsky, Thomas Doniol-Valcroze, John K. B. Ford, Kenneth C. Balcomb, and Daniel W. Franks

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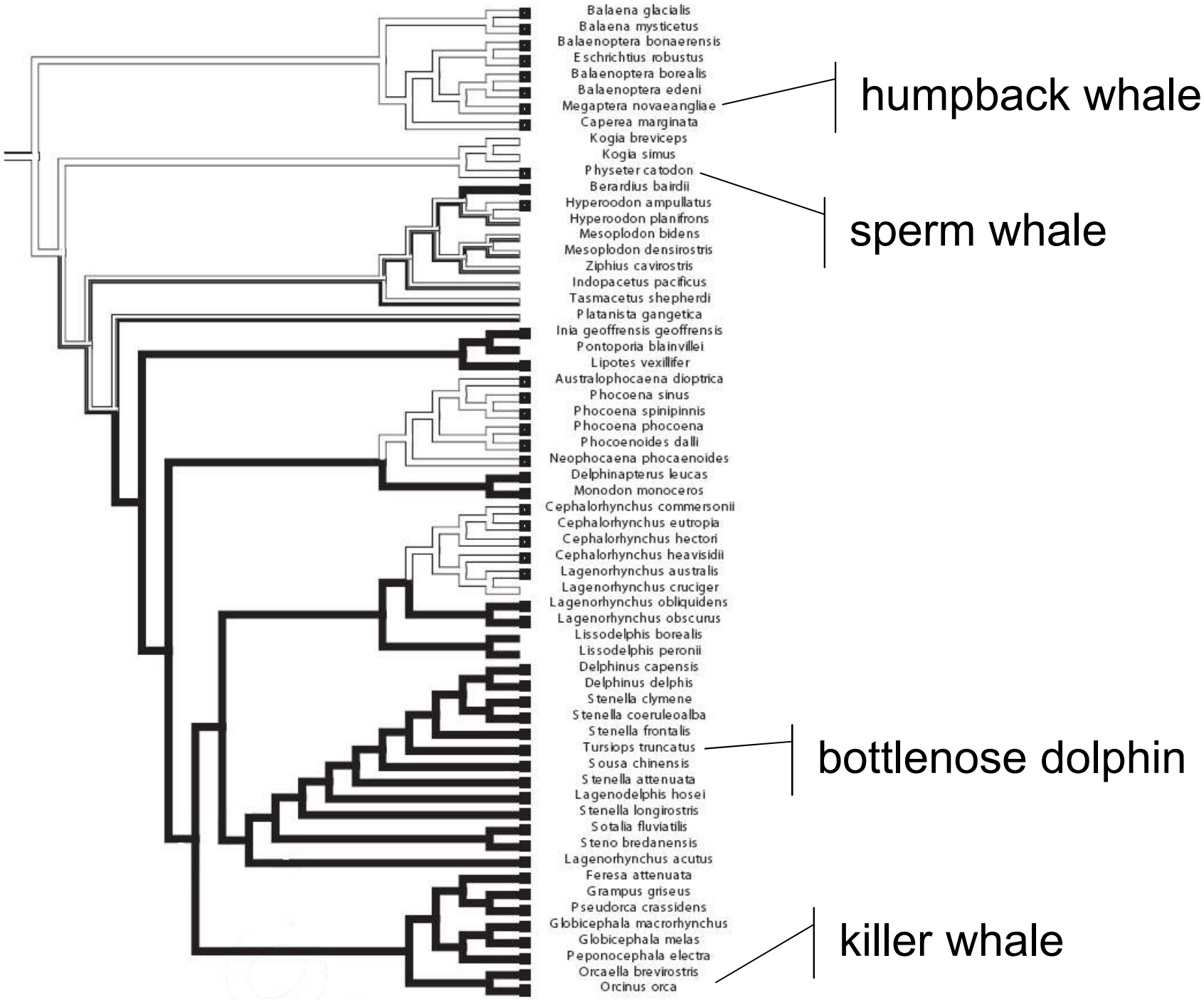
Courtesy Jennifer Modigliani

