OFFSHORE FORAGING OF MEDITERRANEAN GULLS *LARUS MELANOCEPHALUS* IN PORTUGAL DURING THE WINTER

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Poot M. 2003. Offshore foraging of Mediterranean Gulls *Larus melanocephalus* in Portugal during the winter. Atlantic Seabirds 5(1): 1-12. Movements and behaviour of Mediterranean Gulls *Larus melanocephalus* were observed along the Atlantic coast of central Portugal in December 2001. The observations suggest that at least part of the Mediterranean Gull population wintering in central Portugal feeds extensively at sea and possibly during the night. In the morning, Mediterranean Gulls flew in straight lines towards the coast, where they settled on water to roost in flocks of several tens of birds. Because there were no gulls near the coast at sunrise, it is assumed that these arrivals were Mediterranean Gulls that had spent the night out at sea. With an estimated 'ground speed' corrected for wind speed, it was estimated that the birds could have covered several tens of kilometres offshore between sunrise and the peak of arrivals at the coast. One late afternoon, there were no roosting birds at the coast, but foraging birds were observed which were apparently successful. The question is raised whether the foraging activity is solely restricted to the hours around sunrise and sunset, or whether it is truly nocturnal. Changes in prey availability resulting from vertical migrations in the water column may have influenced diurnal patterns in foraging activity of the gulls. Alternatively, the possible utilisation of discards cannot be ruled out, since night-active purse seine vessels normally discharge discards early morning. However, outside the breeding season, the Mediterranean Gull is so far only known to attend trawlers during the day.

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INTRODUCTION

The Mediterranean Gull *Larus melanocephalus* has undergone a spectacular expansion of its breeding range in the last decades, from its main quarters in the Black Sea (over 90% of the world population, Nanikov 1996) towards north and western Europe (Meininger & Beckhuis 1990). The winter distribution of Mediterranean Gulls along the Atlantic coasts of western Europe, Northwest Africa and along the Mediterranean coasts, has been documented with a colour-ringing program (e.g. Baccetti *et al.* 1999, Boschert & Dronneau 1999, Meininger *et al.* 1999, Varga *et al.* 1999).

Little is known of the foraging ecology of the Mediterranean Gulls outside the breeding season, when the species apparently shifts from terrestrial to coastal and marine food sources. Although the marine environment is considered important for the wintering Mediterranean Gulls (Snow & Perrins 1998), the information on the diet and feeding habits in winter is sparse.

In early autumn (Jul-Oct), along the west coast of France, large numbers of Mediterranean Gulls occur in temporarily used stop-over sites.

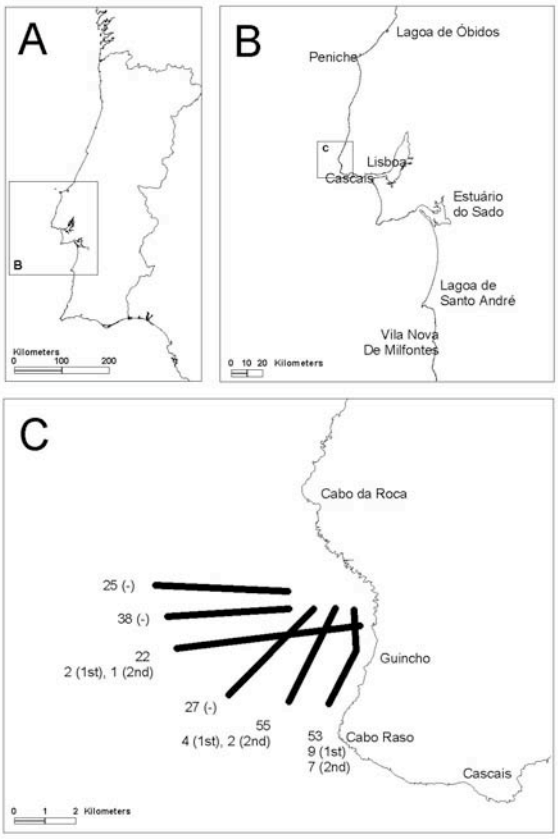

Figure 1. A. Overview of Portugal; B. Portuguese coast with names of lagoons and settlements; C. schematic flight paths of Mediterranean Gulls flying towards the coast of Cabo Raso near Cascais, early morning 29 Dec 2001 (total number per flight path and the number of first and second year birds). (-) = no age identification.

