

Feeding associations between Grey Phalaropes *Phalaropus fulicarius* and Basking Sharks *Cetorhinus maximus* over a tidal-topographic front off southwest Cornwall

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Abstract

This paper documents a previously unreported feeding association between Grey Phalaropes *Phalaropus fulicarius* and Basking Sharks *Cetorhinus maximus*. The observations were made during effort-based visual monitoring from Gwennap Head in southwest Cornwall, in October 2008. Flocks of up to 50 Grey Phalaropes were seen to follow and aggregate around surface-feeding Basking Sharks, mostly in an area characterised by a prominent tidal-topographic front. It is proposed that Grey Phalaropes were initially attracted to visual manifestations of upwellings and convergence zones over and adjacent to this front (with enhanced surficial prey availability), and then opportunistically used the tall dorsal fins of foraging Basking Sharks as a visual cue to home in on particularly dense prey patches.

Introduction

The 'SeaWatch SW' project, which ran from 2007 to 2011, included intensive effort-based visual observations from Gwennap Head, southwest Cornwall (e.g. Wynn & Brereton 2009; Wynn *et al.* 2010). This site is at the southwest tip of the UK mainland, and is ideally situated for observing migrating seabirds moving around the southwest peninsula. A primary aim of the project was to assess the flux of seabirds passing the watch-point during the autumn migration period, from 15 July to 15 October. Between these dates, the watch-point was manned daily from dawn until dusk, and over the five years of survey ~5,000 hours of effort-based data were collected. This short paper describes a series of observations of Grey Phalaropes *Phalaropus fulicarius* associating with foraging Basking Sharks *Cetorhinus maximus* off Gwennap Head in October 2008. The watch-point overlooks Runnelstone Reef, a horseshoe-shaped rocky platform that delimits an inshore zone of shallow water (< 10–20 m depth) from deeper water (> 50 m depth). A visible tidal-topographic front is associated with the depth change approximately 1.5 km offshore (Figure 1; Jones 2012).

Results

Grey Phalaropes were sporadically recorded during the five-year 'SeaWatch SW' survey, particularly in September and October. A significant influx occurred in October 2008, with up to 65 birds present offshore from 6–11 October, a period

