

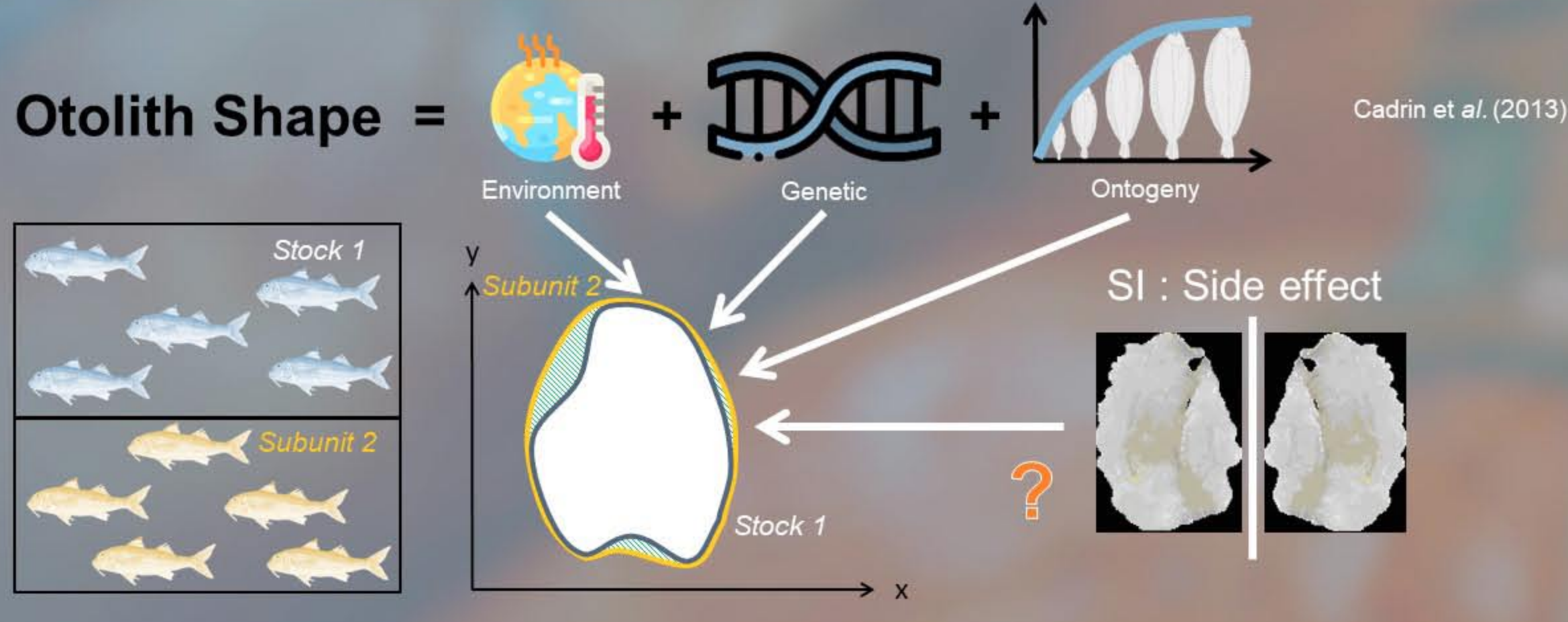


SIDE EFFECT OF THE OTOLITH SHAPE APPLIED TO THE RED MULLET (*Mullus barbatus*) IN THE MEDITERRANEAN SEA: COMPARATIVE ANALYSIS OF 2D AND 3D OTOLITH SHAPE DATA

Nicolas Andrialovanirina^{1,2}, Émilie Poisson Caillault¹, Sébastien Couette³, Rémi Laffont³, Lauriane Poloni³, Camille Lutet-Toti^{3,4}, Kélig Mahé²