Figuur 1. A. Overzicht van Portugal; B. Kust van Portugal met namen van lagunes en in de tekst genoemde plaatsen buiten de Cascais regio; C. schematische weergave van vliegbanen van Zwartkopmeeuwen, 's morgens 29 december 2001 naar de kust van Cabo Raso nabij Cascais (totaal aantal per vliegbaan en aantal eerste- en tweedejaars vogels). (-) = geen leeftijdsdeterminaties.

These birds feed mainly in shallow coastal waters and on rocky plateaus on tube worms during low tide. Small numbers are seen to forage at sea, often in

association with Sandwich Terns *Sterna sandvicensis* and Common Terns *S. hirundo* near the coast (Le Gall & Robreau 1999). Apart from this, large numbers forage here on terrestrial food sources inland on freshly ploughed fields (Hoogendoorn *et al.* 1999), just as during the breeding period. Most reports on offshore foraging come from the Mediterranean, where large numbers are found wintering (Snow & Perrins 1998). Recent studies revealed that Mediterranean Gulls profit from discards produced by offshore fishing vessels (Arcos 2001, Arcos *et al.* 2001, Arcos & Oro 2002.). Just as in autumn in France, large numbers of wintering birds in the Mediterranean forage close the coast on mudflats, and opportunistically on fallen olives in plantations (Baccetti & Smart 1999). Nearshore and onshore foraging is most prominent during bad weather, with the same birds foraging offshore under more favourable conditions (J.M. Arcos *pers. comm.*). In conclusion, wintering Mediterranean Gulls commonly forage in marine areas, but this has thus far received little attention.

In December 2001, the behaviour of Mediterranean Gulls along the Atlantic coast of central Portugal has been studied and details are reported in this paper. Observations included counts of flying birds arriving near the coast, of birds roosting along the coast and studies of the foraging behaviour of Mediterranean Gulls at sea. The results were compared with observations of other seabirds in the area.

METHODS AND STUDY AREA

Observations were made of Mediterranean Gulls flying over sea along the coast near Cascais, central Portugal on three mornings and one late afternoon (Table 1, Fig. 1). On 20, 24 and 27 December the observations were carried out from Cabo Raso, a rocky cliff *c.* 5m a.s.l. On 29 December, observation were done 1.5km further to the north, close to the nearest roosts of Mediterranean Gulls near Guincho on a rocky cliff of *c.* 10m a.s.l.. On 23 December, observations of Mediterranean Gulls were made also near Vila Nova de Milfontes. Two other coastal sites were visited during the last week of December 2001, but no Mediterranean Gulls were found there (Lagoa de Santo André on 23 Dec 2001 at 17.15 and Lagoa de Óbidos on 28 Dec 2001 at 17.30). Special attention was paid to Mediterranean Gulls flying out at sea near Cabo Raso and Guincho. In order to discover the birds in time (i.e. on the horizon), a 30x telescope and 10x binoculars were used. Observations of flying and roosting birds were logged per minute. On 29 December 2001, the age of all birds near Guincho was determined (first year, second year and adult; Grant 1986). Only birds flying at <1 km distance were close enough to be properly aged. The third morning (29

Dec), also flight paths were classified in five direction-distance classes relative to the coast (Fig. 1).

RESULTS

Flight movements in the morning towards the coast On the morning observations conducted from Cabo Raso, attention was drawn to Mediterranean Gulls flying in small flocks far out to sea and towards the coast. The birds were discovered by telescope at an estimated distance of about 4 km. The birds flew in straight lines to the coast, where they settled behind the surf to roost in flocks of up to several tens of birds. When approaching the coast, some birds turned to fly parallel to the shoreline (Fig. 1c). Eventually, these birds joined the scattered flocks resting on the water in front of the beaches of Guincho, between Cabo da Raso and Cabo da Roca. The timing of the observations was different on 20 and 29 December, but the early morning flights of Mediterranean Gulls were apparently very similar in scale and timing (Table 1). On 24 December, however, the arrival seemed delayed (Fig. 2) and the first flocks arrived at 10.48, perhaps as a result of strong offshore winds. On this day, due to the strong wind, the birds flew with powerful wing beats low over the water, in line formations with small inter-individual distances. On average the flocks were larger than on the other days (Table 1), when the birds flew in broad, scattered fronts with large inter-individual distances of several up to a few tens of metres.

In the morning of 29 December near Cascais, 135 out of a total of 220 birds could be aged (61.4%): 11.9% 1st year, 7.4% 2nd year and 80.7% adults. Proportionally many 1st year birds were observed in the two flight path categories nearest and parallel to the coast (Fig. 1c). In Vila Nova de Milfontes the proportion of first year birds was estimated to be around 10%.

