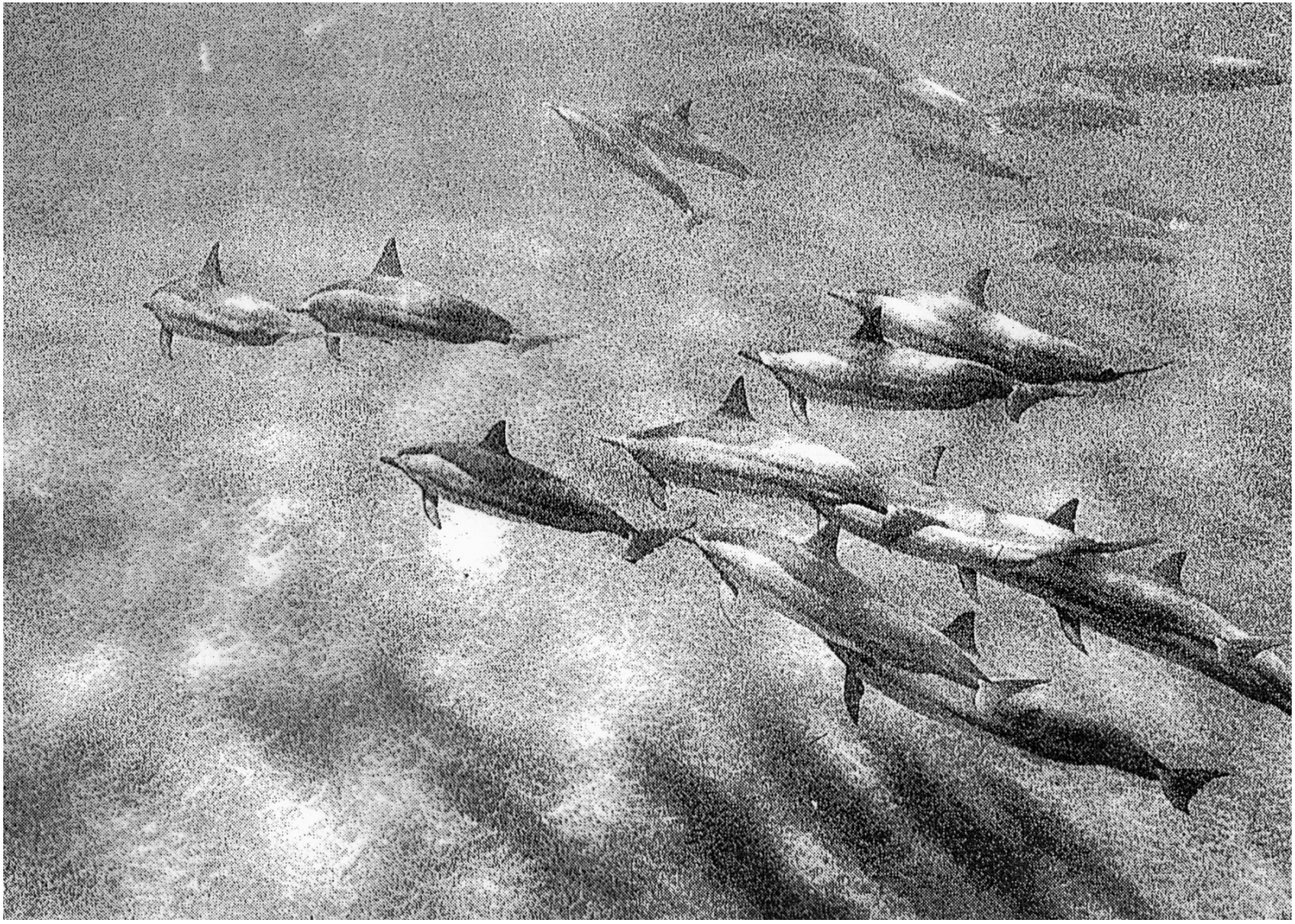
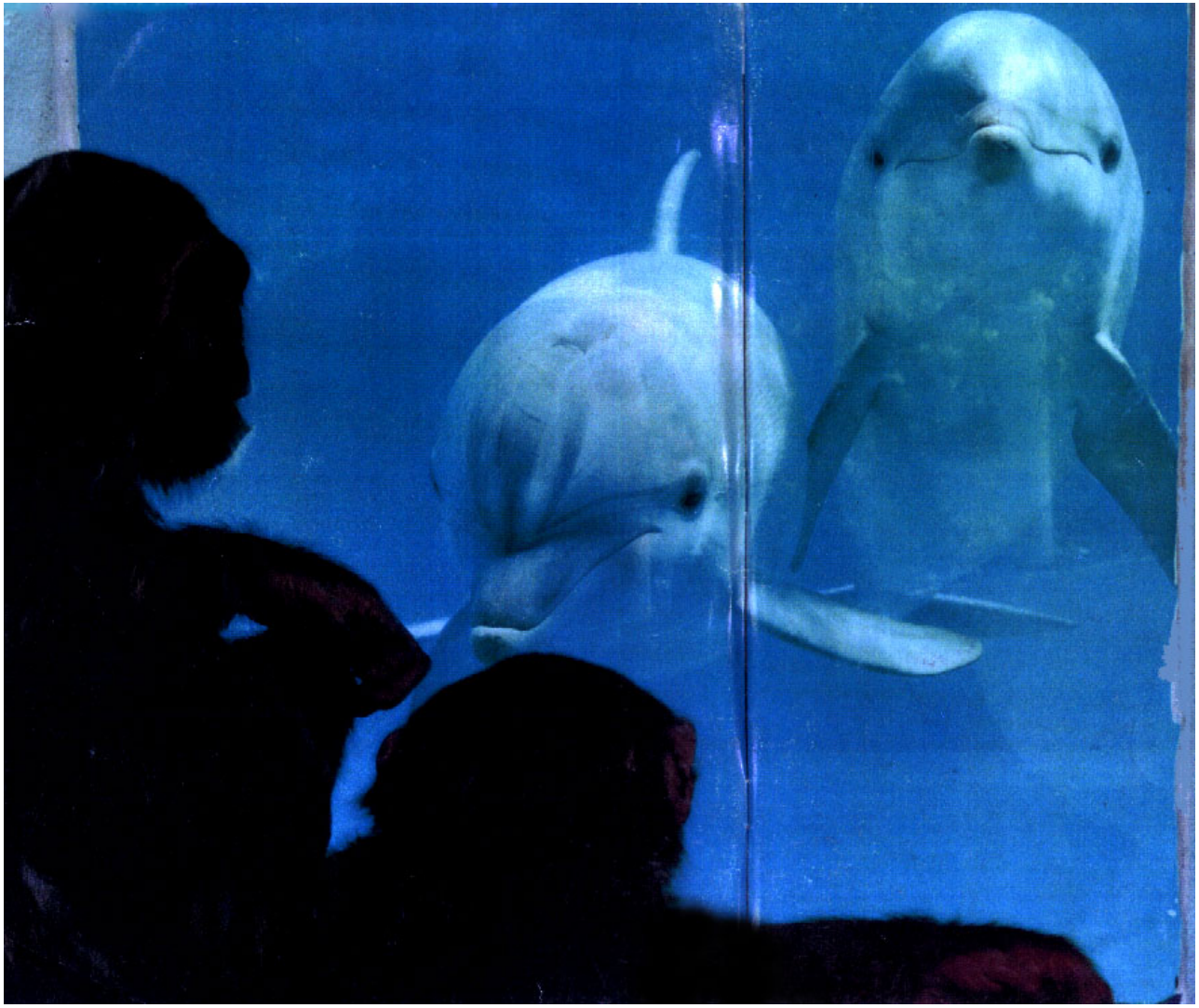
Cetacean Communication

Cogs 143 * UCSD

Cetaceans are SOCIAL



Maybe even *moreso* than Primates…



Ecological pressures make them more <u>Inter-dependent</u>

The school is all…

No nest, no hiding place, no territory – only each other…

Communication

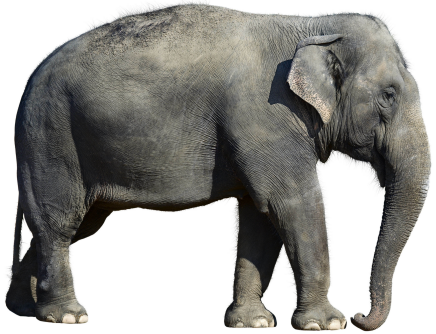
Gestural repertoire limited by hydrodynamic streamlining & few articulations

Even so, they do use multiple modalities to communicate. (See *Herzing* chapter)

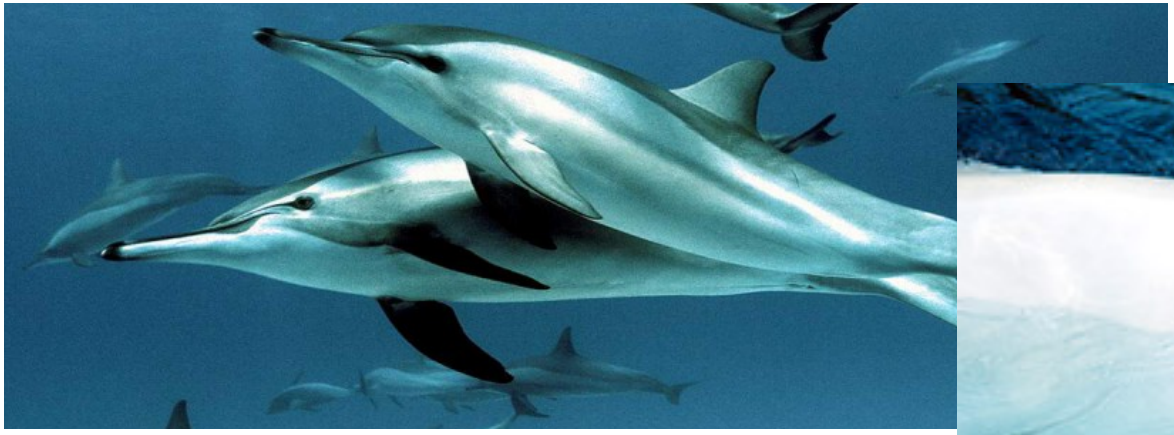
Communication

In dolphins, like in most animals,
eyes are near the "leading edge" of the animal's body

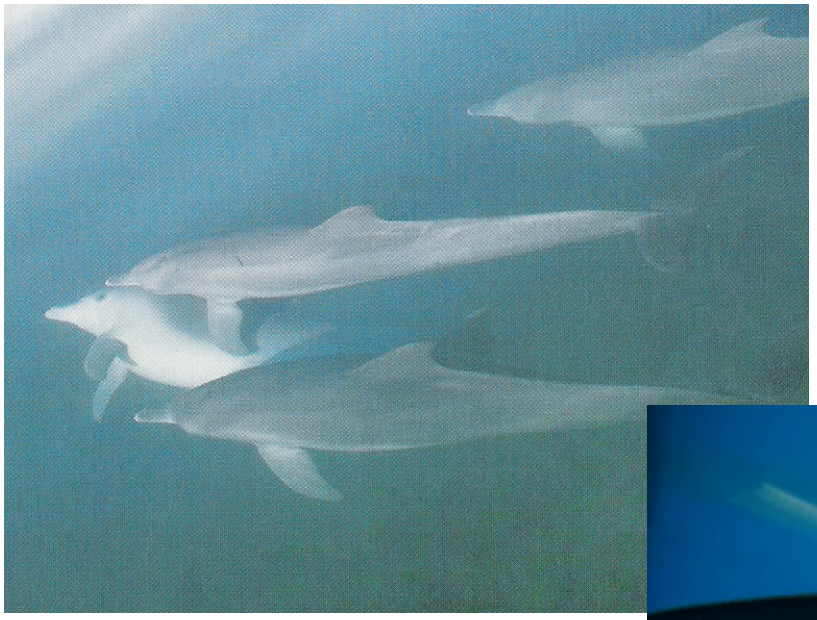
As a result,
eyes predict an animal's
forward trajectory



Eyes often high contrast, salient – so, likely to be signals



Vision, esp in intimate social engagements



Use gaze socially
especially at close range

Disruptive Coloring

Hwever, eyes can also be obscured via “disruptive coloring”

In top predators…

Eyes at leading edge, w/teeth,
so can interfere with predicting trajectory

…or vulnerable prey

In a group, disruptive coloring also interferes w/discriminating individuals.