Courtesy David Ellifrit


Balaena glacialis
Balaena mysticetus
Balaenoptera bonaerensis
Eschrichtius robustus
Balaenoptera borealis
Balaenoptera edeni
Megaptera novaeangliae
Caperea marginata
Kogia breviceps
Kogia simus
Physeter catodon
Berardius bairdii
Hyperoodon ampullatus
Hyperoodon planifrons
Mesoplodon bidens
Mesoplodon densirostris
Ziphius cavirostris
Indopacetus pacificus
Tasmacetus shepherdi
Platanista gangetica
Inia geoffrensis geoffrensis
Pontoporia blainvillei
Lipotes vexillifer
Australophocaena dioptrica
Phocoena sinus
Phocoena spinipinnis
Phocoena phocoena
Phocoenoides dalli
Neophocaena phocaenoides
Delphinapterus leucas
Monodon monoceros
Cephalorhynchus commersonii
Cephalorhynchus eutropia
Cephalorhynchus hectori
Cephalorhynchus heavisidii
Lagenorhynchus australis
Lagenorhynchus cruciger
Lagenorhynchus obliquidens
Lagenorhynchus obscurus
Lissodelphis borealis
Lissodelphis peronii
Delphinus capensis
Delphinus delphis
Stenella clymene
Stenella coeruleoalba
Stenella frontalis
Tursiops truncatus
Sousa chinensis
Stenella attenuata
Lagenodelphis hosei
Stenella longirostris
Sotalia fluviatilis
Steno bredanensis
Lagenorhynchus acutus
Feresa attenuata
Grampus griseus
Pseudorca crassidens
Globicephala macrorhynchus
Globicephala melas
Peponocephala electra
Orcaella brevirostris
Orcinus orca
humpback whale
sperm whale
bottlenose dolphin
killer whale

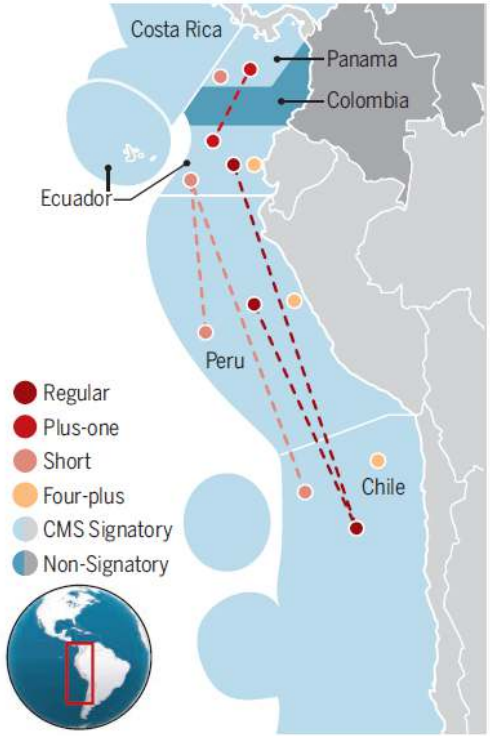
POLICY FORUM

CONSERVATION

Animal cultures matter for conservation

Understanding the rich social lives of animals benefits international conservation efforts

By **Philippa Brakes, Sasha R. X. Dall, Lucy M. Aplin, Stuart Bearhop, Emma L. Carroll, Paolo Ciucci, Vicki Fishlock, John K. B. Ford, Ellen C. Garland, Sally A. Keith, Peter K. McGregor, Sarah L. Mesnick, Michael J. Noad, Giuseppe Notarbartolo di Sciara, Martha M. Robbins, Mark P. Simmonds, Fernando Spina, Alex Thornton, Paul R. Wade, Martin J. Whiting, James Williams, Luke Rendell, Hal Whitehead, Andrew Whiten, Christian Rutz**



Spread of Longline Depredation

Courtesy SEASWAP

Spread of Longline Depredation

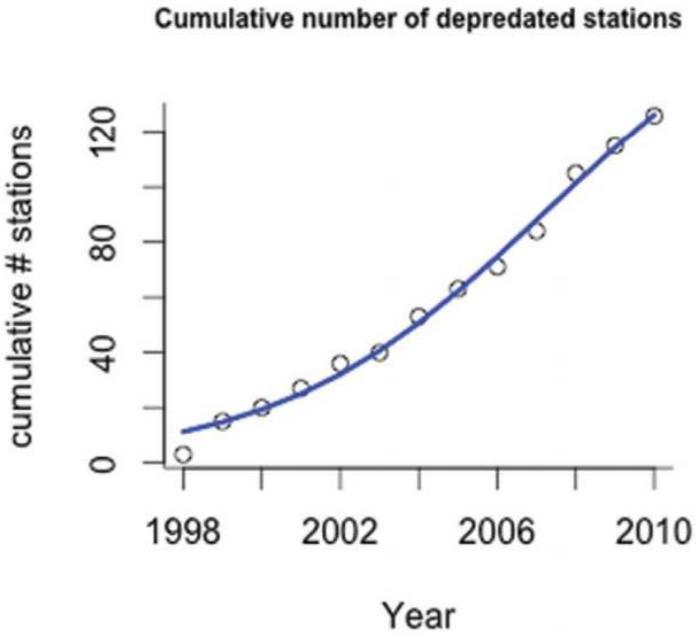


Figure 3. Spatial radiation of depredation and Wave-of-Advance model shows a positive correlation between time and the distance of new observations of depredation from origin (r^2 = .55, p = 0.003).

Schakner ZA *et al* (2014) PLoS ONE

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