1. CONTEXT



Case of study

Red mullet (*Mullus barbatus*)
2nd most caught fish in the Mediterranean sea

Commercial fish

TL

Sampling

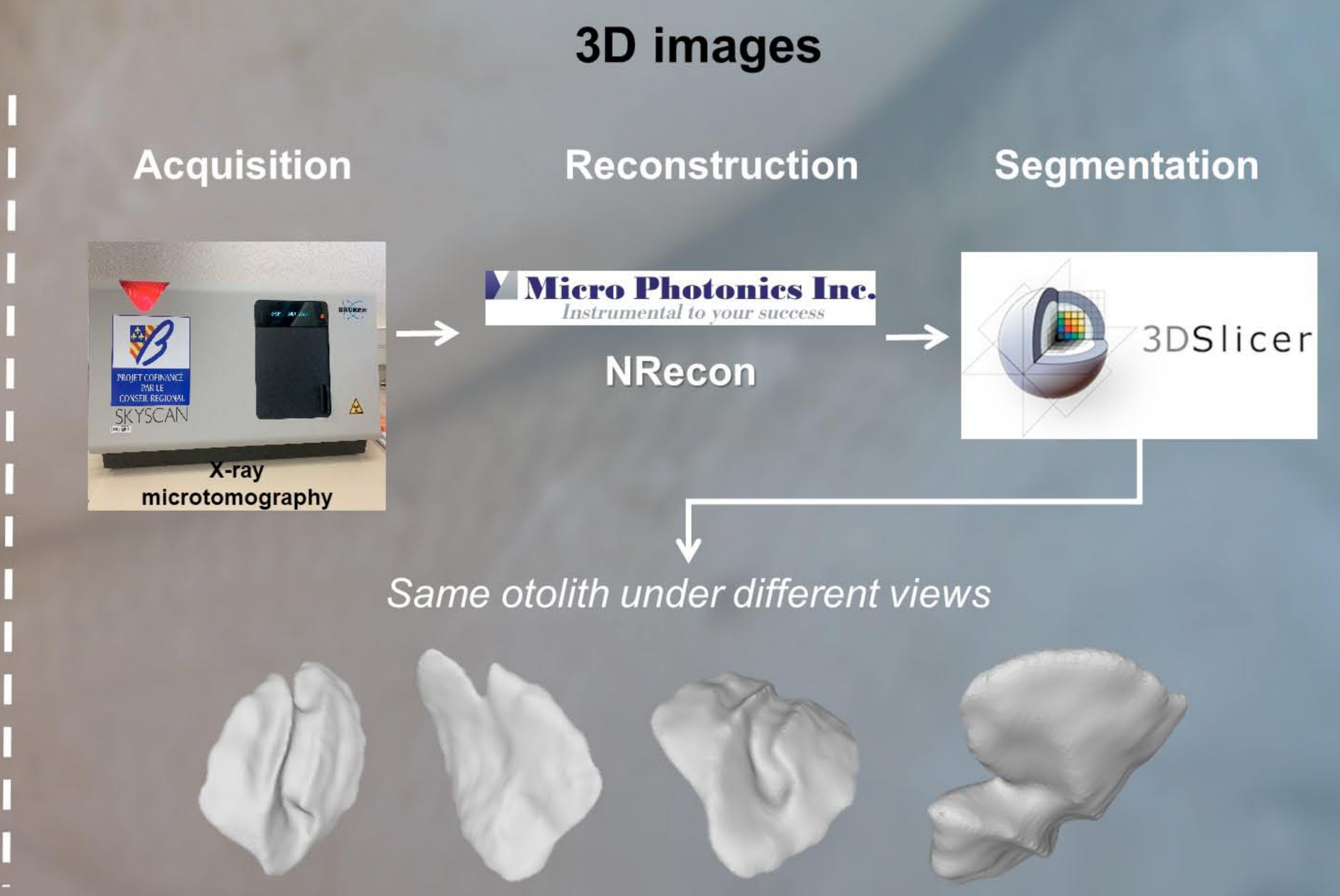
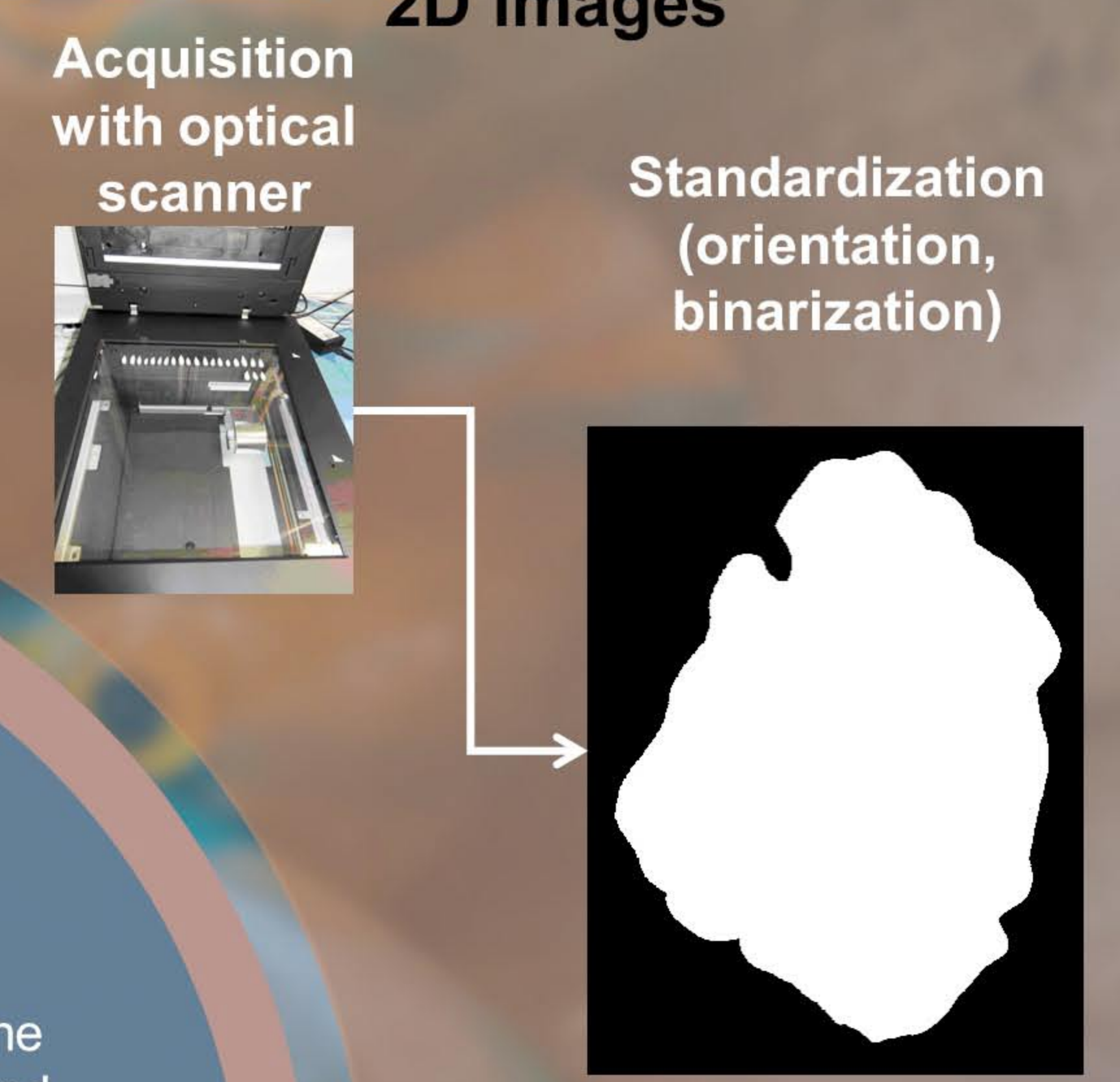