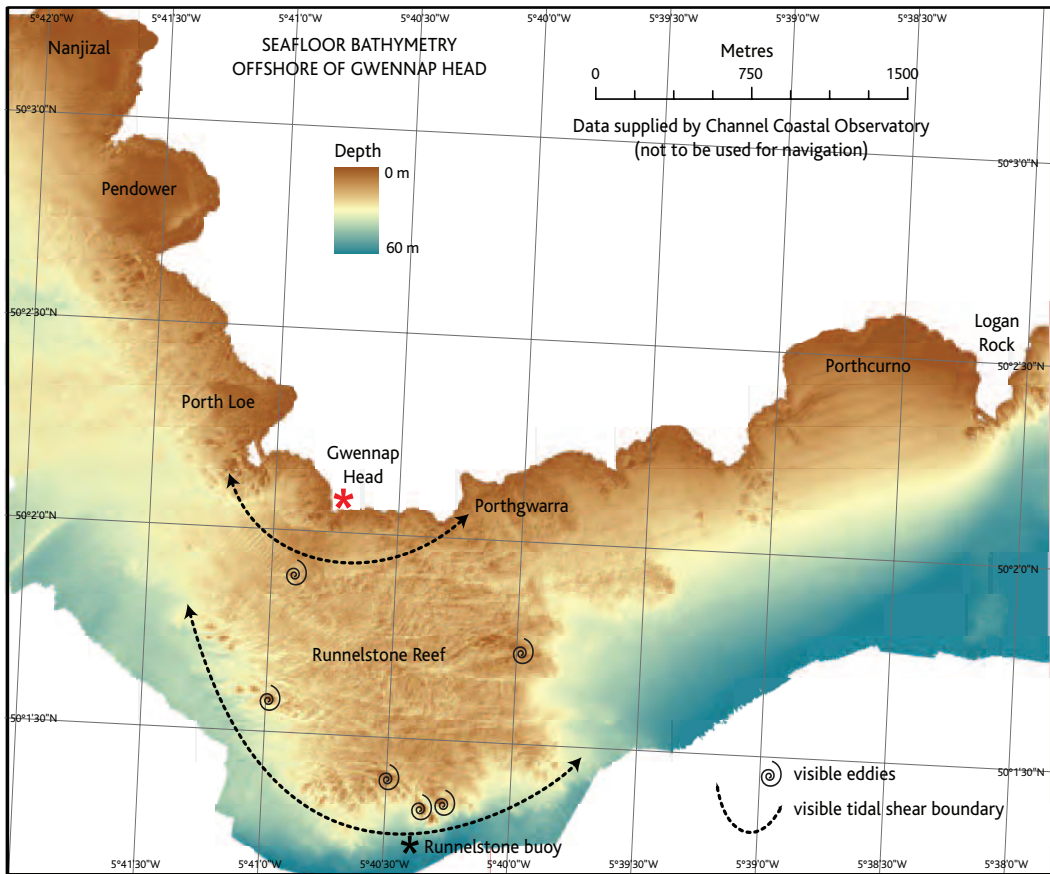


Figure 1. High-resolution multibeam bathymetry map of Runnelstone Reef offshore of Gwennap Head, southwest Cornwall (SeaWatch SW watch-point shown by a red star). Runnelstone Reef comprises a rocky platform < 20 m deep that extends ~1.5 km offshore. Dashed lines show locations of visible tidal shear boundaries; spiral symbols show location of visible surface eddies and upwellings, associated with tidal flows interacting with topographic highs. The Runnelstone Buoy is located ~1.7 km offshore (black star) and is a useful visual marker when estimating distances.

dominated by southwest winds. This period also produced daily observations of up to five Basking Sharks feeding offshore (Figure 2), with some animals lingering in the area for several days (based upon repeat observations of animals with distinctive fin markings).

The first observation of a possible association between the two species occurred on 6 October, with a single Grey Phalarope seen settled on the water alongside a surface-feeding Basking Shark at ~1.4 km range at 15.08 h. On 7 October, three phalaropes passed west at ~0.9 km range at 12.59 h, and were seen to pause over a surface-feeding shark before continuing. At 14.33 h another two phalaropes moved west at ~1.4 km range, before settling on the sea alongside a surface-feeding shark. Between 15.17–15.45 h, a flock of up to 20 phalaropes was seen sitting on the sea in association with four sharks at ~1.4 km range.

On the morning of 8 October, a series of small flocks of phalaropes totalling at least 50 birds were observed sitting offshore to the southwest at 1–2 km range from 08.14 h onwards, but no sharks were visible. The first surface-feeding shark was seen at 11.03 h at ~2 km range, and from 11.10–11.40 h it was closely followed by an aggregation of up to 50 phalaropes. No further sightings were made until 15.40 h, when ~15 phalaropes were seen on the sea at ~1.6 km range, close to where a surface-feeding shark had been seen 20 minutes earlier.

No feeding aggregations of phalaropes were noted on 9 October, but on 10 October four birds were seen offshore at 15.48 h increasing to 25 by 16.12 h at ~1.6 km range. A surface-feeding Basking Shark then appeared closer inshore at ~0.8 km range, and from 17.05–17.15 h it was closely followed by a group of six phalaropes. The closer range enabled confirmation that both the phalaropes and the shark were actively foraging, the latter because the open mouth was visible (c.f. Figure 2). The shark's dorsal fin occasionally dipped below the surface and would then re-appear a few metres away, at which point the phalaropes would immediately fly over to rejoin it and continue feeding alongside. Although up to eight phalaropes and three sharks were seen on 11 October, no further interactions between the two species were observed.