Cooperative Defense

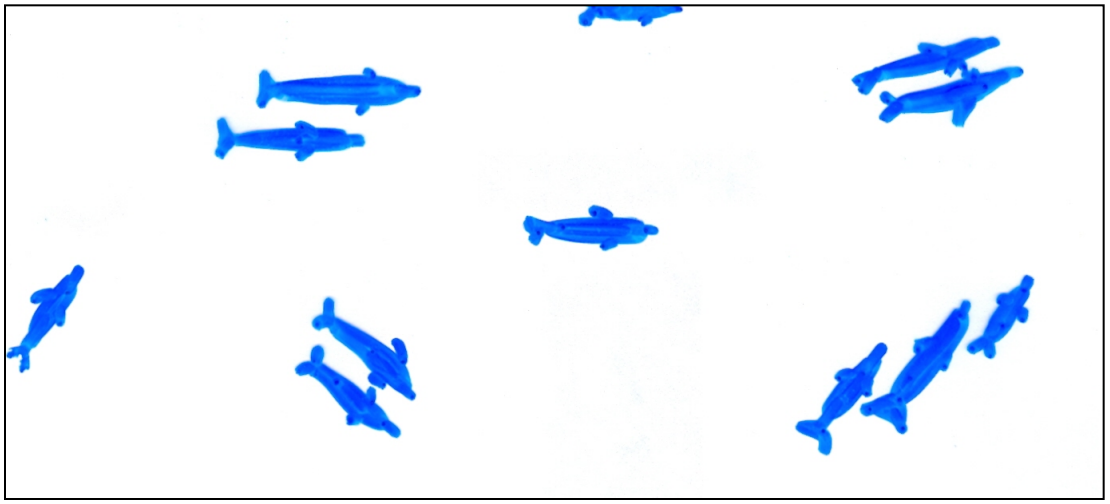
1:1 Shark wins

Many:1 School of dolphins can defeat shark

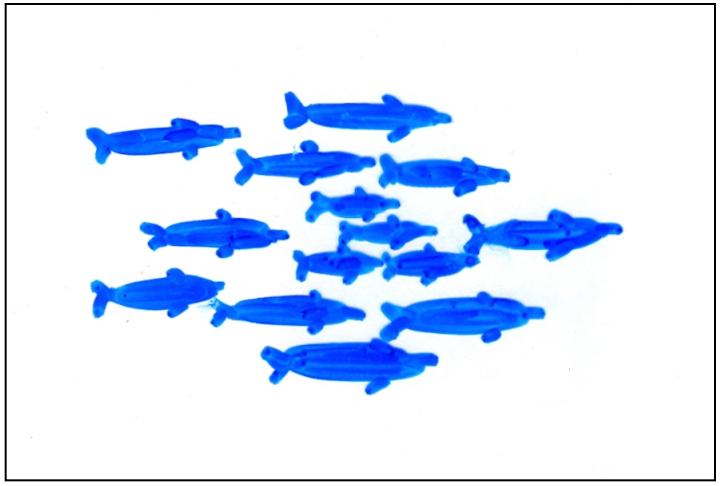
Alarm Calls in Cetaceans…???

Cooperative Defense

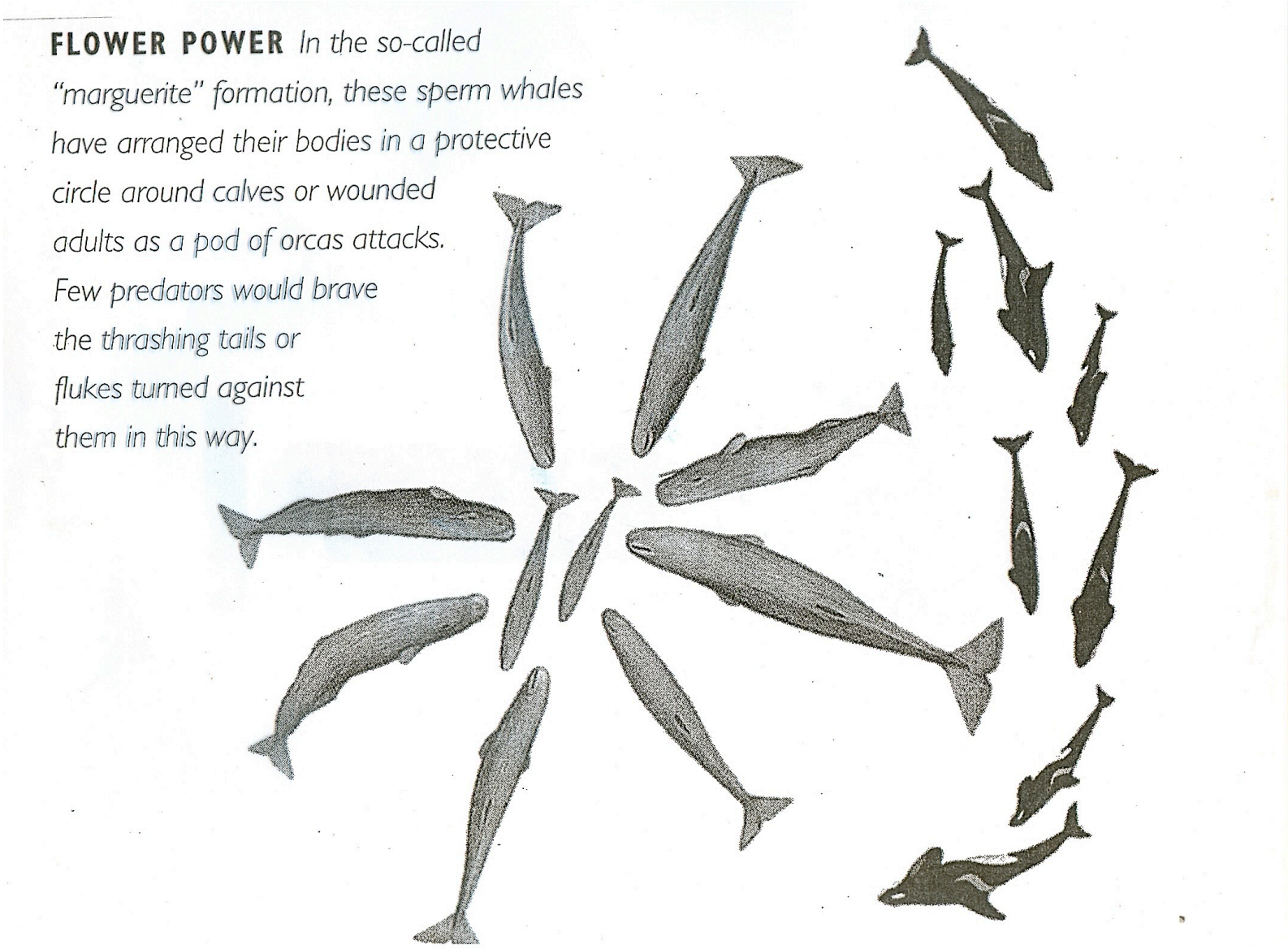
No threat present



Threat!



Cooperative Defense



Synchrony

Plays a major, life-long role in dolphin socializing

Sync'd surfacing predicts prolonged pairing

Synchronize from infancy

Synchrony

Plays a major, life-long role in dolphin socializing

Becomes an important facet of male

Coalitional Displays

in Bottlenose Dolphins

Antagonistic Communication

Display teeth = THREAT!

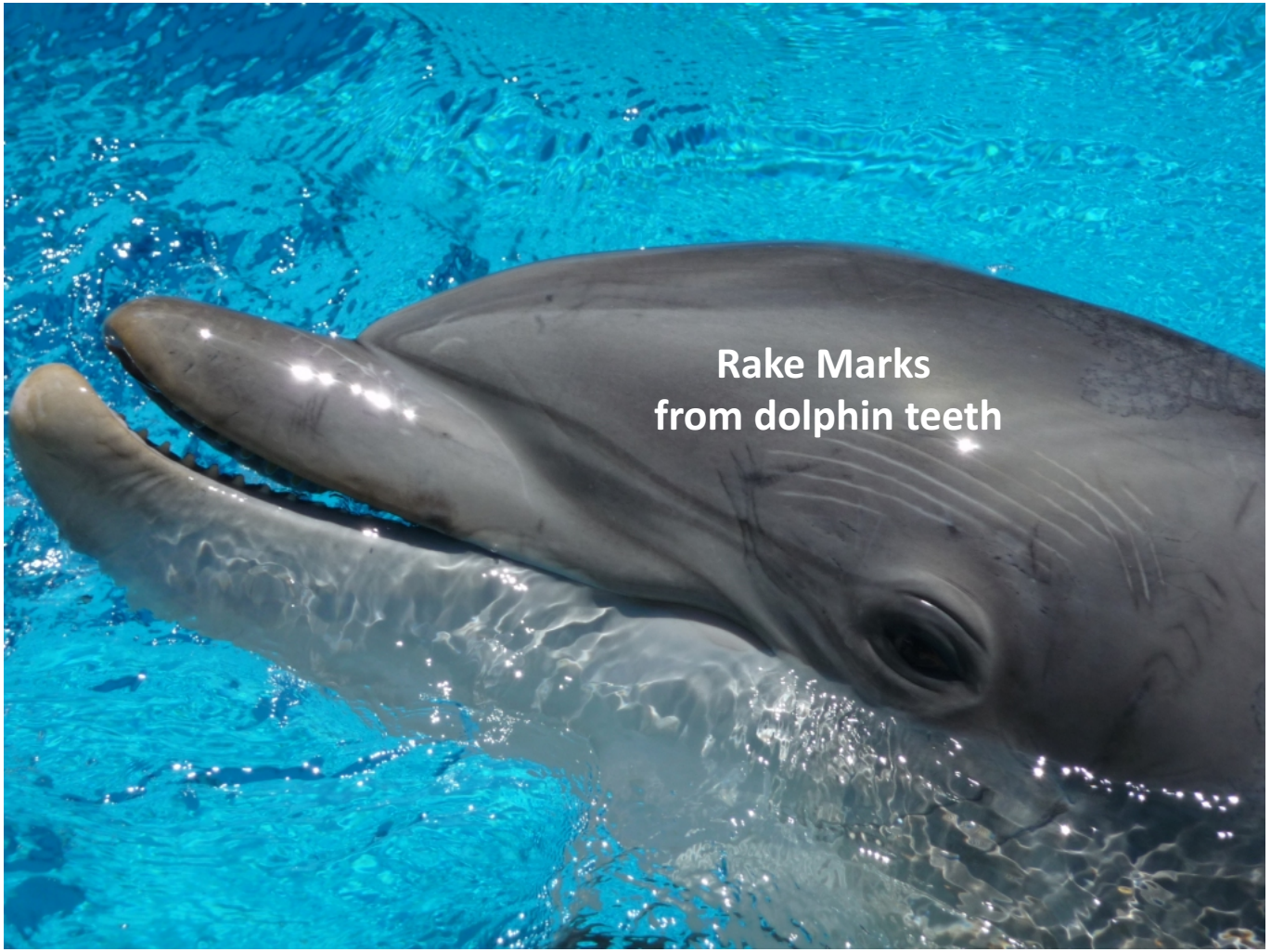
“Jaw Clap”

Snap jaw shut

>> Loud intense sound

Antagonistic

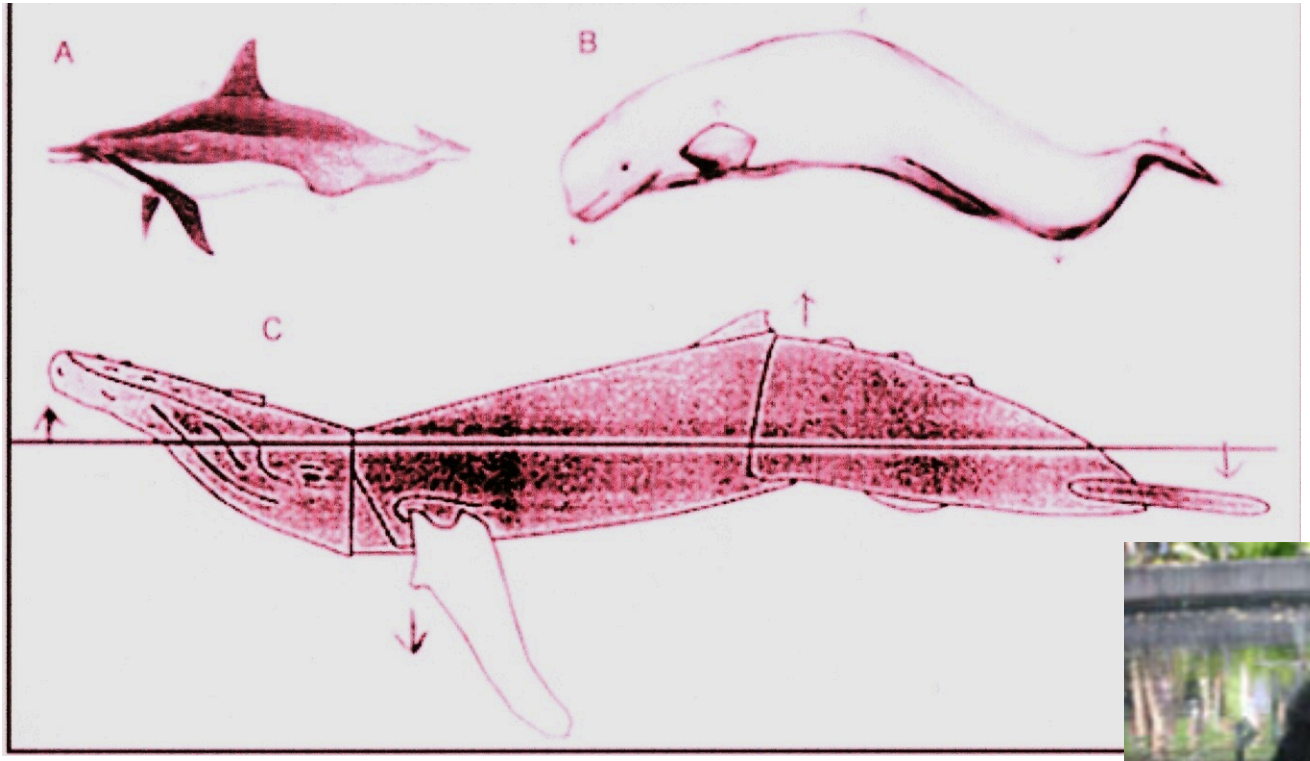
Sometime threats escalate into aggression



Antagonistic

”S Posture”

Also a threat...