Roosting along the coast during the day As soon as the Mediterranean Gulls arrived at the coast, they settled on the water behind the surf. Most birds landed near widely scattered flocks of tens to a few hundreds of Lesser Black-backed Gulls *Larus graellsii*. The Mediterranean Gulls usually kept some distance from the flocks of Lesser Black-backed Gulls. Small numbers joined floating flocks of a few tens of Black-headed Gulls *Larus ridibundus*. When roosting, the birds floated usually just behind the surf or up to a few hundred metres behind it. In the morning of 29 December 2001, however, a flock of over 100 individuals was seen afloat at over 1.5 km from the coast. Smaller concentrations could easily have been missed at this distance. In the early morning of 24 December, there were no birds on the water near the coast (10:10h; Table 2). Similarly, early morning of 29 December 2001 (8:10h) the complete strip of coast near

Table 1. Number of Mediterranean Gulls flying towards the coast (n) between Cabo Raso and Guincho (Cascais, central Portugal) and wind conditions on three mornings in December 2001.
Tabel 1. Aantal Zwartkopmeeuwen vliegend naar de kust (n) tussen Cabo Raso en Guincho (Cascais, midden Portugal) en de heersende wind op drie ochtenden in december 2001.

morning	observation time	time of flight movements	*n*	inter-quartile range flock sizes (25-75%)	wind (B)
20 Dec	10:00-11:00	10:00-11:00	55	2.0 – 5.75	E 4
24 Dec	10:10-12:30	10:48-11:55	84	2.0 – 8.25	E 6
29 Dec	8:10-10:50	8:10-9:00	4	(2.0)	E 2-3
		9:00-10:00	49	1.0 – 3.0	E 2-3
		10:00-10:50	82	1.0 – 4.0	E 2-3

Table 2. Number of Mediterranean Gulls roosting locally on water near Guincho (Cascais, central Portugal), on three mornings in December 2001.
Tabel 2. Aantal Zwartkopmeeuwen rustend ter plekke op het water nabij Guincho (Cascais, midden Portugal), op drie ochtenden in december 2001.

morning	time	total number of birds	individual flock sizes
20 Dec	11:45	106	94, 2, 10
24 Dec	10:10	0	-
	12:25	74	16, 5, 26, 12, 15
29 Dec	8:10	0	-
	10:50	>140 (220)	10, 30, >100

Cabo Raso to Cabo da Roca was checked and no roosting birds were seen anywhere.

With a few exceptions, Mediterranean Gulls near Guincho always roosted on water. Only solitary birds or small flocks settled on rocks, often joining small flocks of Yellow-legged Gulls *Larus michahellis*. Such flocks were often disturbed by people on the beach. On 23 December 2001 between 13.00 and 14.45 hour in Vila Nova de Milfontes a flock of 320 birds was present on the water of the river near the centre of the village. Some birds were standing on tidal river flats, but here too nearly all birds were seen floating on the water.

Foraging behaviour of gulls in the late afternoon In the late afternoon of 27 December 2001 only a few Mediterranean Gulls were present on the water along the coast of Guincho. Most birds had probably already left the area to forage at sea. At 16:45h a flock of 6 Mediterranean Gulls was performing