Figure 2. Basking Shark *Cetorhinus maximus* surface-feeding along a foam line off Gwennap Head, July 2009. The white insides to the open mouth are just visible, indicating the animal is actively feeding. Note the tall, prominent dorsal fin. © Russell B. Wynn.

Discussion

In nearshore and freshwater environments, phalaropes often exhibit characteristic spinning behaviour whilst foraging (Hohn 1971; Obst *et al.* 1996), which is known to generate small-scale upwellings that bring food items to the surface. However, at sea, phalaropes are rarely seen spinning and are more frequently observed feeding along linear oceanographic features that are surface manifestations of convergence zones, i.e. zones where pelagic organisms accumulate (e.g. Brown & Gaskin 1988; DiGiacomo *et al.* 2002). Visual cues, including surface slicks and foam lines, are used by phalaropes to locate these prey aggregation zones, which can hold elevated concentrations of target food items such as fish eggs and copepods (Briggs *et al.* 1984; Brown & Gaskin 1988; DiGiacomo *et al.* 2002).

The presence of surface-feeding Basking Sharks is a good indicator for elevated levels of zooplankton prey in surface waters, particularly calanoid copepods (Sims & Quayle 1998; Sims 2008). More than half of the observations of feeding associations between sharks and phalaropes presented here were at ~1.4–1.6 km range, which is consistent with a visible tidal-topographic front located about 1.5 km offshore where strong tidal flows interact with a series of upstanding pinnacles and the steep margins of a rocky platform (Figures 1 & 3). This frontal boundary is a known hotspot for marine megavertebrates (Jones 2012), and is a focus for ongoing research. Basking Sharks (with accompanying phalaropes) were also observed following ephemeral wind- or tide-driven surface slicks and foam lines (Figure 4), inshore and offshore of the reef margin (consistent with observations of Briggs *et al.* (1984), Brown & Gaskin (1988) and DiGiacomo *et al.* (2002)). Associations between the two species were recorded in a range of sea states, from 2–6 (i.e. wave heights up to 4–6 m). Basking Shark dorsal fins are up to 2 m high (Figure 2), so even in relatively rough conditions they are likely to be visible to phalaropes in flight or sitting on the sea surface.



Figure 3. Rough water associated with tidal-topographic interactions at the margins of Runnelstone Reef, July 2009. The strip of rough water represents an area where strong tidal flows interact with upstanding pinnacles ~1.5 km offshore, marked by the location of the Runnelstone Buoy. A loose aggregation of Northern Gannets *Morus bassanus* is just visible over the zone of disturbed water. © Russell B. Wynne.



Figure 4. Ephemeral surface slicks (driven by wind and/or tide) over Runnelstone Reef, October 2009. The slick close to Runnelstone Buoy is probably related to flow interactions with the reef margin, but the closer feature is not linked to any obvious topographic feature. © Russell B. Wynn.

Grey Phalaropes have previously been observed feeding in association with a range of cetacean and seabird species at sea during the inter-breeding period (e.g. Obst & Hunt 1990; Grebmeier & Harrison 1992), and a variety of seabird species have been seen foraging in association with Basking Sharks (Bruce 1952; Angles 1966). However, published observations of Grey Phalaropes associating with Basking Sharks appear to be lacking. In the example presented here, we suggest that Grey Phalaropes were initially attracted to visual manifestations of upwellings and convergence zones over and adjacent to a tidal-topographic front (with enhanced surficial prey availability), and the birds then opportunistically used the tall dorsal fins of foraging Basking Sharks as a visual cue to home in on particularly dense prey patches. The observations documented here were the only times this specific interaction was observed during the five-year 'SeaWatch SW' survey (covering ~5,000 h), and was presumably due to a weather-driven influx of Grey Phalaropes into southwest UK coastal waters coinciding with a rather late influx of surface-feeding Basking Sharks (Wynn & Brereton 2009).

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