Makes body appear larger

Like pilo-erection in furred animals

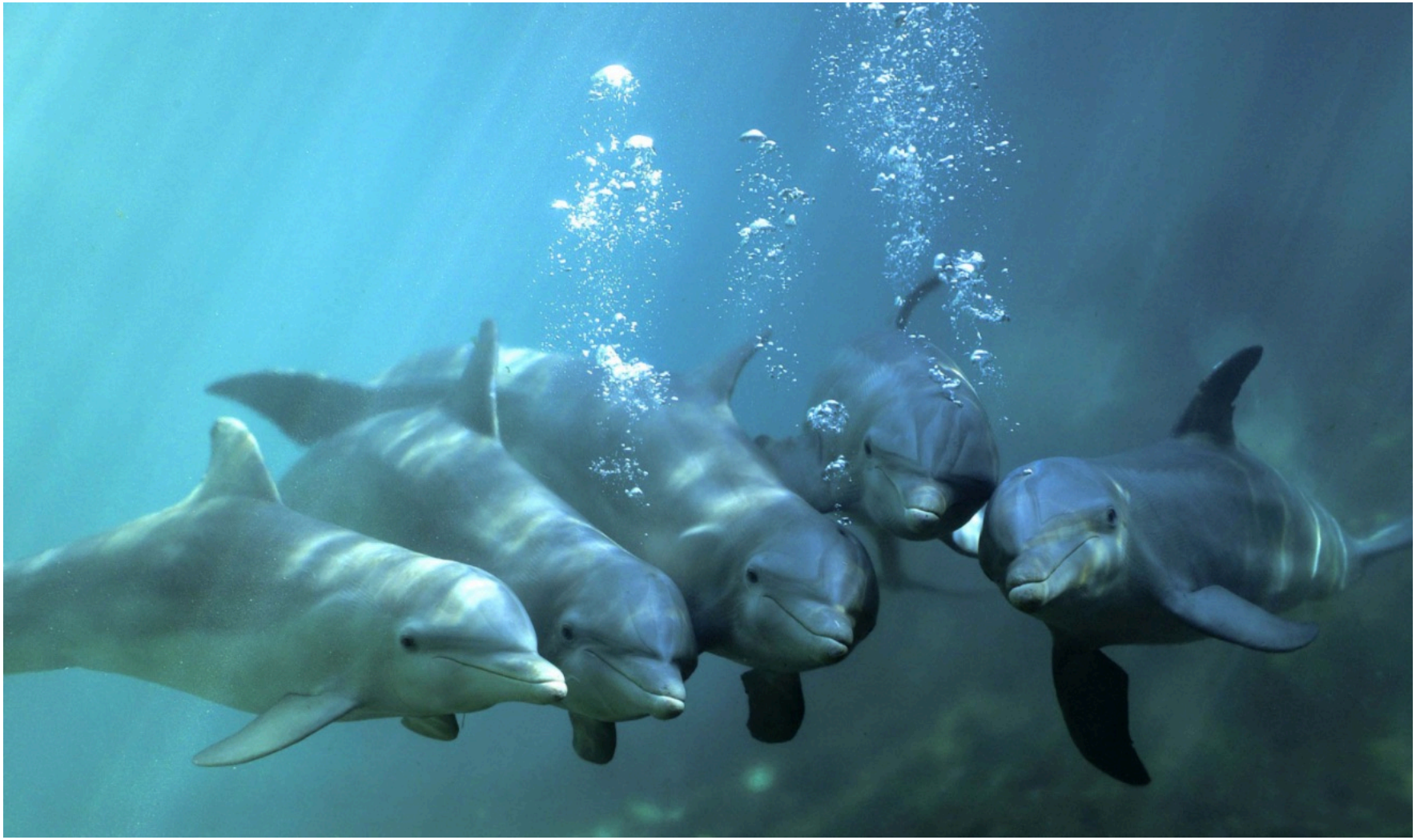
Antagonistic

S Posture + Jawclaps !

VIDEO

Antagonistic

Intimidating!



Antagonistic

Ecological Constraints

- Coastal (shallow water) animals can be more aggressive
  - If group splinters, stay local to habitat, <u>will</u> find each other again
  - (Note supports Fission/Fusion!)

- So, in Coastal species like Bottlenose dolphins, **beam pointing abounds**!

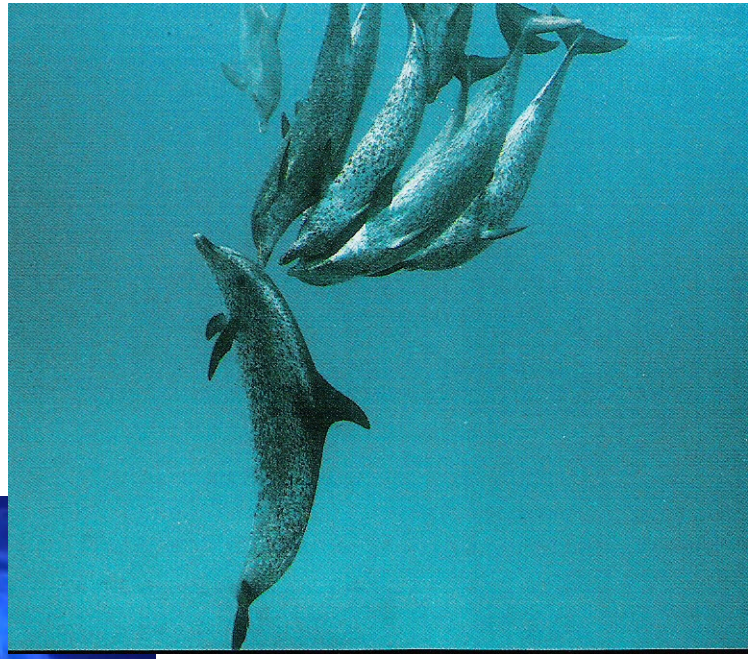
Antagonistic

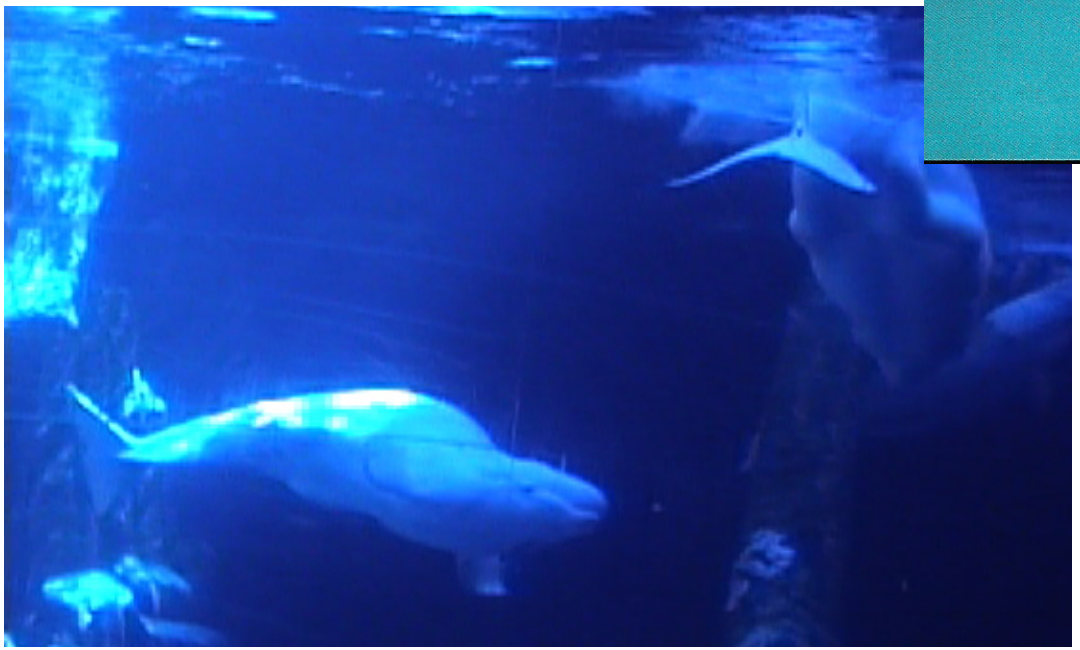
Ecological Constraints

In coastal species,

Perpendicular

more likely





Affiliative

Ecological Constraints

- So, in pelagic species like Spinner dolphins**, parallel is polite**.

Affiliative

Touch

High tactile sensitivity

Affiliative behavior often involves contact

Affiliative

Touch

No hands, but…

Pec Rub

Whetting Pecs

Affiliative

Reconciliation in Dolphins

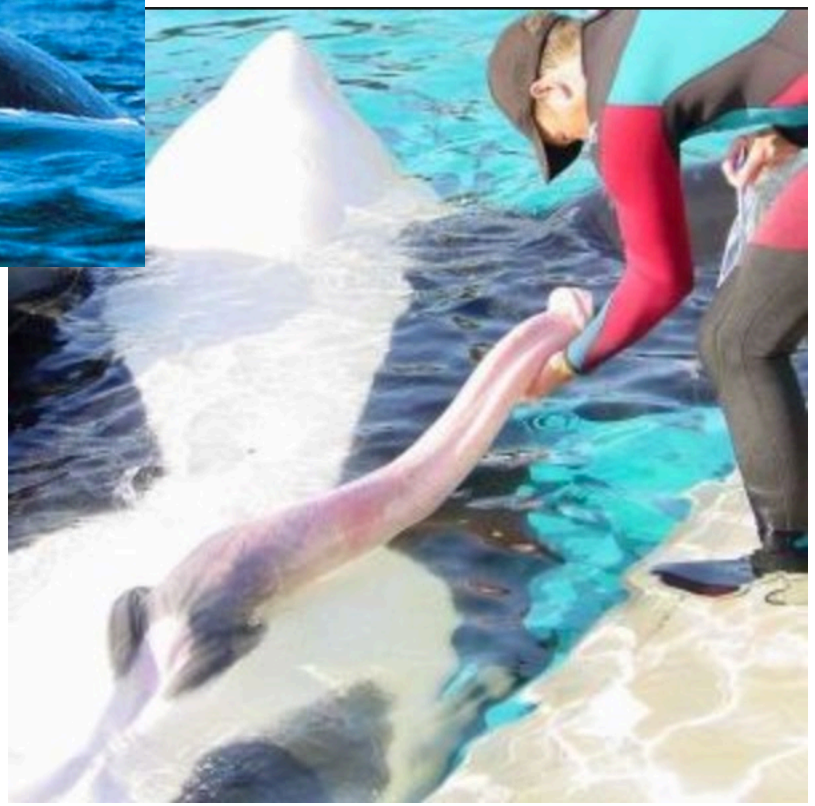
There actually IS some data!