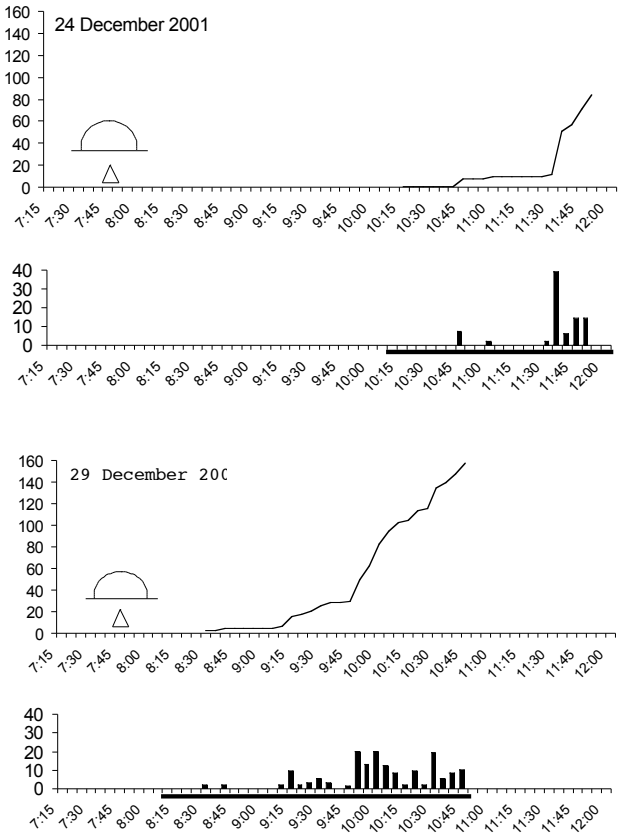

Figure 2. Timing of Mediterranean Gulls flying towards the coast of Cabo Raso near Cascais, W coast of Portugal in the morning of 24 and 29 December 2001. The line is a cumulative graph of flying birds approaching the coast per 5-minute period and reflects increasing numbers roosting locally. Sunrise is indicated. Bars depict the numbers of flying birds per 5-minute period. The black bar along the x axis indicates the observed period.

Figuur 2. Naar de kust vliegende Zwartkopmeeuwen bij Cabo Raso bij Cascais (westkust Portugal), in de morgen van 24 en 29 december 2001. De lijn is een cumulatieve weergave van het aantal vogels 5min^{-1} dat naar de kust vliegt en weerspiegelt het toenemende aantal dat ter plaatse op het water rust. Het moment van zonsopkomst is aangegeven. De staafdiagram geeft het aantal langsvliegende vogels 5min^{-1}. De zwarte balk langs de x-as geeft de waarnemingsperiode weer.

remarkable acrobatic flights low over the water and headed off the coast to fly out far at sea until it was out of sight. At 17:05h, 3 adult Mediterranean Gulls were seen searching, flying against the moderate NW wind. The birds deployed several foraging techniques: shallow plunge diving, surface dipping, pattering and surface seizing (*cf.* Ashmole 1971). The three birds stayed in close contact with eachother. Between 17:10-17:20, these birds were joined by three Lesser Black-backed Gulls, which foraged in more or less the same manner. After 17:20 the Mediterranean Gulls left the foraging spot and continued flying low over the water in search flight far at sea until they were out of sight. At 17:30 a flock of 35 Lesser Black-backed Gulls was foraging in the same spot. At 17:40 three adult Mediterranean Gulls, possibly the same birds as before, were observed foraging among the flock of Lesser Black-backed Gulls.

On this late afternoon at 16:30 it was observed that large numbers of gulls flew out to sea (mainly Lesser Black-backed Gulls and Yellow-legged Gulls). At 17:45, with the sky almost completely dark, large numbers of gulls were soaring high in the sky far at sea (>2km). Meanwhile, Lesser Black-backed and Yellow-legged Gulls were actively foraging along the coast and with success given the frequent inter- and intraspecific kleptoparasitic pursuits. Black-headed Gulls were only seen foraging in small flocks within 500m from the coast.

DISCUSSION

Vila Nova de Milfontes was known as a wintering site for Mediterranean Gulls along the Alentejo coast (Moore 1998), but the coast near Cabo Raso and Guincho had not previously been identified as such. Recent observations of large concentrations suggest a sharp increase in the winter population of Mediterranean Gulls in Portugal (e.g. 1100 birds in December 1998 roosting on salinas near Faro in south Portugal; P. Rock unpubl. data). Very little was known about their (winter) feeding habits in this area. The species was believed to occur mainly in estuaries and salinas along the coasts, but not offshore (Farinha & Costa 1999). The observations described here suggest that at least part of the Mediterranean Gull population wintering along the central coast of Portugal feeds offshore and presumably mainly during the night.

During four winters of study, the mean (± SD) proportion of adult birds in Portugal was 40.7 ± 25.8 in a studied wintering population of 334–1315 individuals per season (Moore 1992). This is a much lower proportion than found in the present study. Offshore foraging is only indirectly indicated by observations of sudden appearances of large flocks, closely linked to storm conditions, along the coast east of Cascais (Moore 1992) and near Vila Nova de Milfontes (Moore 1998). In these large flocks, adults were relatively numerous,

suggesting that adult birds may forage further offshore than younger individuals (in line with the observations presented here).

