SHARKS: predators or preys ?

Elements of biology and conservation of sharks

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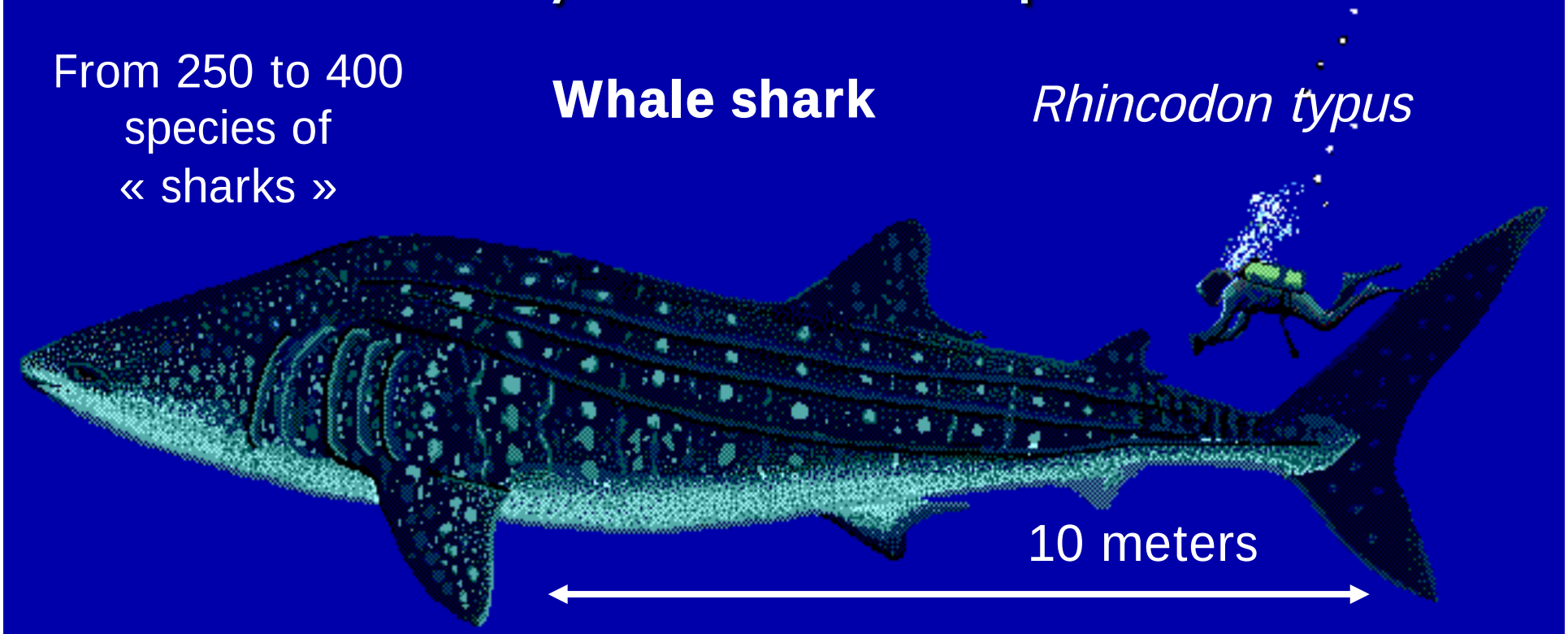
CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

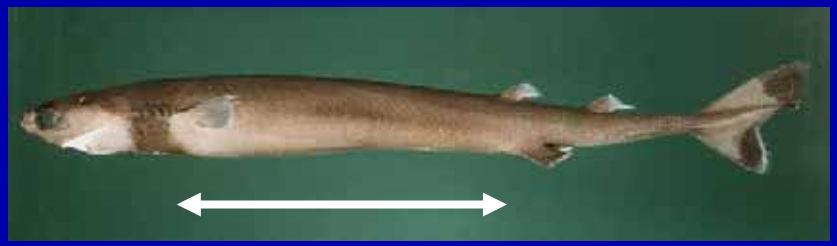
CRISP
Coral Reef Initiative for the South Pacific
Initiative Corail pour le Pacifique Sud

Variety of roles and species

From 250 to 400 species of « sharks »