See Weaver 2003

After aggression,
captive dolphins showed
increase in affiliative behavior

Affiliative

Sex



“Sea snake”

Affiliative

Sex

Requires cooperation, collaborative effort

Mounting

Occurs between males,
probably as a **dominance** behavior

Can even occur between
sympatric species

Affiliative

Affiliative postures include “belly tilt”

VIDEO

Affiliative

Most species are dark above, light below

Camouflage

Seen from below against light sky

Seen from above against dark depths

So, **tilting is salient** to
vision sensitive to high contrast & motion

Affiliative

And, since genitals are on underside,
tilting can increase/decrease other's access
during social interaction

Bubbles

Sometimes released
while whistling
- for emphasis?

But released in large burst,
indicates agrievation, frustration
Not ☺!

Visually salient, even from afar

Communication

Percussives

Using substrate

Communication

Percussives

Each leap makes
a particular sound
when it hits the surface

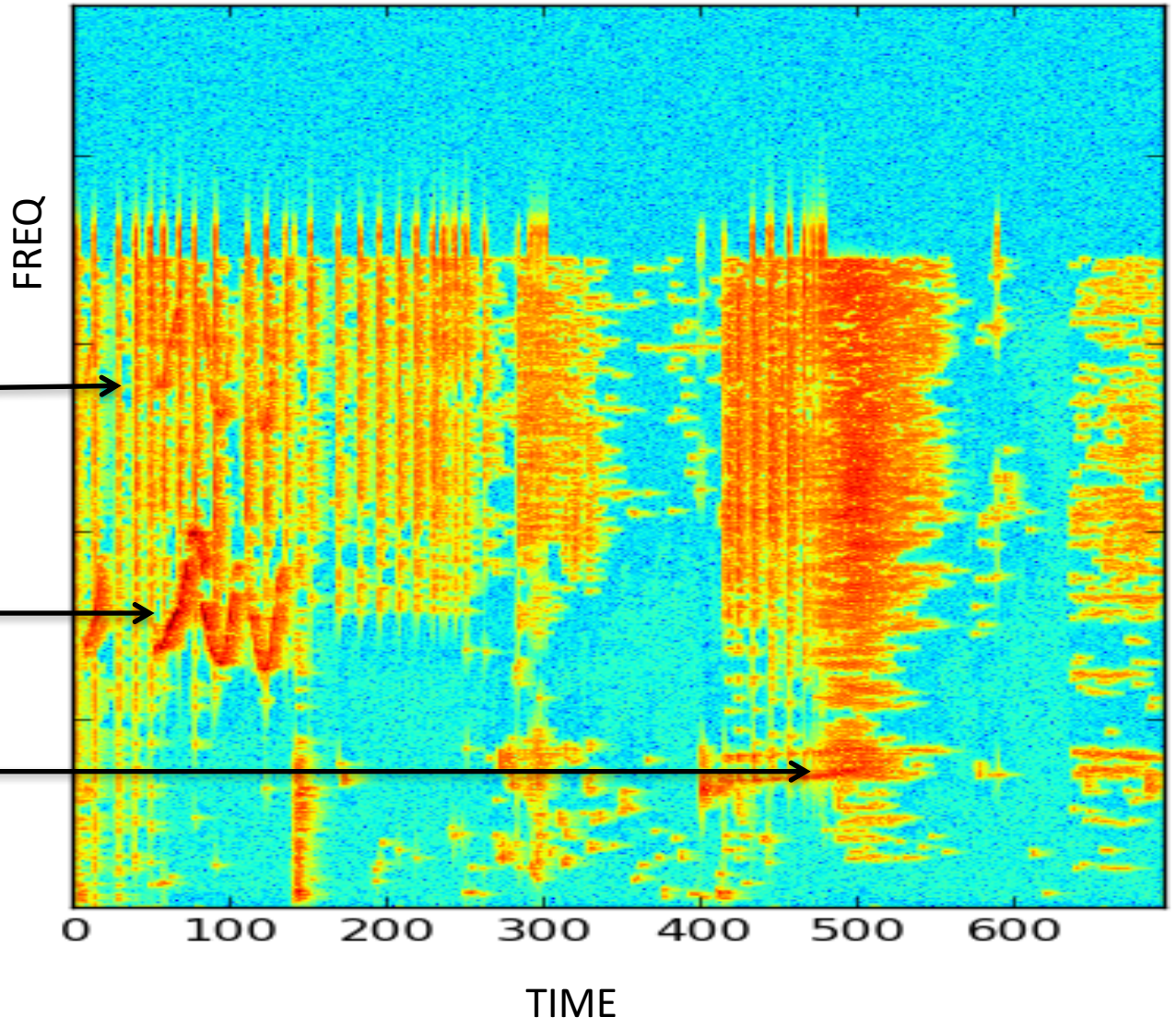
Part of RALLY
in Spinners involves
high arousal
aerial displays

