PML | Plymouth Marine Laboratory

NEODAAS application

Office use

App no.	Grade	UID	Received	Reviewed	Returned	Replied	Started	Finished

Principal investigator

Name	Telephone	Email
Steve Votier		
Department/address		

Collaborators

Name	Telephone	Email
Peter Miller		
Department/address		

Name	Telephone	Email
Bethany Clark		
Department/address		

Reference number	Degree level	Course end date
		Mar 2018
Course title		
Biosciences		

Project details

Project title	Project duration
Three-dimensional space use by a top marine predator: New perspectives in animal movement at the interface between air and sea	3.5 years
NERC science theme(s)	**Funding**
Climate system, biodiversity & sustainable use of natural resources	Not specified

Background rationale for project

Fronts attract seabirds, among other marine predators, but the sensory mechanisms are poorly understood. Visual cues indicating the presence of prey-rich frontal areas include changes in water colour and texture, but more conspicuously, scavengers and predators. Procellariiform seabirds use olfactory cues, such as dimethyl sulphide, to locate food and navigate during non-foraging flights. Miniaturised bio-loggers have facilitated huge leaps forward in understanding how animals interact with their environment, but the availability of technology and analytical tools has largely limited studies to two dimensions. A key goal is to reconstruct three-dimensional movement, particularly important for animals that use both aquatic and aerial habitats. The northern gannet (Morus bassanus) is a large piscivorous seabird able to safely carry bio-logging devices that use aerial dives to exploit marine prey, making it ideal for studying three-dimensional space-use. It is not known whether olfactory cues play a part in gannet navigation or prey finding, particularly in relation to ocean fronts.

Description of project research/activity

We have collected fine-scale 3D movement data (GPS, altitude, acceleration, dive depth) for the Northern gannets Morus bassanus, a large piscivores seabird that use aerial dives to exploit marine prey. We will investigate how foraging behaviour in 3D relates to strength, density and persistence of fronts in sea surface temperature. In the lead up to foraging behaviour and the presence of strong and persistent frontal zones, we will look for typical crosswind and odour plume following flights in our tracking data. As olfactory cues will be stronger close to the surface and visual cues will be stronger at height, we will use flight height data to investigate the contribution of vision.

Use of satellite data to support research

Daily SST will feed into 7-day composite front maps (Miller 2009), combining the location, gradient, persistence and proximity, reducing both the impact of strong but short-lived fronts and data loss due to cloud cover. Bio-

logging data and derived behavioural states will be related to front metrics including, distance to nearest front, front strength and front density.

Expected results

The data is required for 2 or more data chapters in Bethany Clark's PhD thesis, which are intended to be submitted for publication as research papers, and will be contribute to an accepted poster at the 2nd World Seabird Conference: "Fine-scale, three-dimensional bio-logging provides new insights into the use of ocean fronts by foraging gannets", and an invited poster at Ocean Sciences Meeting 2016: "Sensory processes around ocean fronts: insights from the 3D bio-logging of a pelagic seabird".

Related references

Scales KL, Miller PI, Embling CB, Ingram SN, Pirotta E, Votier SC. 2014 Mesoscale fronts as foraging habitats: composite front mapping reveals oceanographic drivers of habitat use for a pelagic seabird. J. R. Soc. Interface 11: 20140679.Miller PI. 2009 Composite front maps for improved visibility of dynamic sea-surface features on cloudy SeaWiFS and AVHRR data. Journal of Marine Systems 78: 327-336

Data requirements

Request

Thermal fronts in daily at a PML suggested resolution between N 49.5 - 53 & E -4 - -8 in NetCDF

Time range (s) of requested data

12th Jul – 12th Aug 2015