What happens when you get rid of P granules? Mutants that fail to partition P granules to the P lineage are viable and fertile, suggesting that P granules are not essential to distinguish soma from germline in embryos. Mutations in individual P-granule components lead to sterility at high temperature and impaired translational control of at least some mRNAs. What happens when germ cells lack all P granules, however, has been hard to determine due to functional redundancy among P-granule components. A recent study found that simultaneous depletion of PGL-1, PGL3, GLH-1 and GLH-4 gives rise to germ cells that occasionally express somatic markers and form neurite-like extensions. An attractive possibility is that P granules preserve the totipotency of the germline by silencing somatic differentiation programs until fertilization.

Where can I find out more?

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Marine mammals trace anthropogenic structures at sea

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On land, species from all trophic levels have adapted to fill vacant niches in environments heavily modified by humans (e.g. [1]). In the marine environment, ocean infrastructure has led to artificial reefs, resulting in localized increases in fish and crustacean density [2]. Whether marine apex predators exhibit behavioural adaptations to utilise such a scattered potential resource is unknown. Using high resolution GPS data we show how infrastructure, including wind turbines and pipelines, shapes the movements of individuals from two seal species (*Phoca vitulina and Halichoerus grypus*). Using state-space models, we infer that these animals are using structures to forage. We highlight the ecological consequences of such behaviour, at a time of unprecedented developments in marine infrastructure.

Evidence for use of anthropogenic structures at sea by apex predators is limited and based on non-individualised presence data from acoustic or visual studies focused on single structures or complexes [3]. To understand this issue, we need high resolution data on fine-scale movement and activity patterns of individual animals in relation to both point (e.g. wind turbines) and linear structures (e.g. pipelines). Such data are now available from animal-borne GPS tracking devices (GPS/GSM tags, Sea Mammal Research Unit). Tags were deployed on harbour and grey seals on the British and Dutch coasts of the North Sea (Supplemental information). Both species alternate foraging trips at-sea, lasting from a few days to a month, with visits to land to haul-out.

We recorded 11 harbour seals within two active windfarms: Alpha Ventus, Germany and Sheringham Shoal, south-east United Kingdom. In the north-east Netherlands, four of 96 individuals tagged in 2010 and 2011 (tag duration: 25–161 days) entered Alpha Ventus (constructed in 2009 and operational from 2010). Two of these four showed striking grid-like patterns of movements as they concentrated their activity at individual turbines (Figure 1). In 2012, while some turbines were operational, seven of the 22 individuals tagged in south-east England entered Sheringham Shoal (construction: 2010–2012); one did so on each of its 13 trips and showed similar grid-like movement patterns (Supplemental movie S1).

Movements of both grey and harbour seal individuals showed associations with subsea pipelines (Supplemental information). In 2008, of ten grey and six harbour seals tagged in south-east Scotland, one of each species associated with pipelines. Of 138 harbour seals tagged in the north-east Netherlands (2009–2011), two encountered a section of pipeline and both followed it on multiple trips for up to ten days at a time (see Figure S1). In addition, two of 22 seals tagged elsewhere in the Netherlands were also recorded following pipelines.

The data strongly suggest that these structures were used for foraging and the directed movements show that animals could effectively navigate to and between structures. Area restricted searching, characterized by high sinuosity and reduced horizontal speed, has been used to identify likely foraging in seals [4]. Using state space models [4], we found that the three animals that showed a grid-like movement pattern concentrated their foraging effort in the windfarms (Supplemental information). Furthermore, once within the windfarm area, the probability of foraging significantly increased towards individual structures for the two seals that spent the majority of their time near the turbines (Figure 1). When following linear structures, high sinuosity associated with area restricted searching should not be expected by default. However, within 100 m of the pipelines, the measurements of speed were similar to the foraging speed distribution estimated by the state-space model (Supplemental Figure S1).