Vocal Communication in Odontocetes

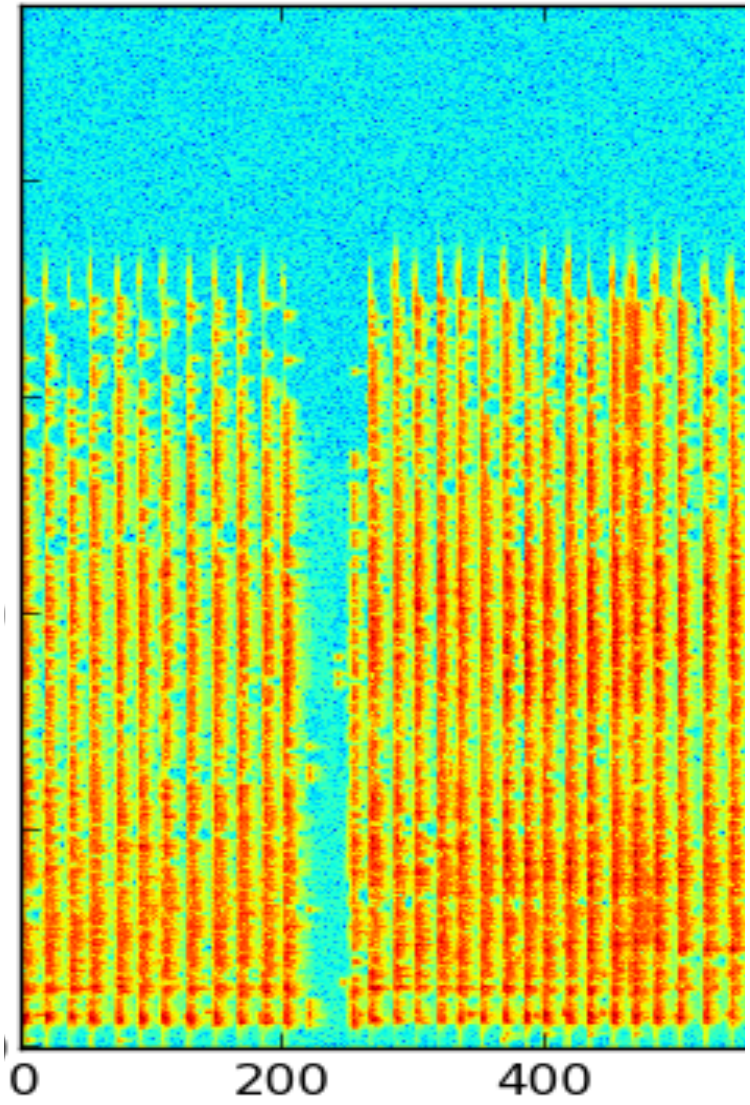
Their primary mode of communication

Vocal Communication in Odontocetes

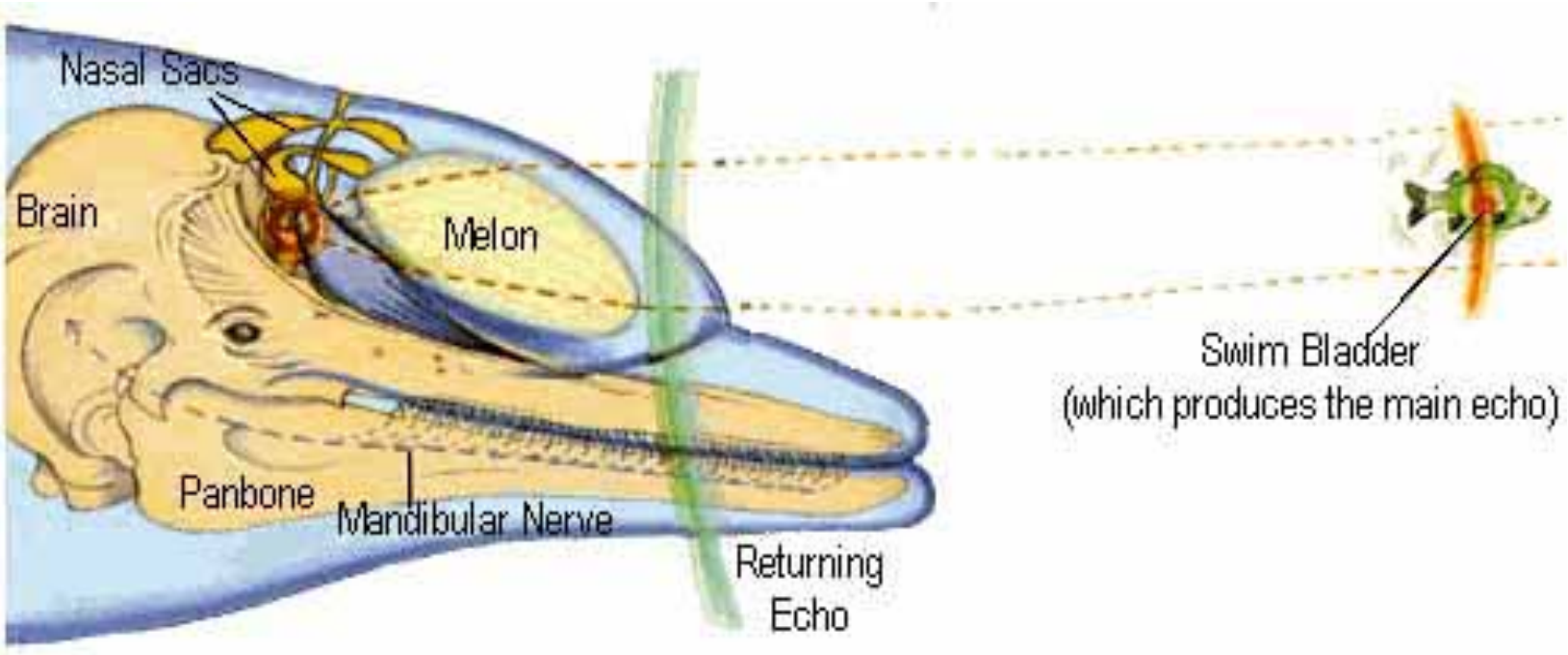
Multiple Classes of Calls



Echolocation Click Trains



All Odontocetes are specialized for Echolocation



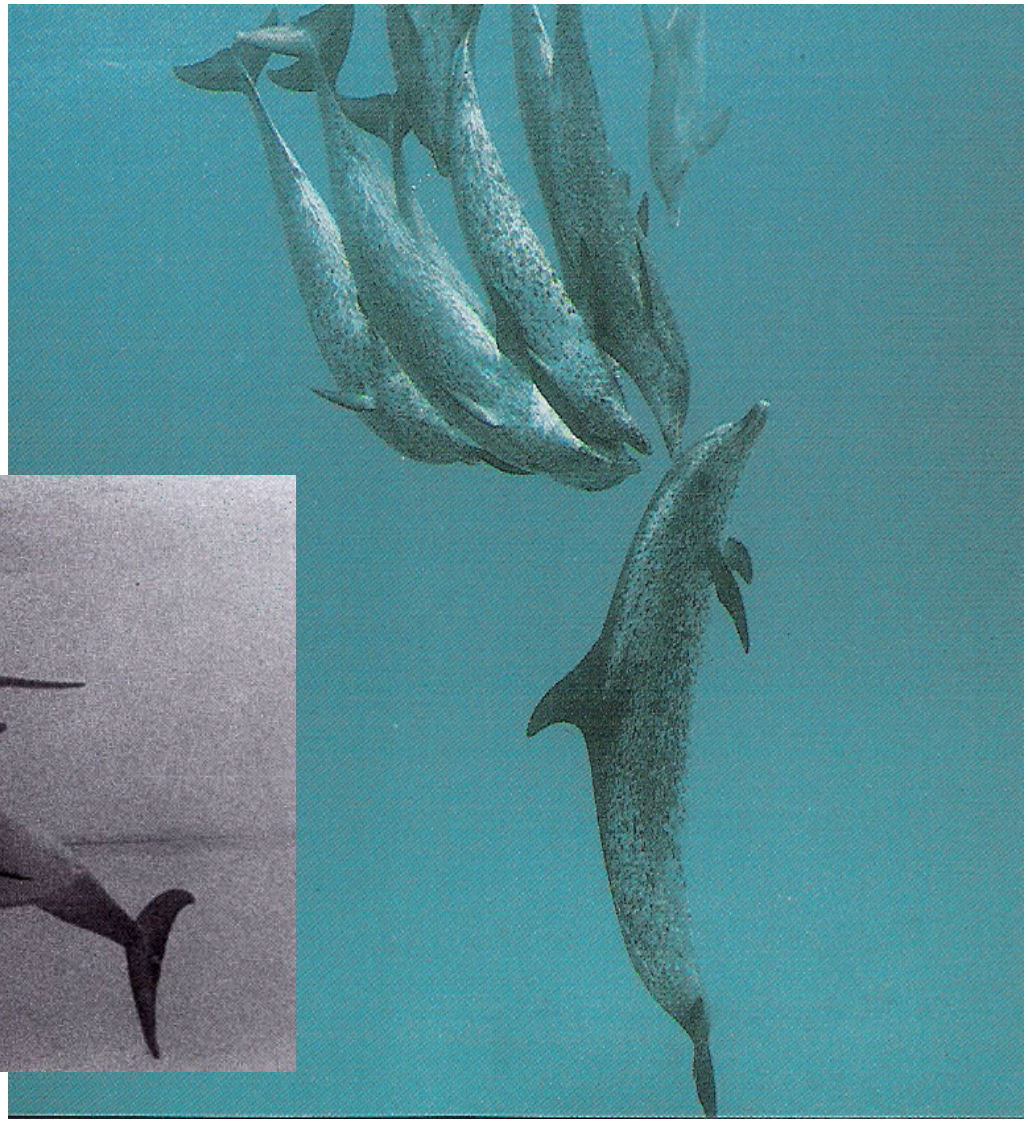
Echolocation

Echolocation also used to “inspect” internal condition of others

Communication

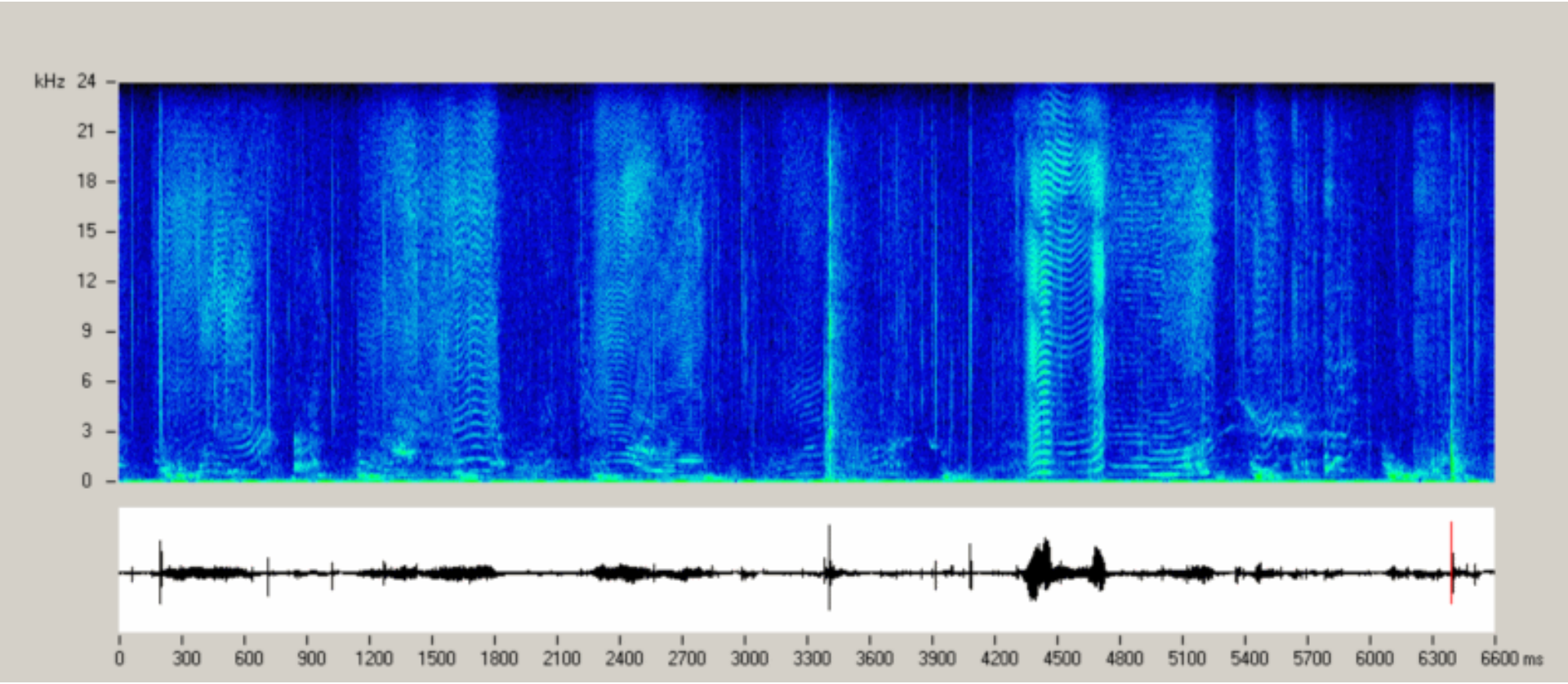
Tactile Impact of Sound

Use Tacto-Acoustics
in affiliative and agonistic
interactions



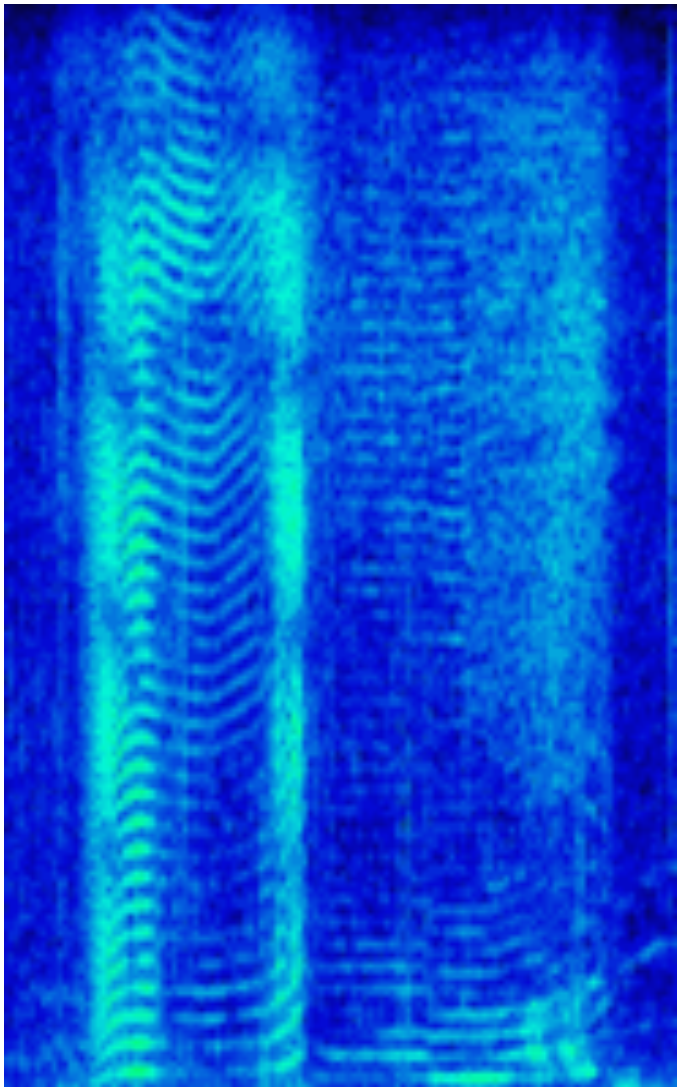
Communication

Burst Pulse Calls



A Mystery!!!

Burst Pulse Calls



Least well understood

"Emotional"? (Squawks, screams, etc)

Some more "conversational"...

High information content??

Tacto-acoustic aspects??

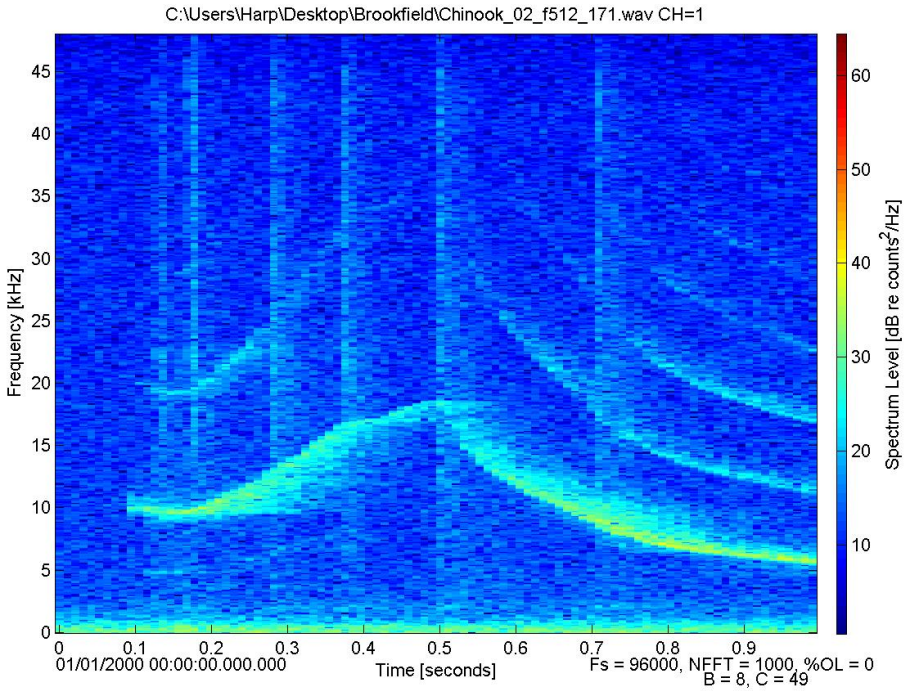
"Language of looks"??

- Perspective, focus of echoloc beam shows level of scrutiny, interest??

Communication

Whistles

Most common social calls,
Highly variable



Communication

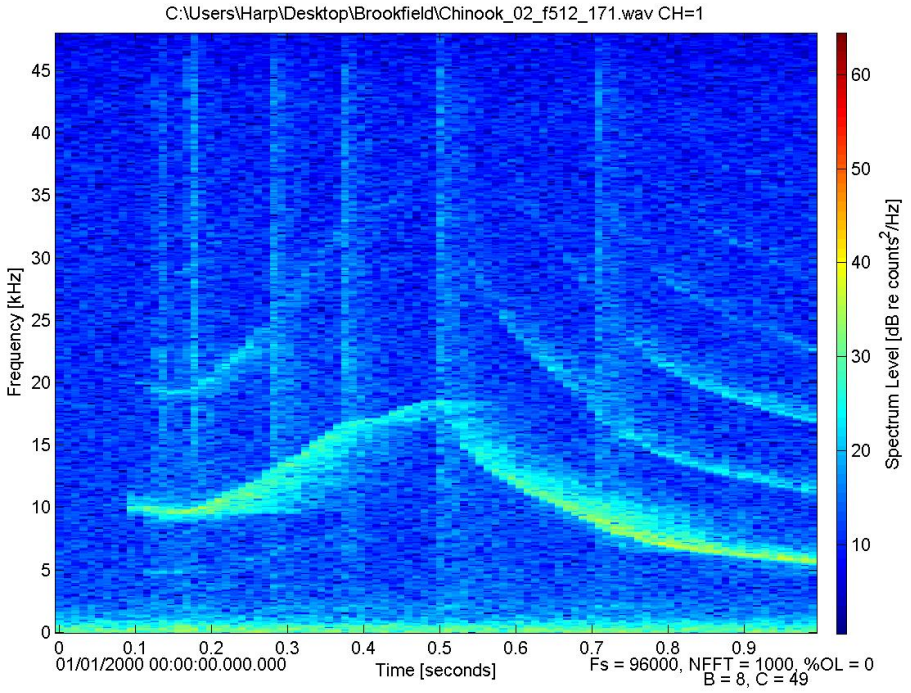
Whistle Chorusing

- Spinners CHORUS their whistles as they prepare to leave the bay together

Communication

Signature Whistles

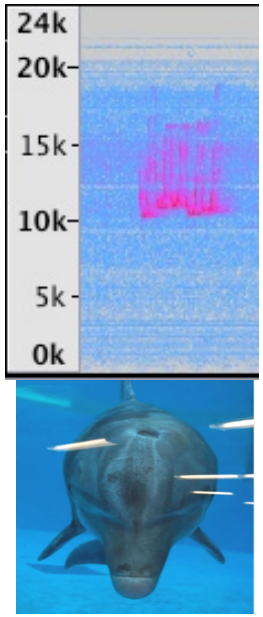
In many dolphin species, each individual has a distinctive whistle



