Movement and diving of killer whales (*Orcinus orca*) at a Southern Ocean archipelago

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Background

The distribution of marine predators is shaped by that of their prey, which in turn is dictated by bio-physical features and processes. The movement and diving of killer whales is poorly known outside coastal areas.

Methods

We deployed 11 satellite-linked tags on 9 killer whales at the Prince Edward Islands, Southern Ocean. Nine tags were position-only, 2 tags also recorded depth.

We used state-space switching models to estimate two behavioural modes from position estimates – *restricted* and *transit*.

We used generalised linear mixed effect models (GLMMs) to explore the relationship between 7 environmental variables and killer whale behavioural mode.

Findings

Individuals moved 416–4470 km (mean 82.7 km/day) but 69% of position estimates were within the 1000 m isobath around the islands ①.

Killer whales showed restricted behaviour close to the islands, particularly inshore where they can effectively hunt seals and penguins, and at seamounts to the north of the islands. Three individuals made rapid and directed long-distance movements northwards of the islands ①.

Killer whales did not clearly target features such as fronts and apparent mesoscale eddies. They showed restricted behaviour in shallow water, at high latitudes and low sea surface temperature ②.

Dive behaviour ③④⑤ suggests that killer whales might also prey on vertically migrating cephalopods and perhaps Patagonian toothfish in addition to seals and penguins.

① POSITION ESTIMATES AND BEHAVIOURAL MODES from 11 satellite tags deployed on 9 killer whales at the Prince Edward Islands, Southern Ocean. Individuals were tracked for 5.6–53.2 days.

③ DIVE DEPTH DISTRIBUTION of 2 killer whales tagged at the Prince Edward Islands. Dives were primarily shallow (7.5–50 m), with secondary modes around 358 and 377 m, respectively.

④ DIVE DEPTHS AND DURATIONS. We used *k*-means clustering to distinguish deep and shallow dives; there was no separation in duration. Maximum dive depths were 767.5 and 499.5 m, respectively.

② ENVIRONMENTAL VARIABLES AT RESTRICTED AND TRANSIT POSITION ESTIMATES. Our best GLM included depth, sea surface temperature, latitude, sea surface height anomaly and bottom slope.

⑤ DIURNAL VARIATION IN DIVE DEPTH. For both individuals, dives were significantly deeper during the day.

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