Whale shark *Rhincodon typus*





10 cm

Cookie shark

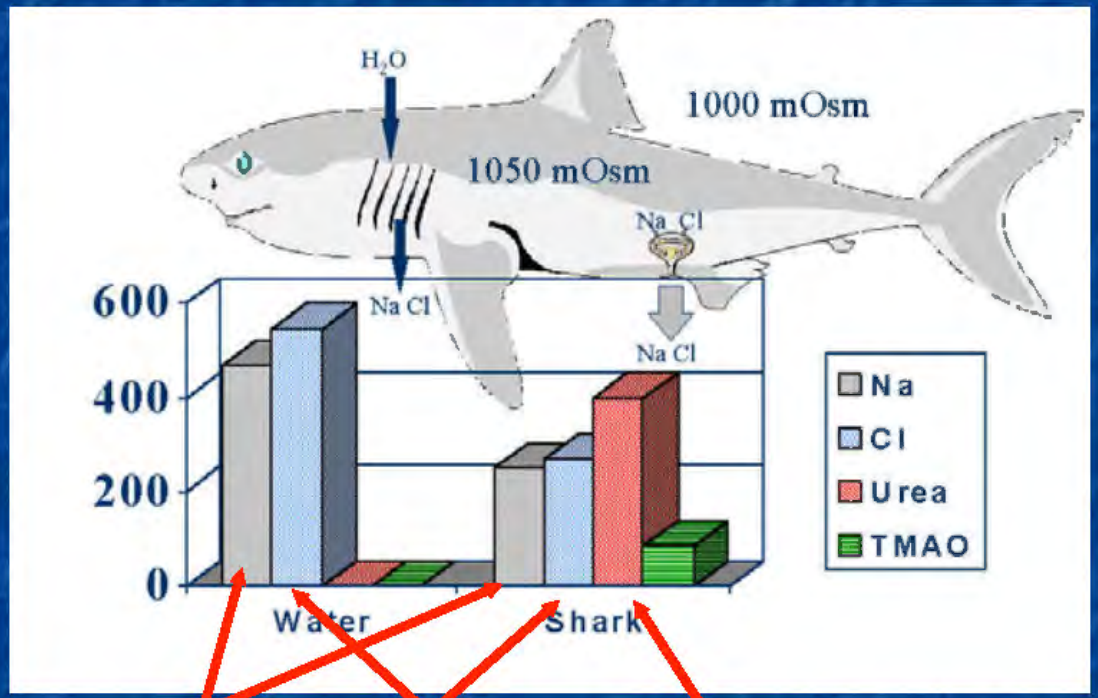
Isistius brasiliensis

Osmoregulation

WATER

Less concentrated → Most concentrated

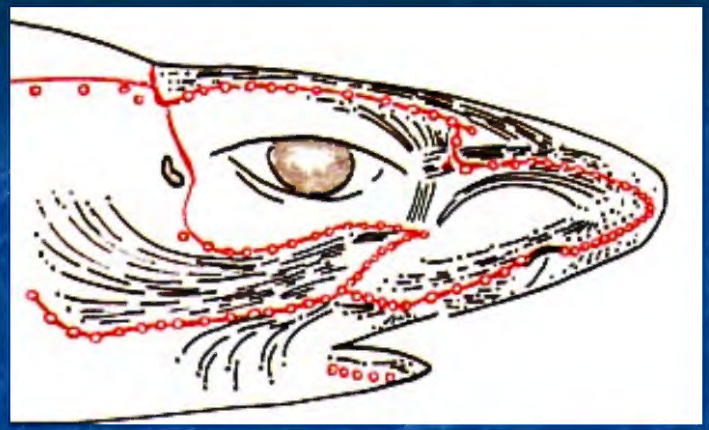
Primitive kidneys



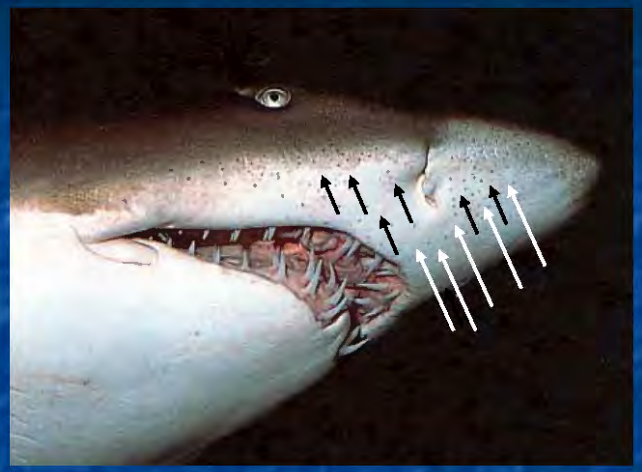
Na Cl Urea

Stinking meat → Low consumption

Electro-location = capacity to detect electric radiation



Lorenzini's devices



Audition = adapted for lows frecuency waves

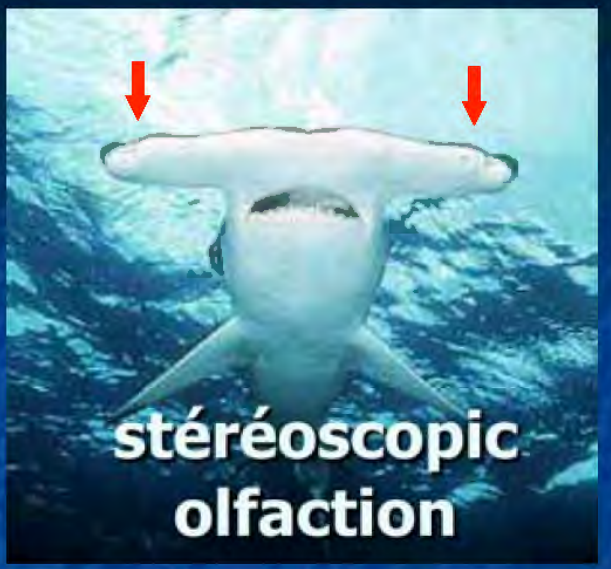
Speed of propagation underwater = 5 times x air (env. 1500 m/s)

Distress = Low frecuency emissions + higher electric activity

Odorat - «the nose of the sea»

Mammal blood = 1 ppm

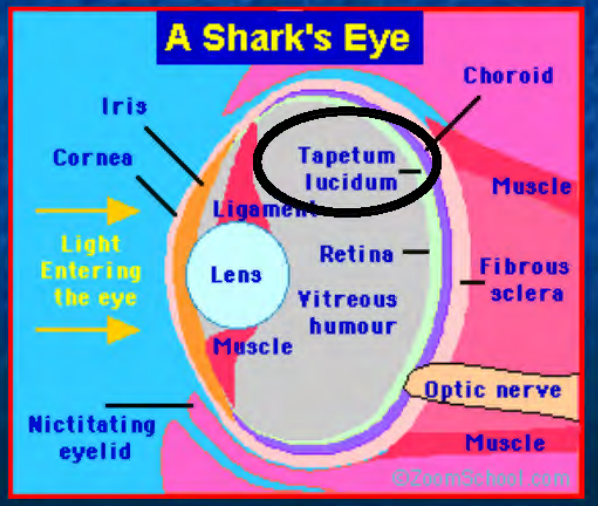
Tuna extract = 1 pp 4 m



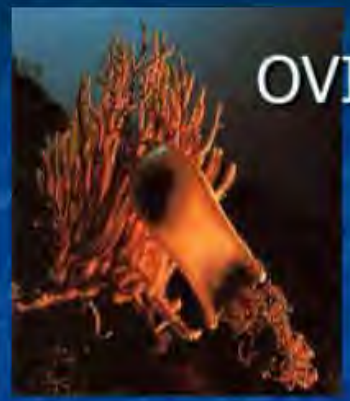
Vision - medium/adapted

Nictitating membran

Tapetum lucidum



Reproduction - diverse but not performant



OVIPAROUS

Ex.
R. léopard,
Roussette,
etc.

Oophagy,
cannibalism

OVOVIVIPAROUS

Ex.
Whale s.,
White s.,
Tiger s.
etc.

VIVIPAROUS

Ex. Grey s.,
Hammerhead
s., Lemon
s., etc.