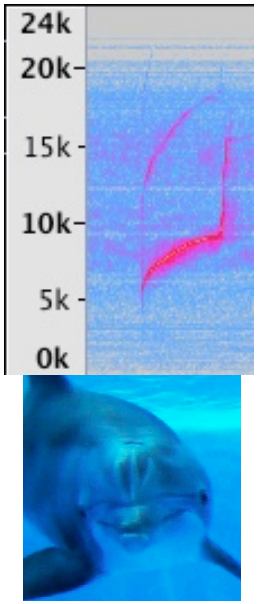
Heard when groups unite, while socializing & when individual isolated (e.g. captured)

Sometimes used by third parties…

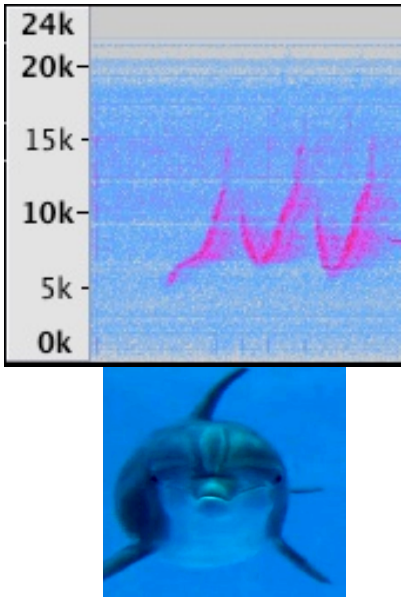
Signature Whistles



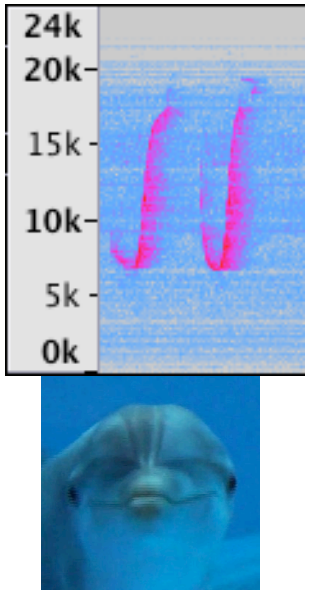
Chinook - ***Male***



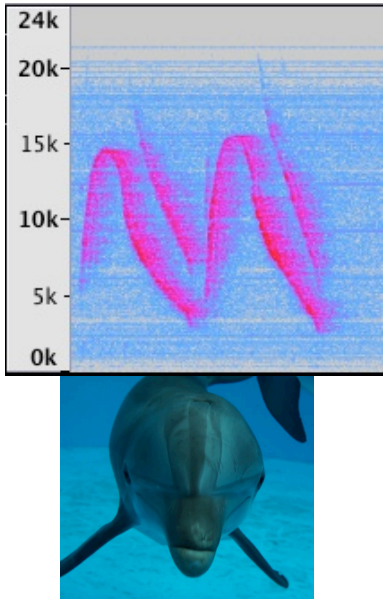
Allie - Female



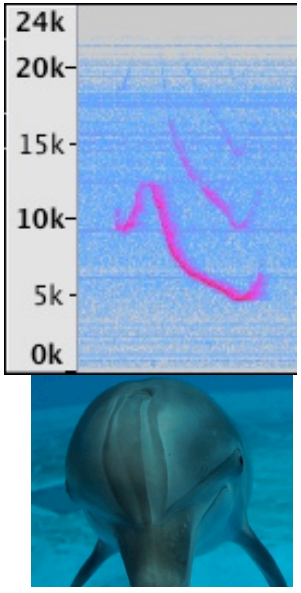
Tapeko - Mother



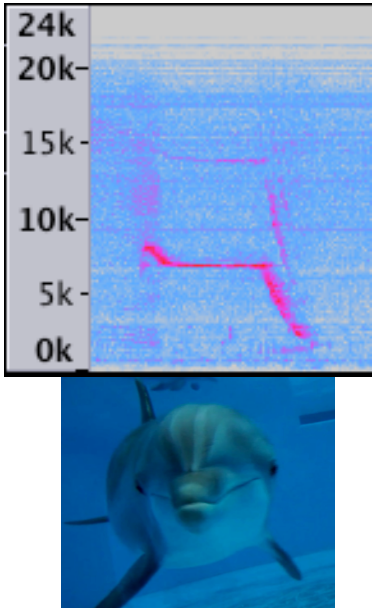
Allison
Younger Daughter



Tatum - ***Male***



Spree - Female



Noelani – Elder Daughter

Signature Whistles

Pregnant females radically increase Signature Whistle production during last weeks of pregnancy

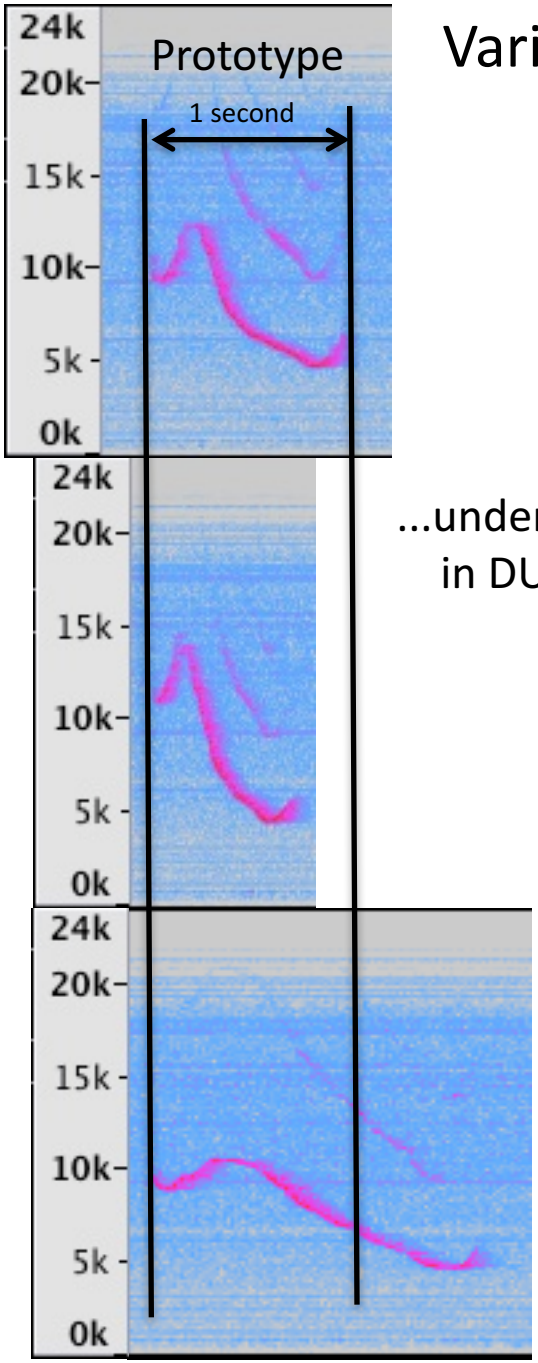
Infants are born knowing mother's Signature

Used as a "contact call", promotes reunions between mother & infant

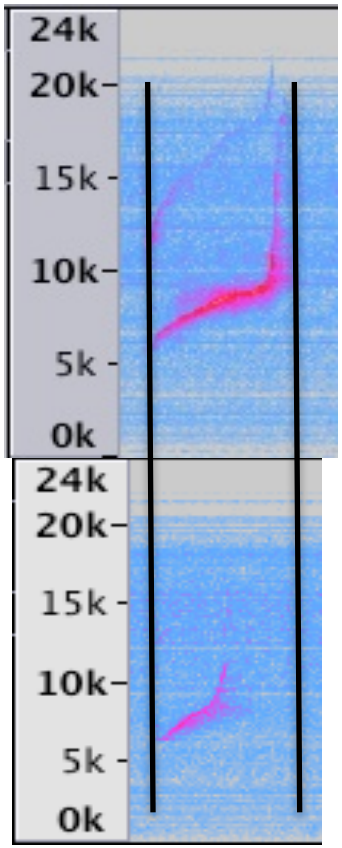
Many animals (e.g. pinnipeds, some birds) use "contact call", based on VOICE recognition

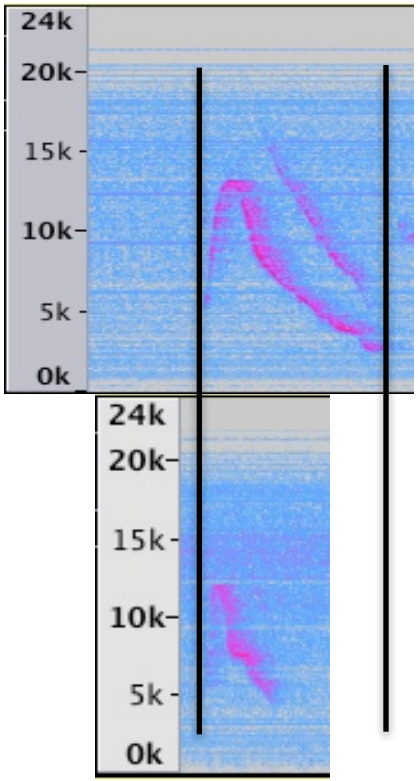
BUT, since changes in water depth alter voice, perhaps dolphins evolved signature contours

