Living and foraging in a fluid-dynamical environment: top predators in a sea of currents

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Animal tracking is revealing a strong link between predators and current patterns.
How do currents impact top predators?

1. **Bottom-up effect** current patterns affect the distribution of phytoplankton and this effect is transferred up trophic webs all the way to prey distribution.

2. **Patterns in favorable physical properties** for metabolism or prey accessibility.

3. **Direct impact** of currents on swimming patterns.
Can ocean currents affect large animals’ swimming behavior?
An animal tracking study: Southern Elephant Seals from the Kerguelen Islands

- GPS trajectories
- **Accelerometers** as a proxy for foraging
- Altimetry-derived **currents**
- A **Lagrangian approach**: from currents to trajectories

Viviant et al., 2010
The “planktonic” seal
The “planktonic” seal

Day 1
The “planktonic” seal
The “planktonic” seal

Day 3
The “planktonic” seal
The “planktonic” seal
The “planktonic” seal
The “planktonic” seal

Day 7
The “planktonic” seal

Day 8
The “planktonic” seal

Day 9
Quantifying the “Quasi-Planktonicity Index” (QPI)
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QPI < 20 km → ~30% of each trajectory
Coherent structures can entrain top predators!

Regions of low QPI ("passive" behavior on the horizontal) correspond to (sub)mesoscale structures and regions of intensive foraging.

Multivariate analysis
Area restricted search in the open ocean
Area restricted search in the open ocean
From a mechanism to conservation

Using transport to identify ecologically significant regions and design MPAs:
a case study from the Crozet Archipelago
Describing the currents top predators experience

Roncon et al., 2018

Cocker et al., 2003
Towards Dynamic Ocean Management

Maxwell et al., 2015
Thank you for your attention!

Questions?