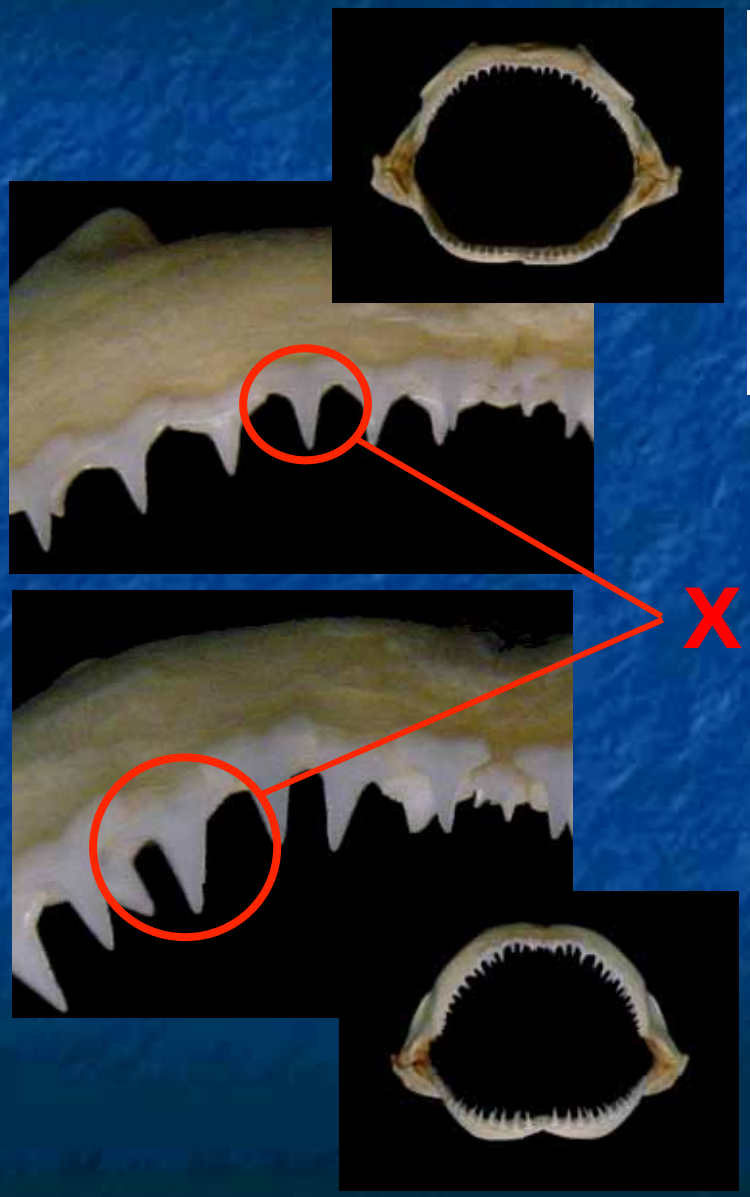
Exemple of Tiger shark

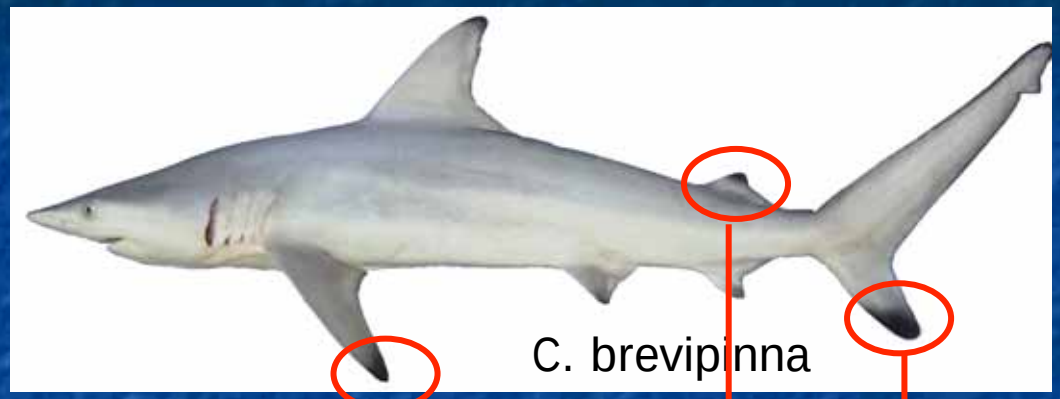
Tiger shark *Galeocerdo cuvieri*

- **max. size 7,4 mètres**
- **max. age >30 years**
- **Age at maturity: around 10 years (3 meters)**
- **Total duration of pregnancy: 13 to 16 months**
- **Phase 1: eggs in the matrice (50 embryos)**
- **Phase 2: development during 9 months**
- **Cannibalism, natural deaths = around 10 juv.**