Variance, with Contour Preservation



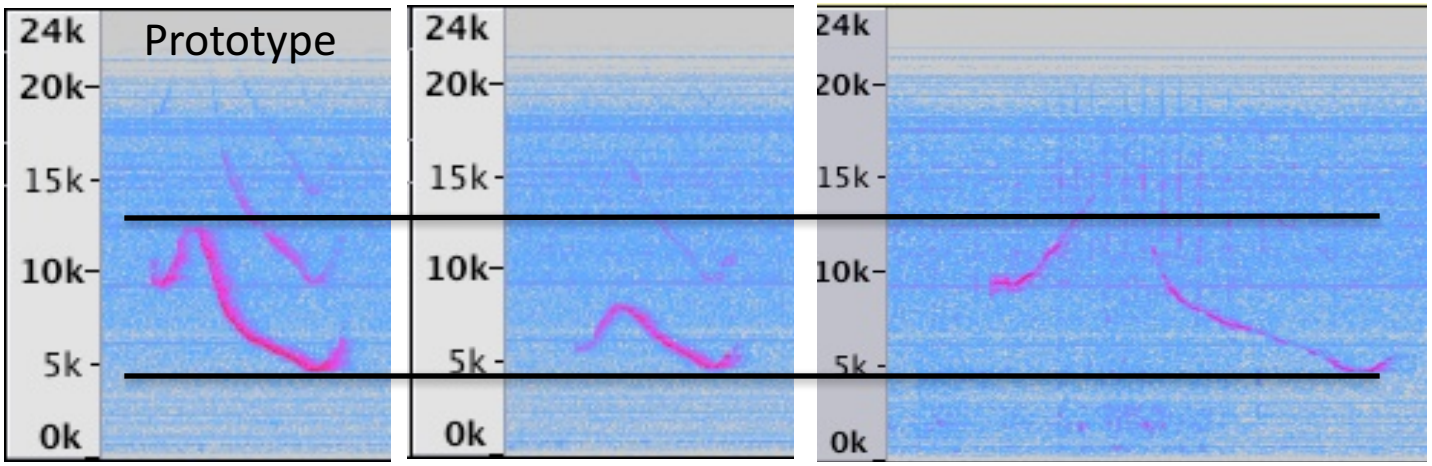
...under changes in DURATION

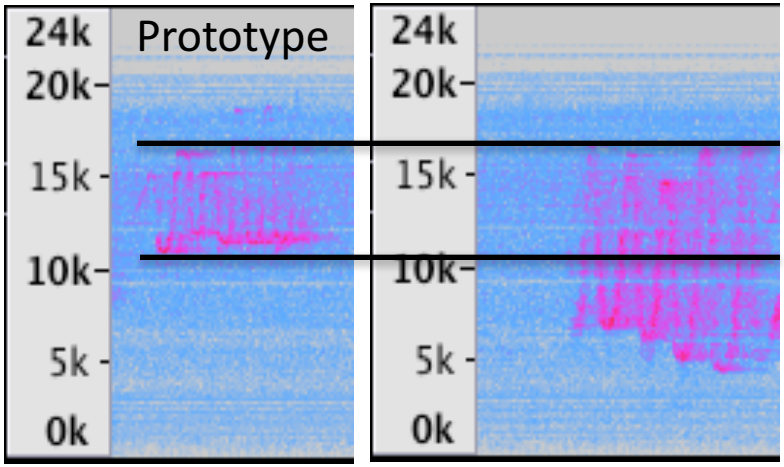




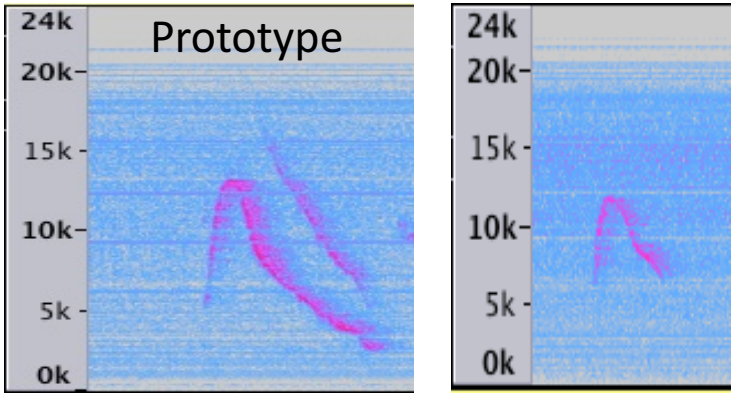
Variance, with Contour Preservation

...under changes in FREQUENCY RANGE

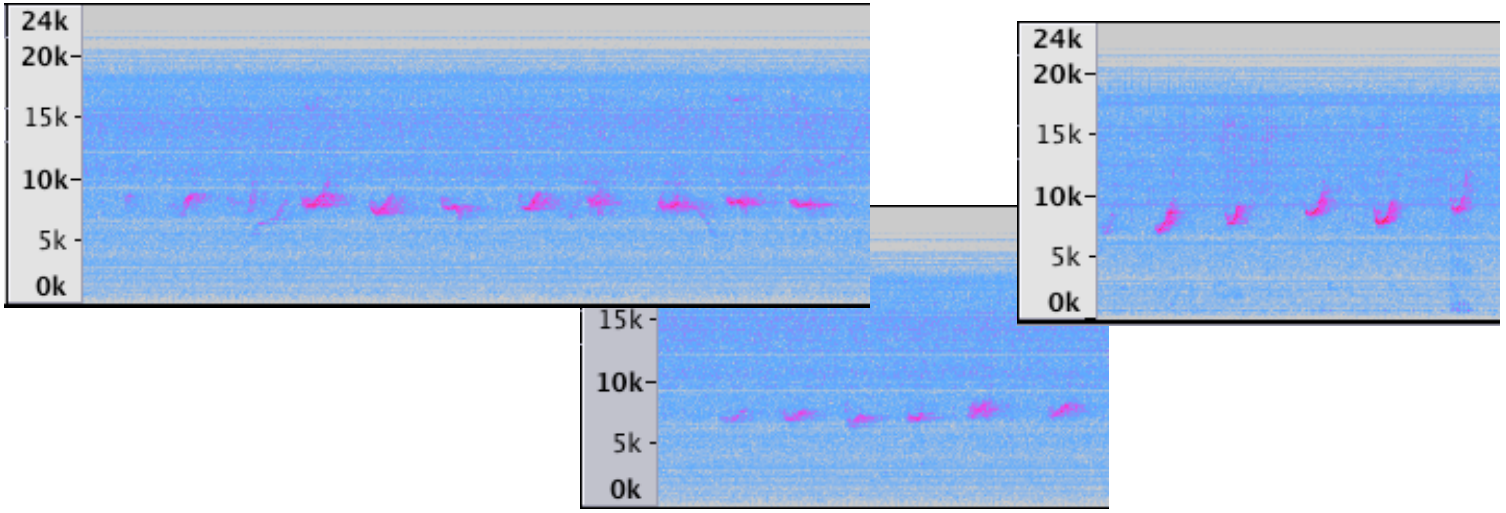


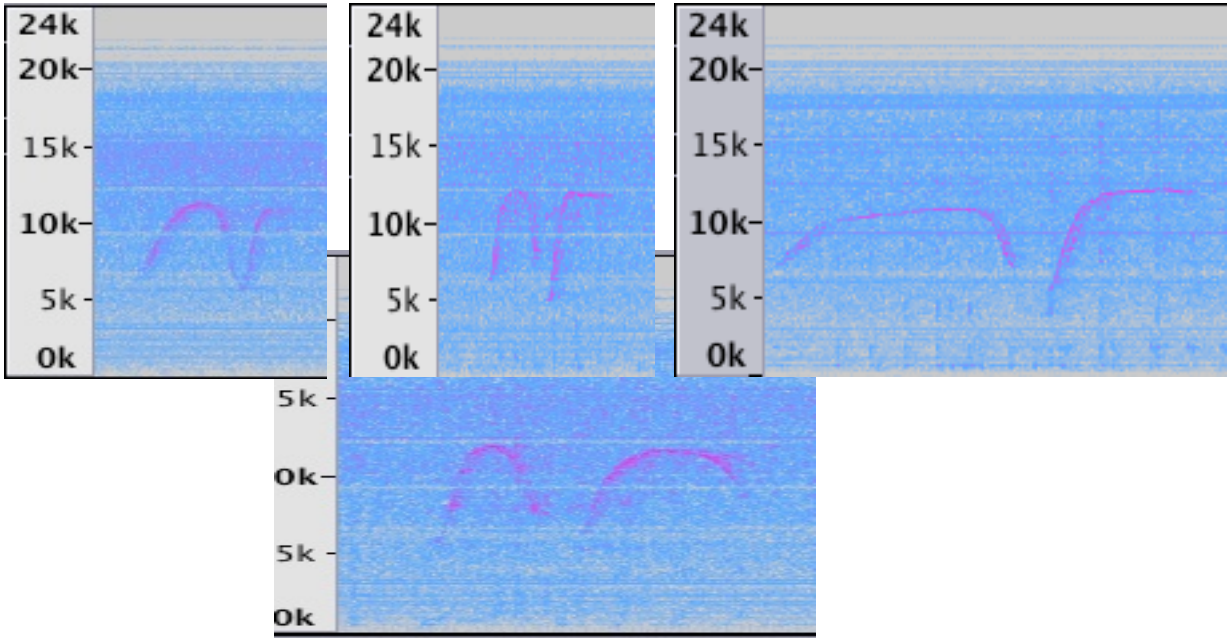


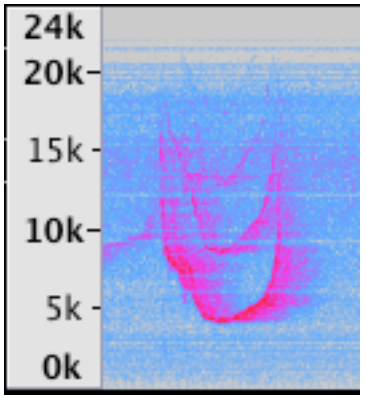
...or can rescale in both dimensions, producing “mini” versions



Many other repeated patterns, not Signatures

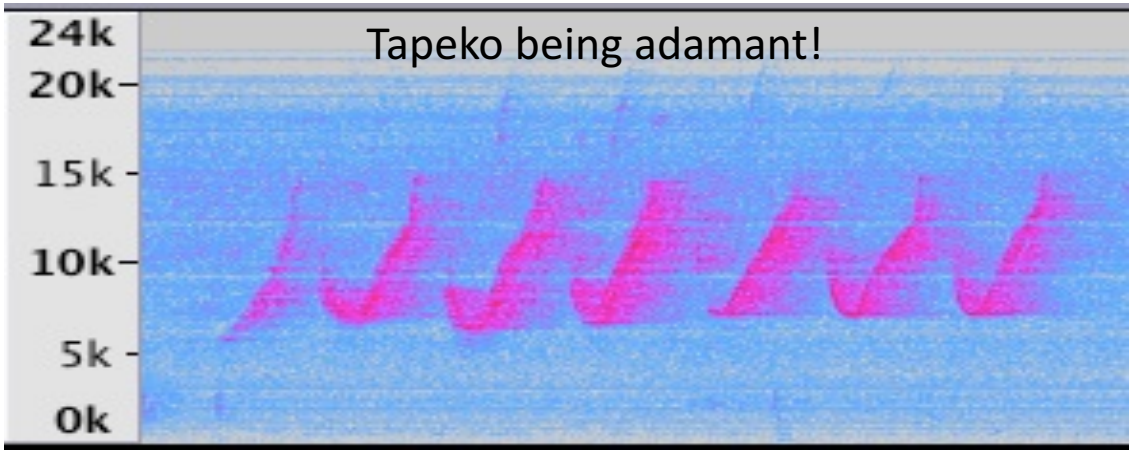


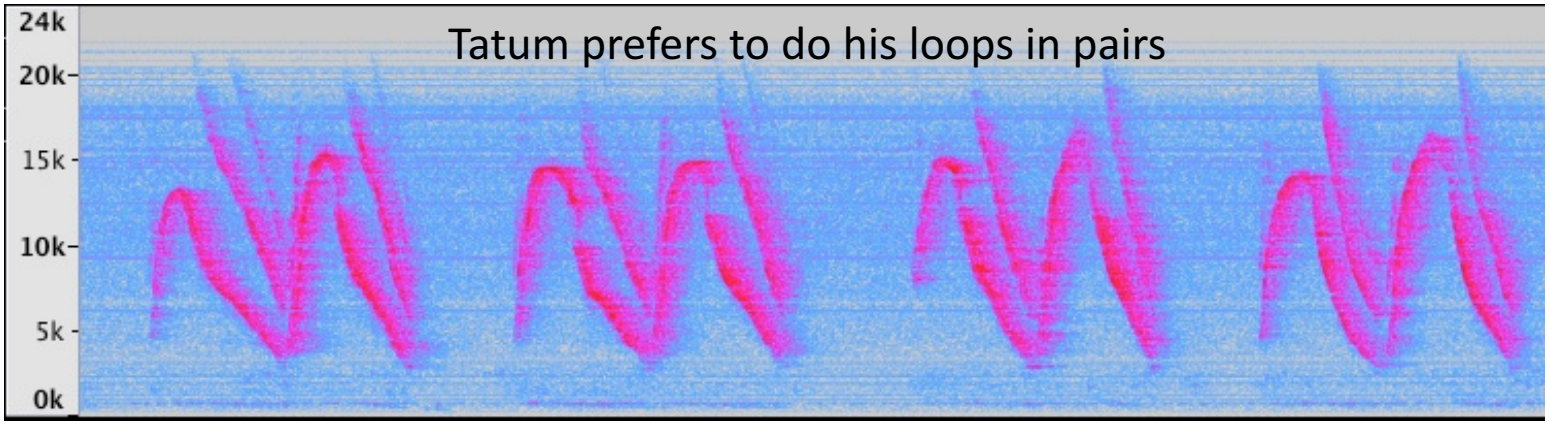




Looping

In lively exchanges, chorusing, dolphins often LOOP their signature

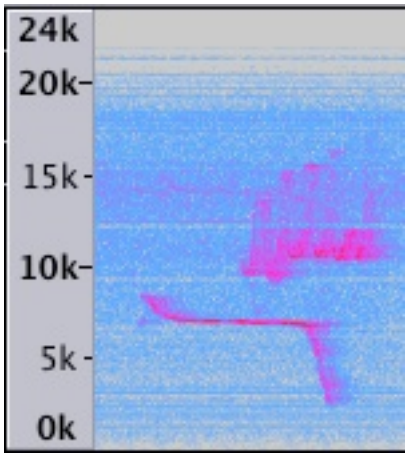




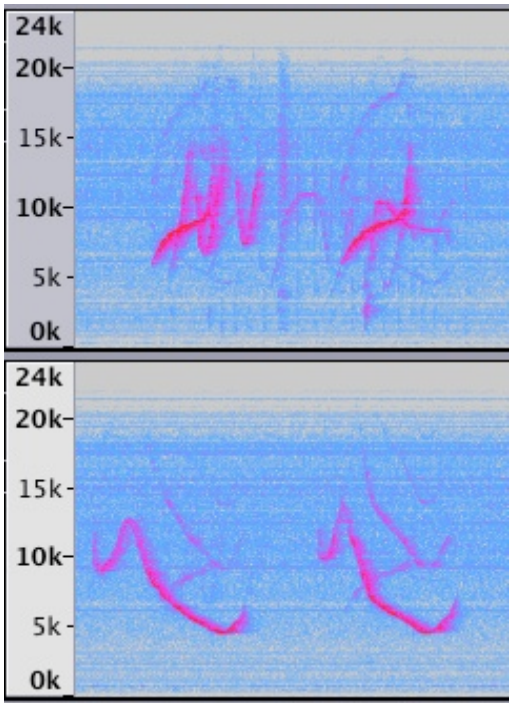
Answering and Call Matching

- "**Answer**" = Second call overlaps first, or begins w/in 1 second after
  - But overall, <u>answering is common</u>
    - Of 4,910 sig events, 2,140 (43.6%) were answers
  - In fact, 67% of sig events were involved in "**chorusing**"
    - Occur within 5 seconds of each other
    - As likely from same (47.5%)
      as different (52.5%) pool