The finding that a proportion of seals adjust their behavior to make use of anthropogenic structures raises questions regarding the attributes of these individuals and the ecological consequences of such behavior. The individuals utilizing structures often did so repeatedly, suggesting that, at least for them, it represents successful foraging behavior. Although it is unclear how many pipelines are exposed on the seabed and thus the number of individuals that may encounter them, a relatively small proportion of individuals encountering windfarms utilized them. Individuals exhibiting the behavior included both sexes and ages (juveniles and adults) and did not differ obviously in condition at capture compared with the rest of the tagged animals. Furthermore, the individuals that foraged in windfarms also foraged elsewhere on their trips. It is, therefore, unlikely that those using structures represent a low-quality subset of the population that is unable to forage successfully elsewhere, or dominant animals that are able to exclude others. We hypothesize that a more likely explanation is individual variation in behavioral plasticity and thus in the tendency to exploit novel habitats [5]. The windfarms considered here were new, and prevalence of such behavior may increase with time, especially if the artificial reefs are not yet fully established. Even at the levels of prevalence within our sample, this behavior is likely to be displayed by a large number of individuals given that the population of harbour seals in the North Sea is estimated at 55,000 [6,7] and 65,000 grey seals are estimated to haul-out on the British coast of the North Sea alone [8].

In this period of unprecedented development of the marine renewables industry, the number of apex predators encountering such structures is likely to increase. The ecological consequences may be dependent on whether such reefs constitute an increase or just a concentration of prey (the ‘production versus attraction’ debate [2]). We need to resolve this uncertainty to assess whether anthropogenic structures should be designed and managed to reduce their overall ecological footprint (if they predominantly concentrate biomass and act as ecological traps [9]) or to maximize any potential ecological benefits (e.g. offering new foraging opportunities for top predators) [10].

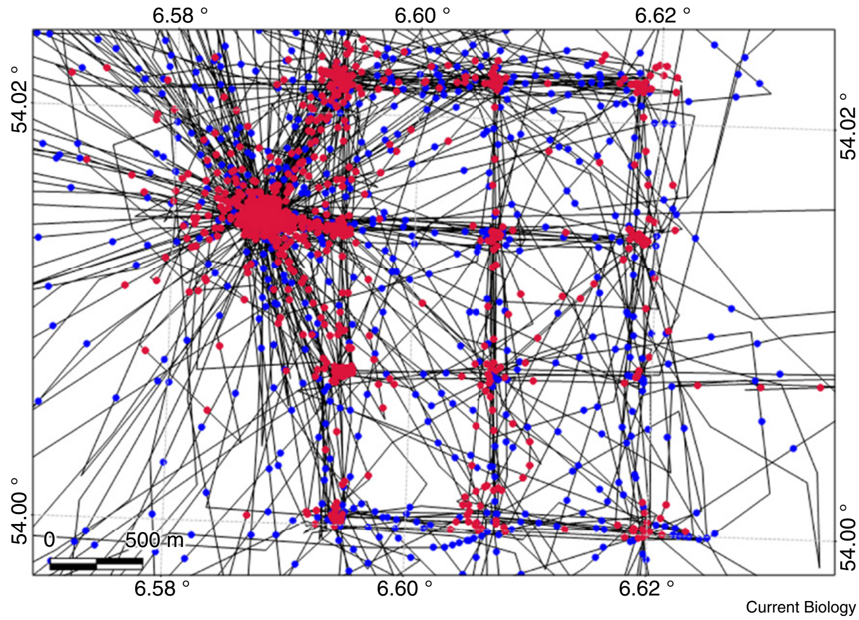

Figure 1. The tracks of a harbour seal around Alpha Ventus windfarm.
Points show locations at 30 minute intervals; red indicates higher chances of foraging (p(foraging) > 0.5) as predicted by our state-space model and blue higher chances of travelling. The individual appears to forage at all 12 turbines and the meteorological mast (constructed in 2003) to the west of the windfarm.

Supplemental Information

Supplemental Information including experimental procedures and one figure can be found with this article online at http://dx.doi.org/10.1016/j.cub.2014.06.033.

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