Ecosystem: 20 years to replace a tiger shark

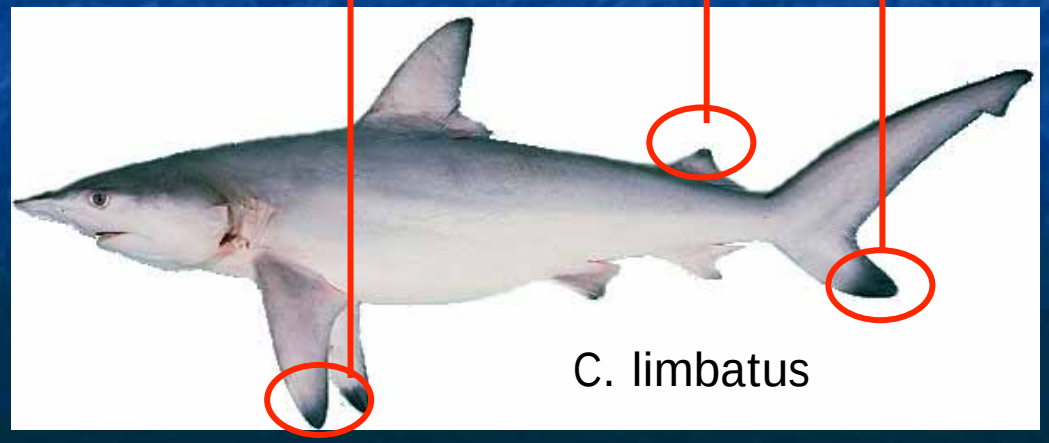
Interspecific similarities





Requin tisserant

Requin bordé

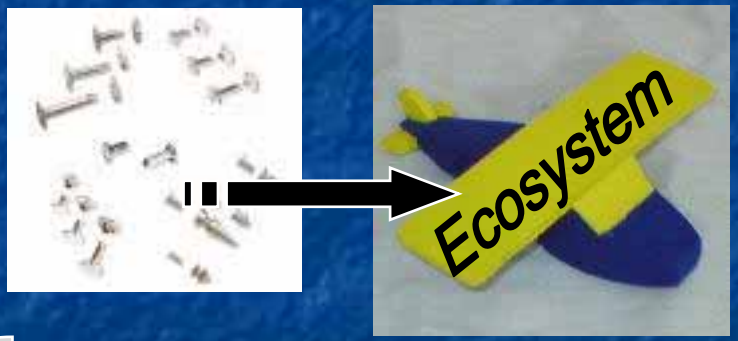


Key knowledge on ecosystems stability

Species play diverse and complementary roles

Species diversity and stability are correlated

Theory of the
« rivets »

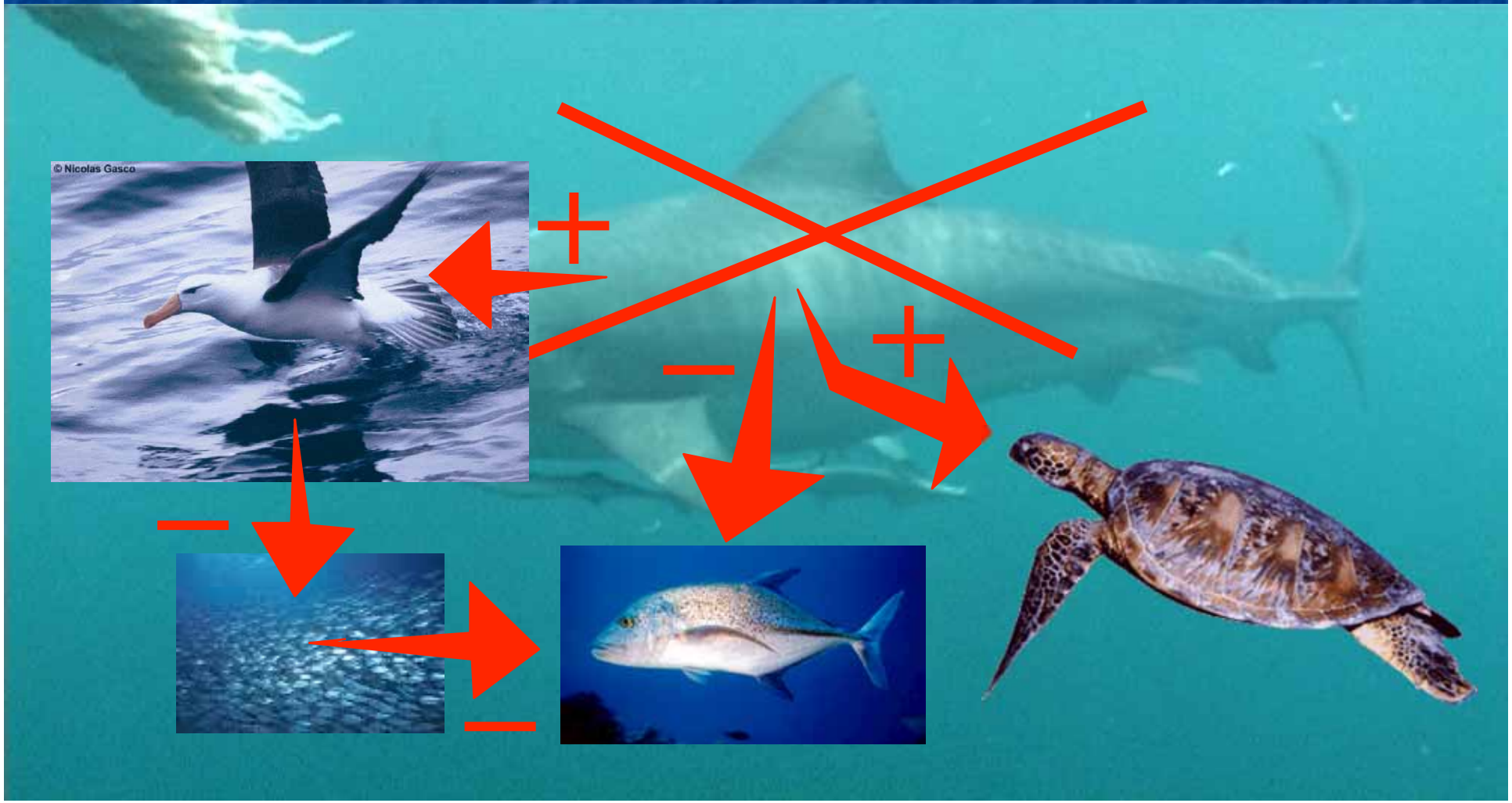


Theory of the
« driver and the passengers »

Hybrid theory

Role of sharks in the ecosystem

Scientific publication: Stevens, J. D. et al. 2000. The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems. ICES. Journal of Marine Science, 57(3), pp.476-494.



Overfishing

> 50,000,000 fished sharks per year

Scientific publication: J.K. BAUM et al., 2003. Collapse and Conservation of Shark Populations in the Northwest Atlantic. Science. Vol. 299, pp. 389-392.