Mediterranean Gulls are known to forage up to several tens of kilometres from their nesting colonies (Meininger *et al.* 1991). Similar distances should not be a problem for these gulls in winter. Assuming straight flight and constant speed, the Mediterranean Gulls seen to arrive early morning from offshore foraging locations may have travelled at least several kilometres away from the coast. With an estimated ground speed based on allometric equations in relation to wind speed for medium-sized gulls (Spear & Ainley 1997), under the assumption that the birds started to fly back to the coast around sunrise, a maximum flight distance can be estimated. On 29 December, with an estimated minimum 'ground speed' of 39 km h^{-1} (taking into account the 2–3 B winds), the birds could have covered at least 75 km in the two hours between sunrise and their arrival near Guincho (10:00 hour). The late arrival of birds on 24 December could be explained by an estimated ground speed of only 21 km h^{-1} (strong headwinds). Under the conditions observed, the birds should have needed over 3.5 h to cover the same distance as calculated earlier. On 24 December the largest numbers started to arrive near Guincho after 11:30, which is indeed *c.* 3.5 h after sunrise. The calculated distances would allow the gulls to cover the whole continental shelf near Cabo Raso (shelf break at 30-80 km from the coast). The continental shelf can be characterised as relatively shallow (up to ca. 200 m deep), with a high productivity resulting from the abundance of sediments and nutrients carried by the Tagus River and upwelling caused by the Eastern Boundary Currents off the Iberian Peninsula (Borges *et al.* 1997). This is considered to be a very important spawning area for different species of fish, with Sardine *Sardina pilchardus* as the most abundant species, and the area holds an important (purse seine) fishery (Afonso & Carmo-Lopes 1994).

The absence of birds on the coast in the early morning and the timing of the movements observed indicate that the birds spent the night out at sea and this raises the possibility of nocturnal foraging. The birds seem to leave their coastal roosts well before sunset. In the late afternoon, the Mediterranean Gulls were foraging near the coast with large numbers of Lesser Black-backed and Yellow-legged Gulls. It is not clear where these gulls were preying upon, but diurnal patterns in prey availability must be driving factors for timing of their foraging activities. Daily migrations up and down the water column are widely described in literature for many marine (prey) organisms, consisting of many species of fish, crustaceans and squid. These migrations towards the surface usually have two peaks: one after sunset and one at dawn (Blaxter & Hunter 1982), and this might explain the observed activity pattern of the gulls. Further offshore, where there are no observations, commercial fisheries could play a role. The utilisation of discards further at sea, where night active purse seine

vessels reject large amounts of discards in early morning (Stratoudakis & Marçalo 2002), can not be ruled out.

It is interesting to compare the foraging activities of Mediterranean Gulls with that of other seabirds feeding near Cabo Raso. At least several hundreds of Balearic Shearwaters *Puffinus mauretanius* were foraging during the day, both in the morning and in the afternoon. The shearwaters operated in flocks of up to 10 individuals, performing regular pursuit plunge-dives (*cf.* Ashmole 1971). In contrast to the foraging gulls, where the foraging activity continued in the dark, the shearwaters completely stopped foraging a quarter after sunset. The same applied for the activity of the large numbers of Northern Gannets *Morus bassanus* present. This species mainly foraged in large temporarily feeding concentrations (occasionally >1500 birds). One such flock, seen north of Cabo da Roca, was associated with a pod of Common Dolphins *Delphinus delphis*. It is of interest to note that dipping or shallow plunge diving Mediterranean Gulls and other gulls commenced or continued feeding in the dark, while deep (pursuit) plunge diving species stopped foraging. Recent studies with logger-equipped Northern Gannets and Northern Fulmars *Fulmarus glacialis* confirm that the plunge diving technique is not used at night (Garthe & Furness 2000, Garthe *et al.* 1999). Obviously, deep diving species that use visual cues to detect prey while still airborne require more light than surface feeding birds such as gulls.

Mediterranean Gulls can be characterised as gentle fliers, able to hang in the wind, hover and make sudden, subtle manoeuvres to catch shallow pelagic prey in the water by surface dipping and surface seizing. Mediterranean Gull could profit from small prey available at the water surface in a natural situation, but could as well utilise resources of food made available in the night around the strong lights of purse seiners, just as Adouin's Gulls *Larus audouinii* (Arcos & Oro 2002). In the NW Mediterranean, however, where Mediterranean Gulls are the second most numerous species attending trawlers during the day, it is not known to show up around purse seiners in the night (Arcos & Oro 2002). Within the Mediterranean, contrary to the observations described here, the gulls returned to the coast to roost in the evening (J.M. Arcos *pers. obs.*).