Same pool

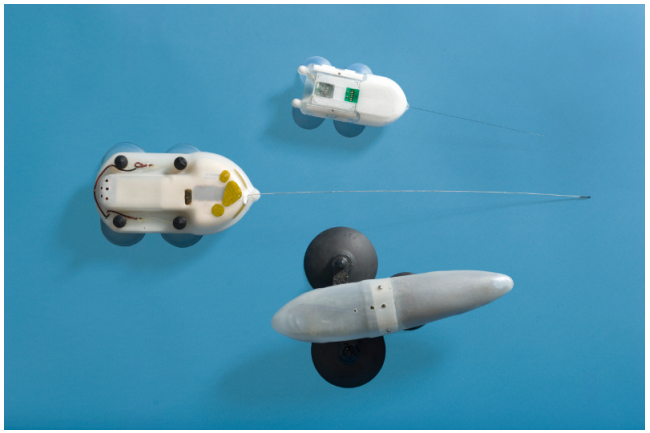


Multiple pools



Problems Studying Dolphin Vocalizations!

- We know so little about social functions of calls since so hard to identify speaker
  - i.e. Hydrophones, even arrays, cannot discriminate which of two side-by-side animals is vocalizing!
  - Need to attach “DTag” (Individual hydrophone) w/suction cups to each animal to study exchanges



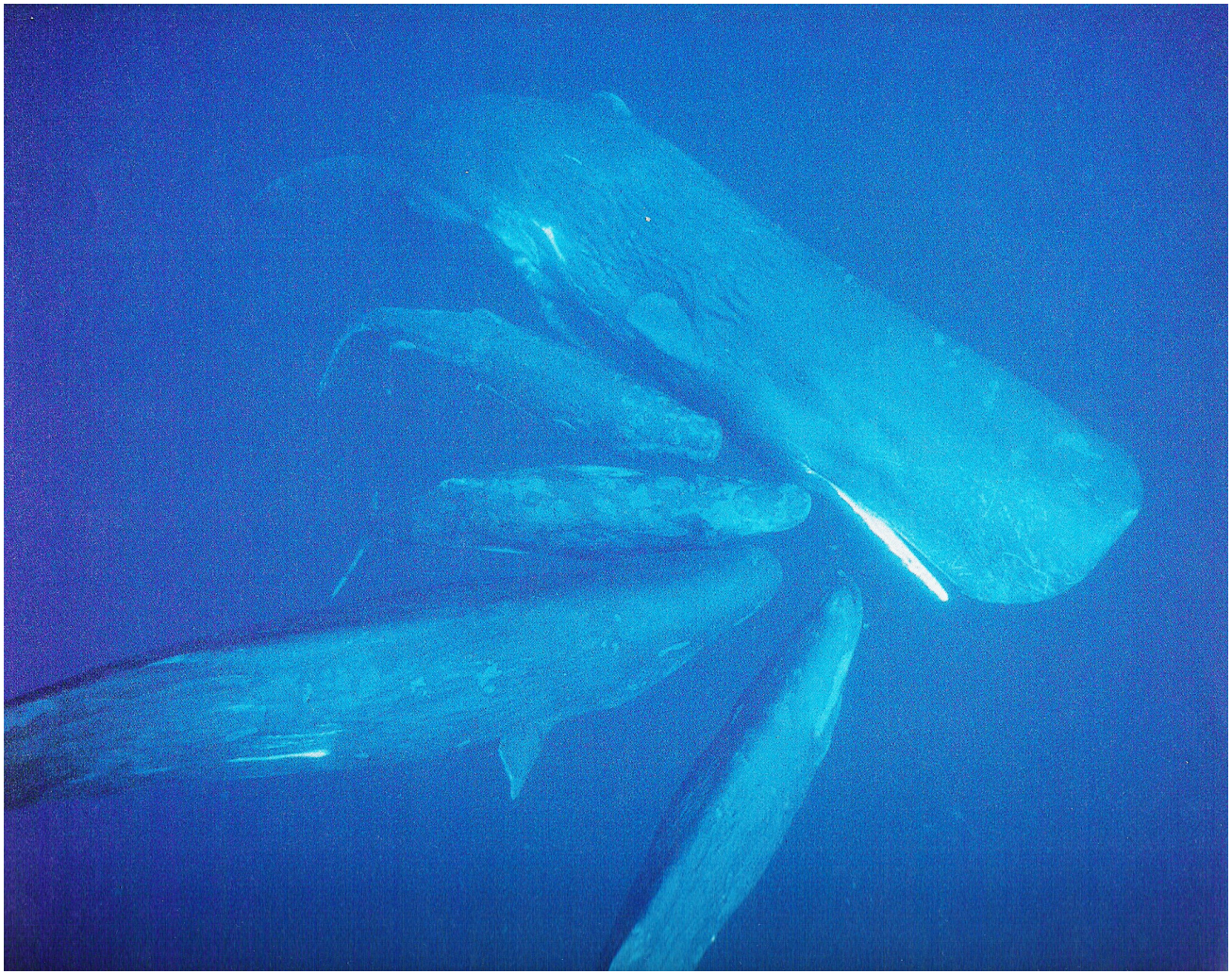
"Dialect Calls" in Orcas

Not whistles, but "burst pulse" calls

Not individual-specific, but
pod (extended-family), community, and region-specific calls

Sperm Whale “Click Codas”

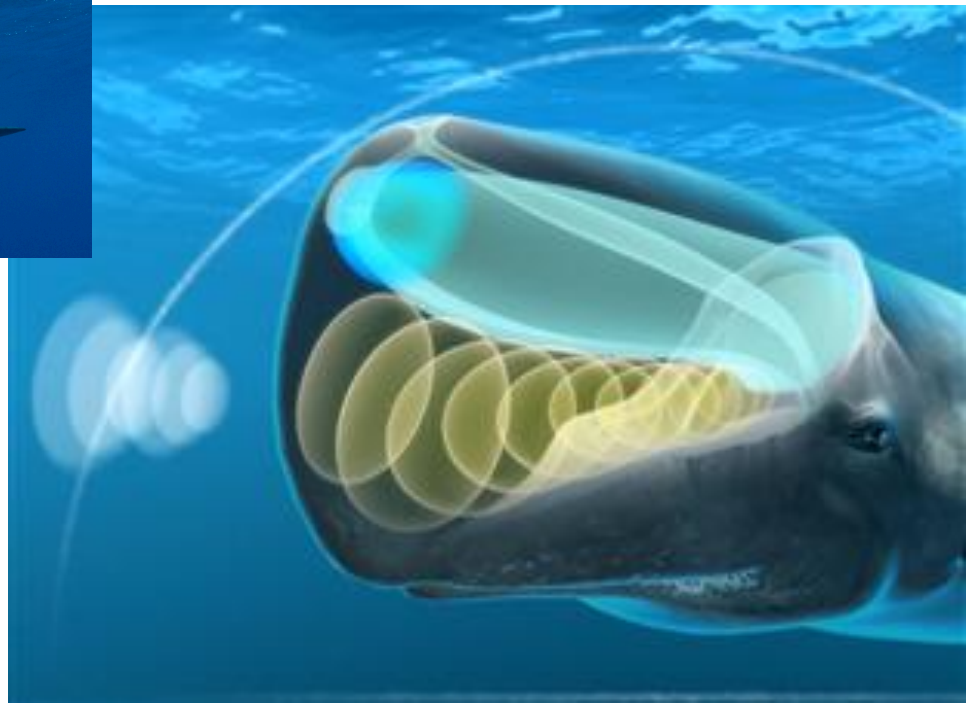
Group-specific click patterns



Sperm Whale “Click Codas”

Sperm Whale

“Codas” are patterned click sequences

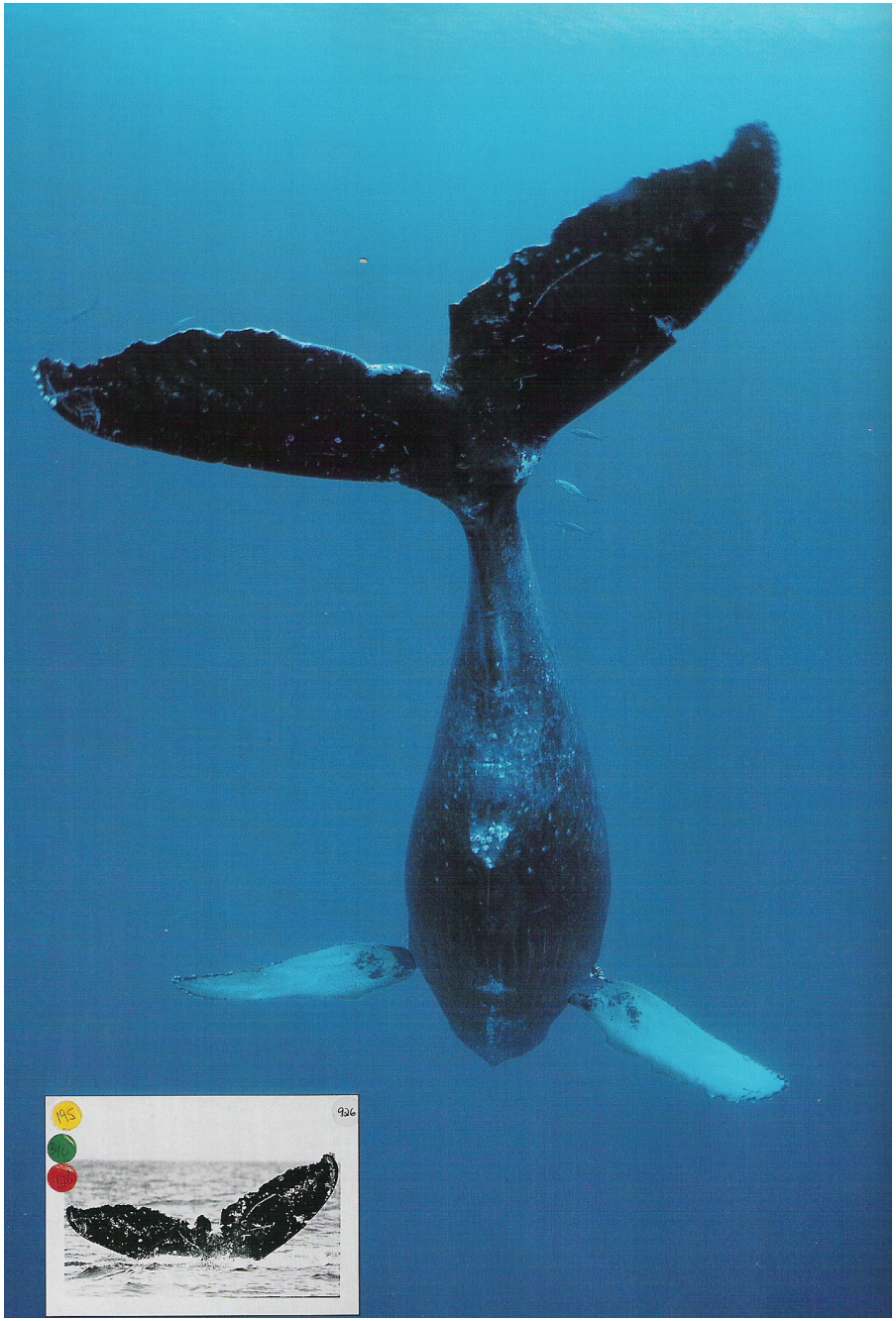


ID (Matrilineal) family, pod, community

Humpback Whale Songs

Includes
Mating Songs, like
that of the
Humpback Whale

Attract females
Repel males



Males hang head-down in water while singing

Creates an “acoustic territory” that spaces out singers

Humpback Whale Song –
A remarkable cognitive achievement