Since 1986, drop in stocks:

Hammerhead sharks = 89 %
White shark = 79 %
Tiger shark = 65 %
Blue shark = 60 %
Mako shark (« sea calf ») = 49 %

Since 1992, drop in stocks

Coastal sharks (*Carcharhinus sp.*) = from 49 to 83 %

Economic valorization of sharks

Liver: vitamine A, squalène
Cartilageous: anti-arthritis
Skin: leather

Few consummed species excepting Mako shark and Dogshark

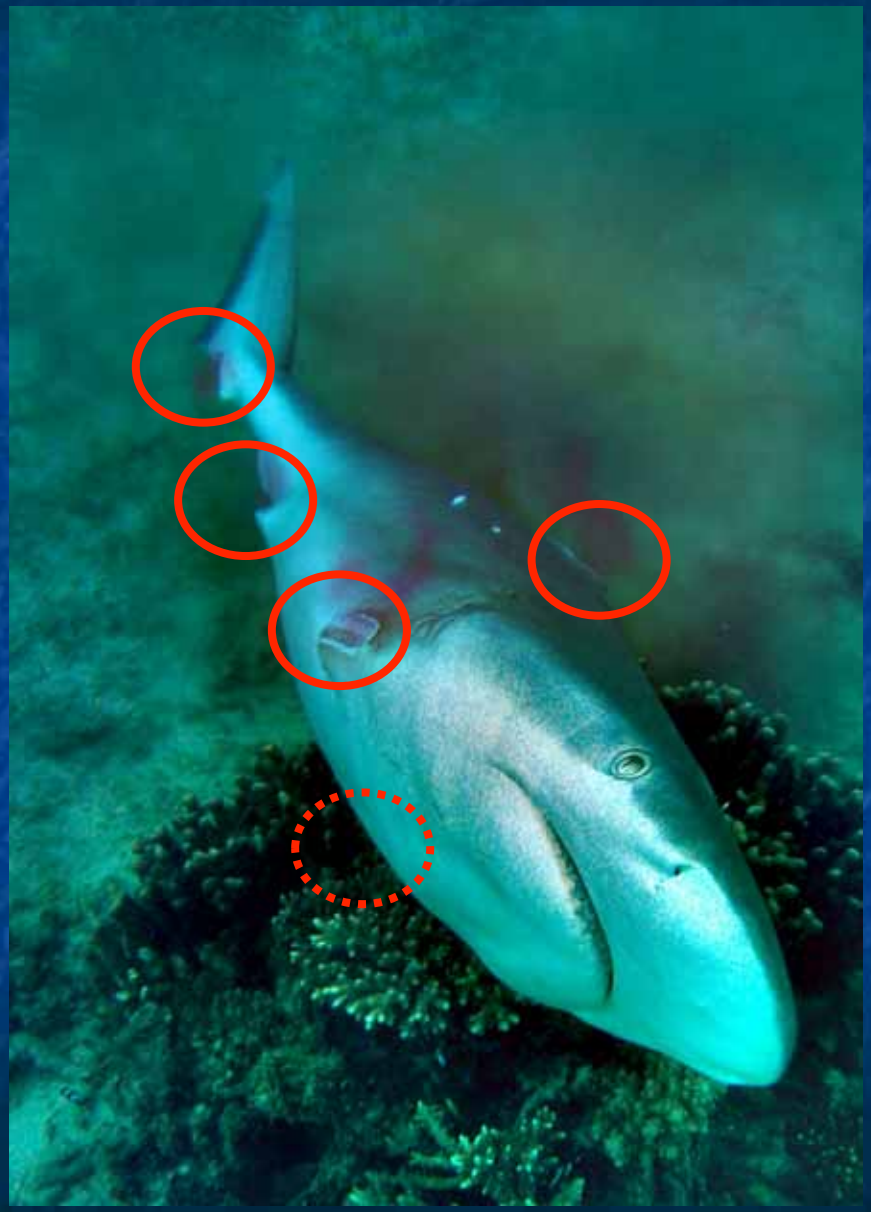
Speciifc demand on

FINS

For fin soup

No aphrodisiac purpose

« Shark Finning »: unacceptable technique



= Removing of all fins, including caudal fin

Sharks dropped back in the water still alive

Reason : economic rentability to make space on bord (boats)

Increasing demand on fins

Hong Kong Exportations x13 since 1980 (> 4000 tons end of 90s)

Development of specific fishing

Increase of the catches in Hawai by 2000% between 1991 and 1998 (source: Ocean Wildlife Campaign)

Waste: fins only represent <5% of total weight

Dorsal fin of whale shark: 10,000 US$!

Unsufficient protection of species

National bans: prohibition of finning in the USA, Canada, Australia, New-Zealand

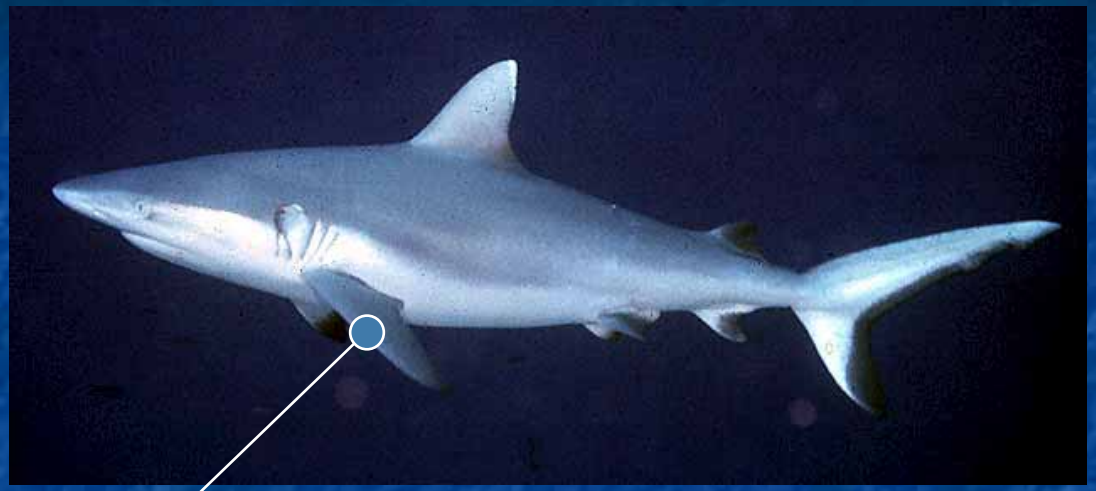
Washington: International convention on endangered species

Annex II of CITES - Total protection

« Shark finning » = no more anatomo-morphological criterias

Help of genetics to differentiate species (1)