The question can be posed why offshore feeding gulls return to the coast to roost. The risks for roosting gulls to become disturbed, attacked or kleptoparasitised all seem greater near the coast than further offshore (excluding the completely unknown risks for underwater attack). Mediterranean Gulls at sea are constantly at risk for kleptoparasitic attacks by Parasitic Skuas *Stercorarius parasiticus*, and in the NW Mediterranean these gulls were preferred as victims over other gull species in the area (Arcos 2000). Parasitic Skuas are much more numerous in coastal waters than offshore, and attacks are therefore more likely to occur in nearshore waters. Nearer the coast, it will be

easier to escape from adverse weather conditions simply by settling on land or by seeking shelter behind headlands. The avoidance of predation might motivate the birds not to roost on land as a default. Apart from the presence of terrestrial mammalian predators, there is the danger to fall victim to Peregrine Falcons *Falco peregrinus* and other raptors (Oro 1996; Oliveira 1984; pers. observ.). Roosting Mediterranean Gulls are clearly alert and afraid of aerial predators. In Vila Nova de Milfontes, all Mediterranean Gulls took wing in response to a soaring Buzzard *Buteo buteo*. The availability of undisturbed beaches near Guincho and Cabo Raso is restricted, as this part of coast of Portugal mainly consists of steep cliffs and rocks and many recreational activities occur on the beaches.

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OP ZEE FOERAGEREN VAN ZWARTKOPMEEUWEN *LARUS MELANOCEPHALUS* IN DE WINTER IN PORTUGAL

In december 2001 zijn op drie ochtenden en één namiddag waarnemingen verzameld van Zwartkopmeeuwen Larus melanocephalus vliegend over zee en rustend langs de kust nabij Cascais (tussen Cabo Raso en Guincho), Centraal-Portugal. Op basis van de vliegbewegingen van en naar de kust lijkt het erop dat tenminste een deel van de populatie Zwartkopmeeuwen overwinterend langs de kusten van Portugal uitsluitend op zee zijn voedsel vindt. Hetzelfde gaat op voor de grote aantallen overwinterende Kleine Mantelmeeuwen Larus graellsii. Gedurende drie ochtenden werd gezien hoe Zwartkopmeeuwen van grote afstand van zee naar de kust kwamen gevlogen om achter de branding op het water te landen en in groepen van meest enkele tientallen exemplaren te gaan rusten. Het is waarschijnlijk dat op de waargenomen dagen de vogels de nacht op zee hebben doorgebracht en niet aan de kust, aangezien in de ochtend daar geen enkele Zwartkopmeeuw werd aangetroffen. Op grond van de aanname dat de vogels op de drie waarneemochtenden vanaf het moment van zonsopkomst naar de kust begonnen te vliegen (ondersteund door aanwijzingen), is berekend dat de vogels tientallen kilometers kunnen hebben afgelegd voordat zij bij de kust werden waargenomen. Mogelijke redenen om in de ochtend terug naar de kust te vliegen om daar te rusten, kunnen predatievermijding en het gemakkelijk kunnen ontvluchten van slechte weersomstandigheden zijn. Het risico om gekleptoparisiteerd te worden door met name kleine jagers is echter aan de kust wel groter. De reden om predatie te vermijden is, naast verstoring door recreatie van mensen, mogelijk ook een verklaring voor het feit dat de vogels langs het bestudeerde deel van Portugal niet of nauwelijks op het land rusten. Tijdens de waarnemingen in de namiddag werden geen rustende Zwartkopmeeuwen waargenomen. Wel werd op dit tijdstip foerageergedrag gezien, waarbij de vogels naar alle waarschijnlijkheid succesvol waren. De vraag kan gesteld worden of het foerageergedrag van de Zwartkopmeeuwen alleen beperkt is tot een periode rond zonsopkomst en zonsondergang. Het ligt voor de hand te veronderstellen dat er ook ‘s nacht wordt gefoerageerd. Waarschijnlijk liggen veranderingen in voedselbeschikbaarheid ten gevolge van

verticale migratie van prooien in de waterkolom ten grondslag aan de dagelijkse timing van het foerageergedrag van de meeuwen. Een alternatieve voedselbron is dat vogels op zee profiteren van vissersschepen overboord gezette visresten. Het gaat hierbij vermoedelijk om purse-seiners, visserschepen die 's nachts actief zijn en 's ochtends vroeg 'schoon schip maken'. Deze visserschepen hebben het gemunt op grote scholen van jonge haringachtigen (o.a. sardines) voor de vismeelindustrie. De vissen worden 's nachts met behulp van grote lampen naar het oppervlak gelokt en vervolgens ingesloten door een groot staand net dat door middel van een tweede schip om de scholen heen getrokken wordt.

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