2D → The same dataset (3 GSA)
GSA 18c, n = 29 fishes
GSA 22b, n = 30 fishes
GSA 27b, n = 23 fishes

← **3D**

GSA: Geographical Sub Areas of the Mediterranean Sea

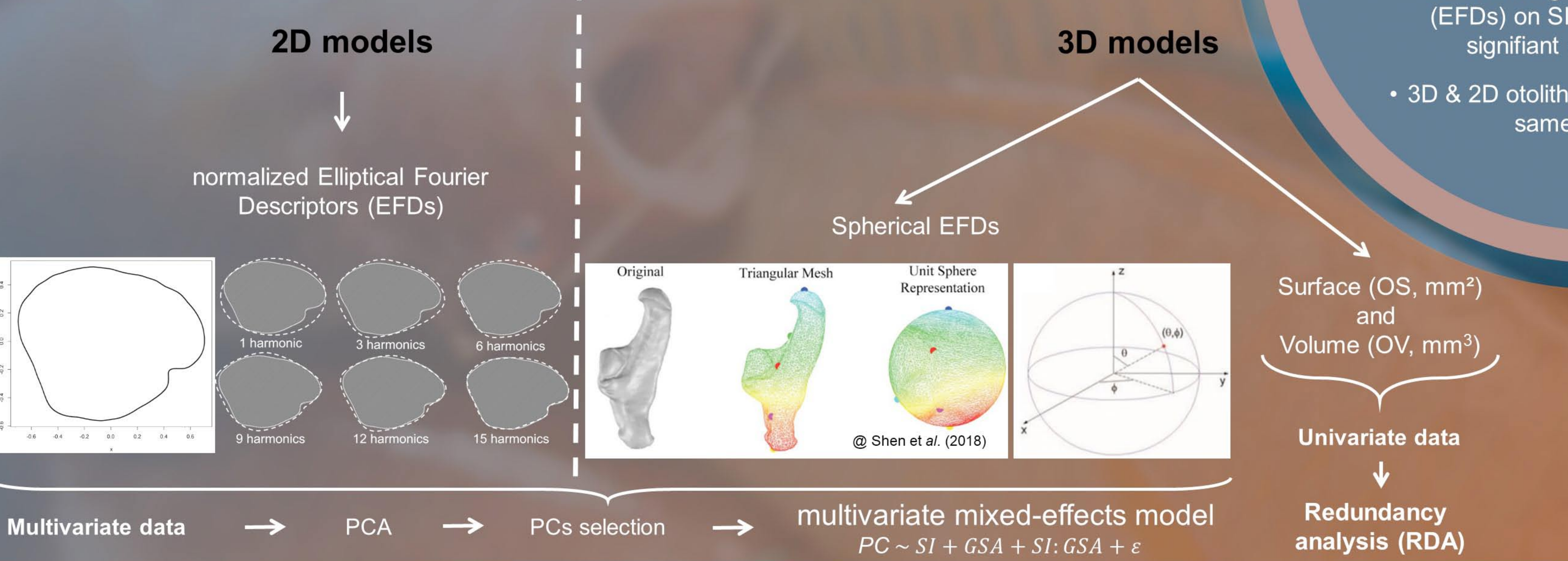
2. MATERIAL



5. CONCLUSIONS

- 3D analysis have more shape information than 2D but it is time consuming
- Otolith 3D shape was significant on the relationship between the side effect and the geographical area of sampling (otolith 2D shape was not significant from SI)
- 3D data: High resolution signifiant (EFDs) on SI / low resolution non signifiant on SI (OS & OV)
- 3D & 2D otolith data did not show the same trend for SI

3. METHODS



4. RESULTS

EFDs 2D

$PC \sim SI + GSA + SI:GSA + \epsilon$

	P-value
PC	2×10^{-16}
PC:SI	0.09
PC:GSA	2×10^{-16}
PC:SI:GSA	0.43

NH = 7 harmonics
nPC = 25
Variance by 70%

NH: Number of harmonics to reconstruct each individual otolith with a precision of 99.99%

PC selected by Broken Stick model

- Significant
- Non-significant

EFDs 3D

$PC \sim SI + GSA + SI:GSA + \epsilon$

	P-value
PC	2.2×10^{-16}
PC:SI	0.02
PC:GSA	2.2×10^{-16}
PC:SI:GSA	0.0001

NH = 11 harmonics
nPC = 6
Variance by 30%

Surface (OS) and Volume (OV)

Only TL ~ Surface (P-value=0.001)

TL ~ OS+OV+OS:SI+OV:SI+OS:GSA+OV:GSA

Value

TL (cm)

Left / Right