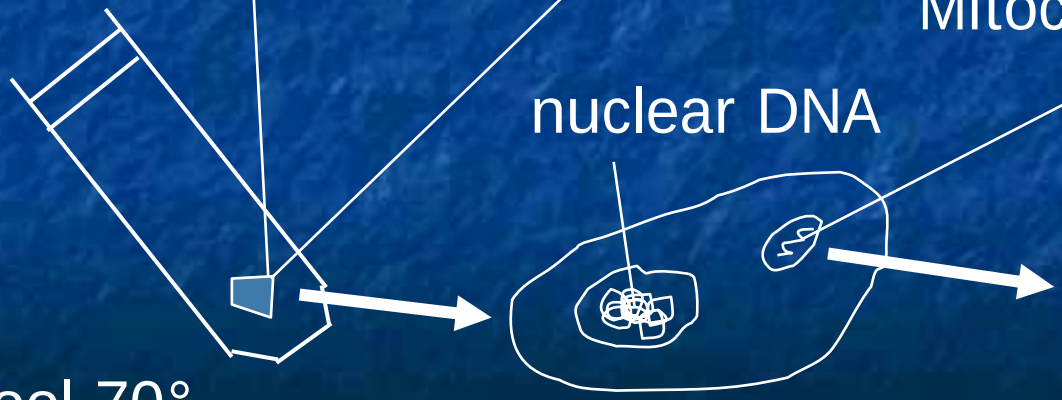
Dead flesh



Live flesh

Mitochondrial DNA

nuclear DNA



Alcool 70°

Help of genetics to differentiate species (2)

Portion of mitochondrial DNA

↓

Recopiying/ Amplification

↓

Lecture of code

↓

DS-16S-AreFi-Cor.txt
GGAAGTGNCTTGGATCAAAGTGGTTAACCAGCAAACACCTCCCTTACACCGAGGAGATAC
CGTGCAACTCGGGTCATTTTGAACCTCAAAGCTAGCCTACACACCAACTTTAACCAAACCT
AATAAATCTAATTAACATTATAATTTTCAACCAAAACATTCTCAACCTTTTAGTATGGGTGAC
AGAACAATAACTCCAGCGCAATAGCTTATGTACCGCAAGGGAAAGCTGAAAAAGAAATGA
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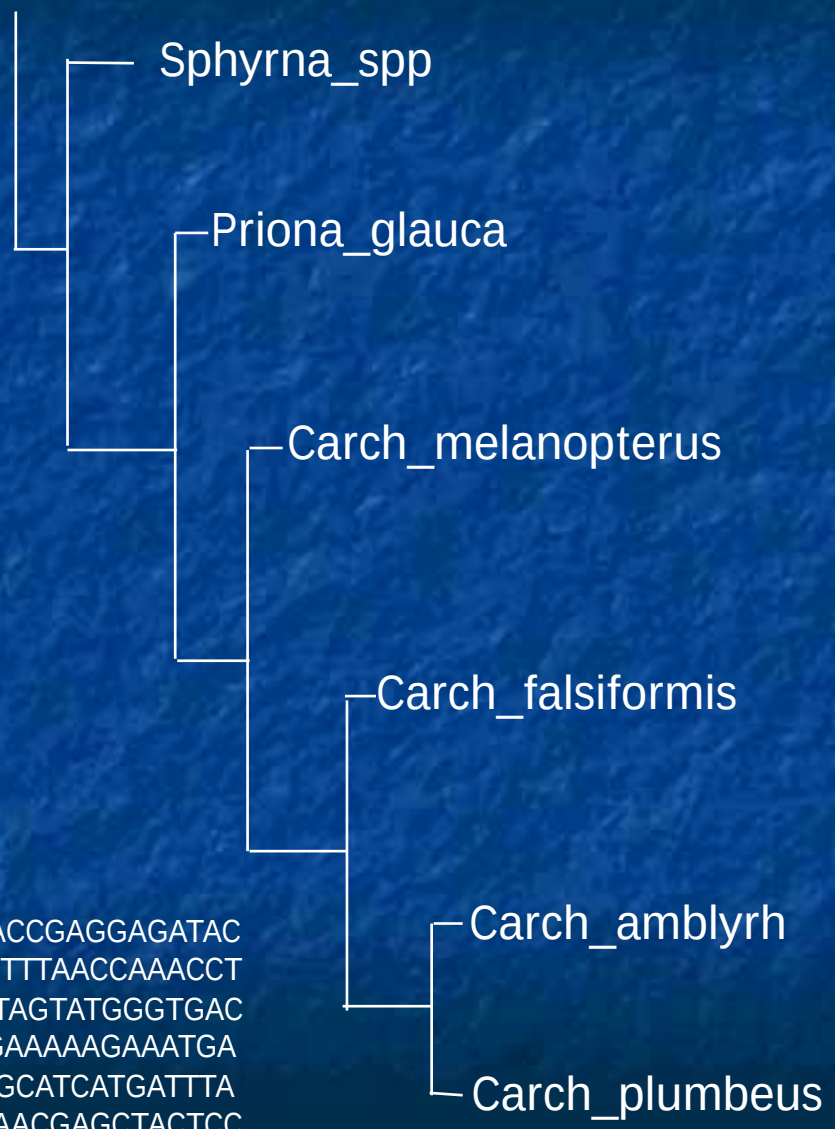
GAAGCAGCAT



Veterinarian thesis on shark genetics

Charles CARAGUEL
French DVM student

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Laboratoire d'Etudes des Ressources Vivantes et de l'Environnement Marin

Université de Nouvelle-Calédonie

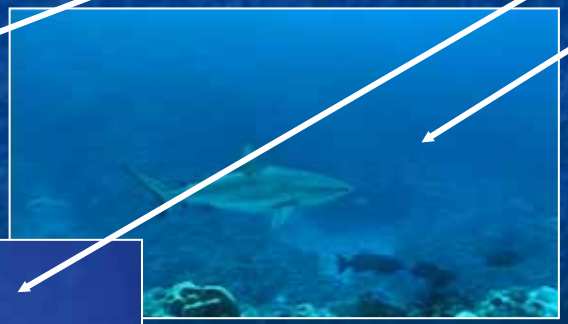
Professeur **Claude CHAUVET**

<u>Subject of research</u>

« Shark speciation: molecular approach and application to species identification based on fins material »

Coastal species - Genus *Carcharhinus*

New Caledonia: largest lagoon in the world



Etc...

2000: 9 species of genus *Carcharhinus*

Biopsy sampling campaign

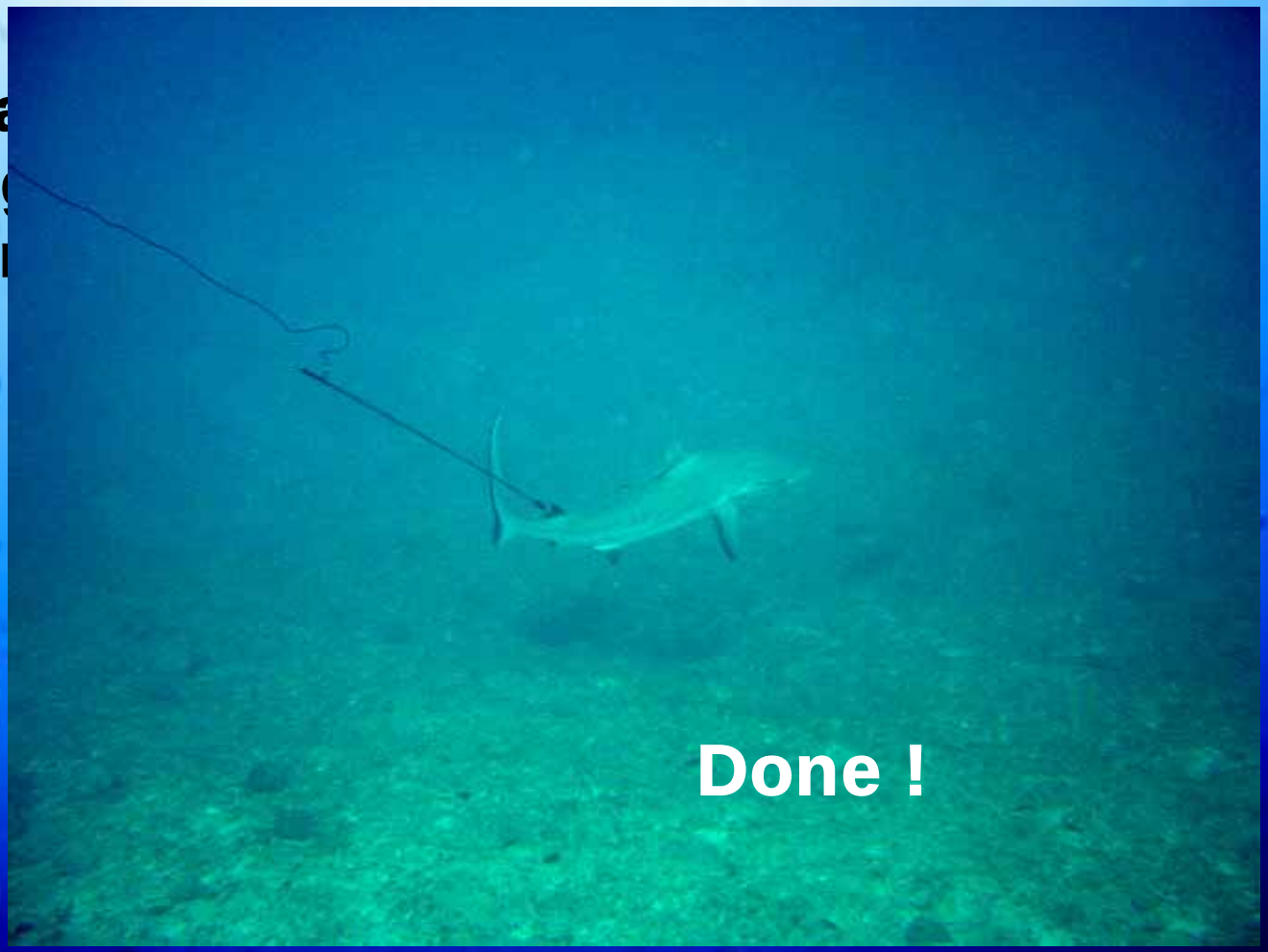
Respect of fishes

Speargun equiped with skin collector

Technique adapted from cetacean studies

Efficiency of free diving

Easy a
Manag
Feedi



Validation of species identification

Morpho-anatomic identification

Genetic card

Genus *Carcharhinus* - New Caledonia

C. melanopterus

C. albimarginatus

C. obscurus

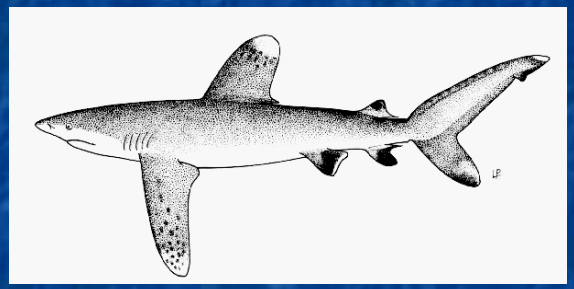
C. leucas

C. falciformis

C. amblyrhynchos

C. plumbeus

C. limbatus

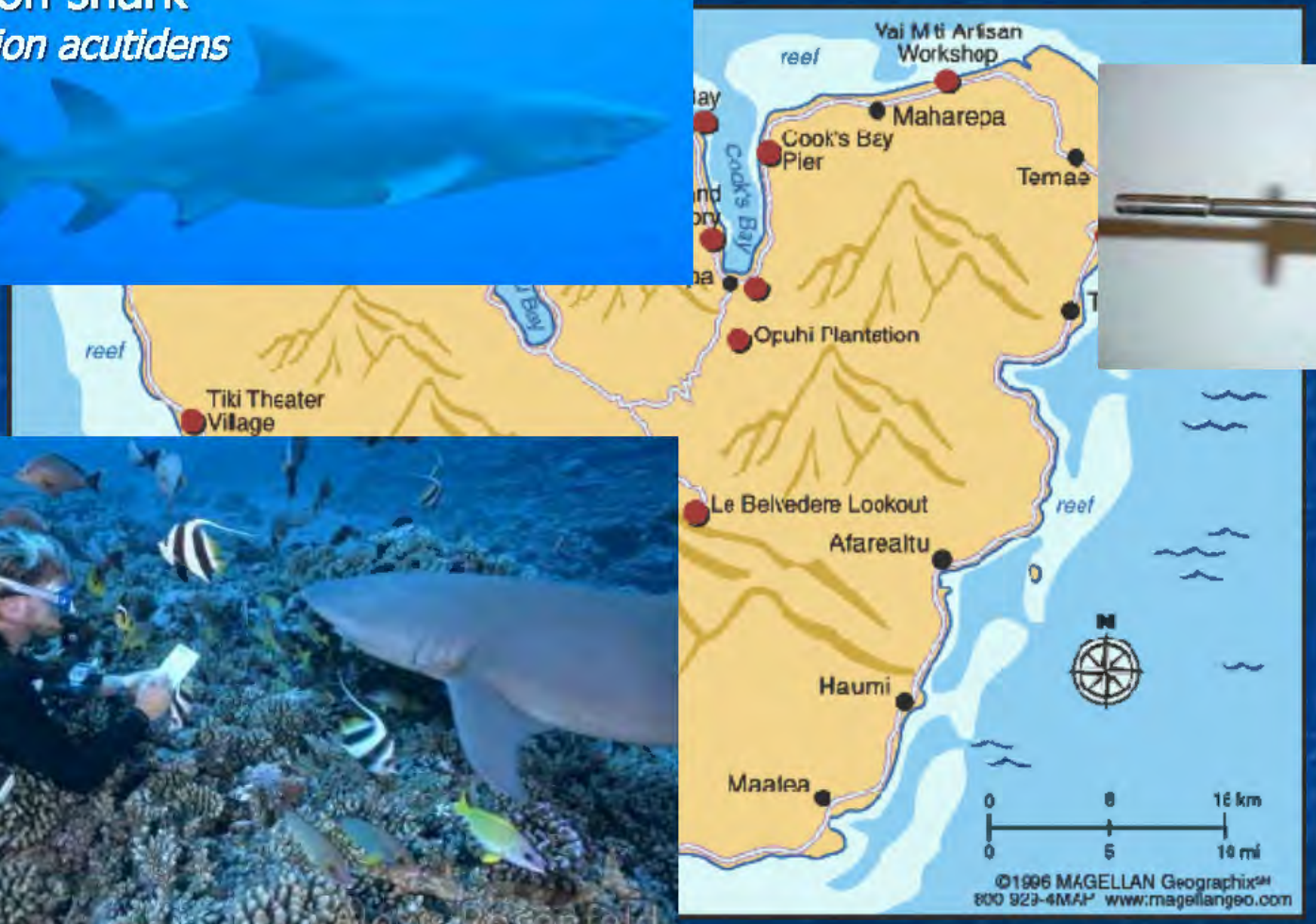


C. longimanus

C. brevipinna

C. sorrah

Study on species vulnberability



French Polynesia - genetic variability of lemon shark population

Public awareness

L'HOMME : UN DANGER MORTEL POUR LES REQUINS !

Sacrifiés pour des impératifs touristiques, massacrés pour des modes alimentaires risibles, assassinés au nom de peurs viscérales infondées, les populations de requins connaissent dans le Monde un déclin plus qu'alarmant…

Par Eric CLUA, vétérinaire-chercheur en biologie marine

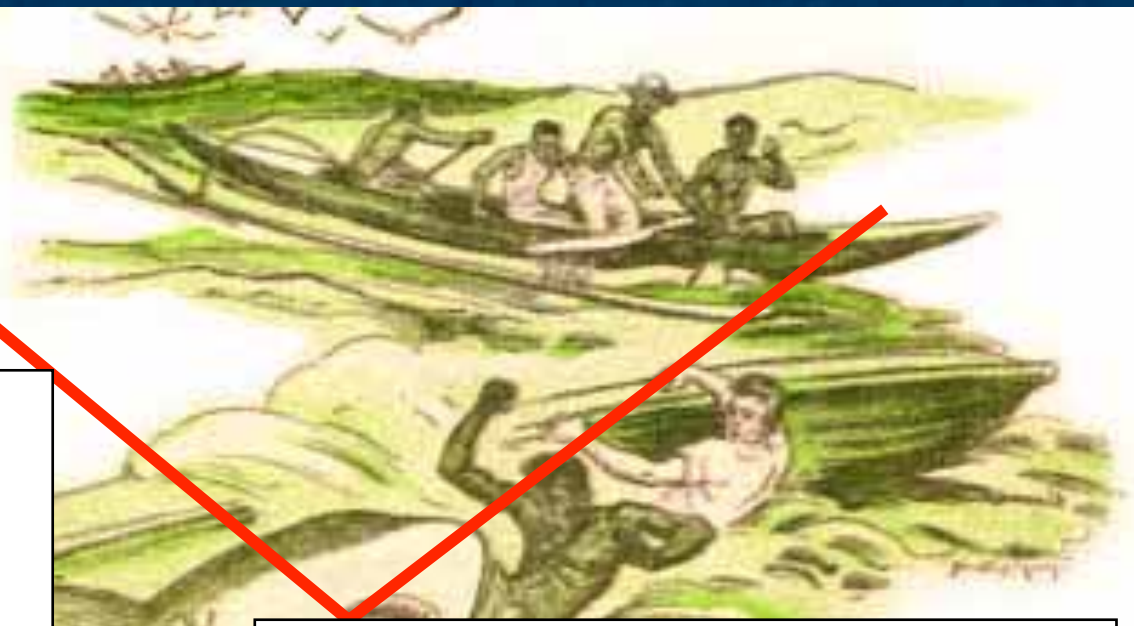
On le craignait, on s'en doutait, mais pas à ce point-là… On savait les requins particulièrement vulnérables à la surpêche qui sévit partout à travers le Monde, mais rien ne vaut des chiffres précis pour prendre conscience de la situation. C'est chose faite depuis la parution récente d'un article dans le renommé magazine « Science »[1], en janvier 2003. Une équipe de chercheurs américains s'est penchée sur les statistiques de pêche collectées au cours des 15 dernières années.

Press release
Les Nouvelles Calédoniennes
Juin 2003

Film making
26 mn RFO Sept. 2003

Real danger: key figures…

Only 1% of dangerous species amongst 400



Non provoqued attacks: 58 (2005)

Human death: 3 (2003), 7 (2004) et 4 (2005)

(source : International Shark Attack File, Florida)

During the same period of time, 10,000 people died in India through Cobra attacks

(source : WorldWatch Institute)

Human beings: real top predators