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# Ocean and Coastal Management

journal homepage: [www.elsevier.com/locate/ocecoaman](http://www.elsevier.com/locate/ocecoaman)

## Motivations and behavior of off-road drivers on sandy beaches

N. Petch<sup>a,b</sup>, G.S. Maguire<sup>c</sup>, T.A. Schlacher<sup>d</sup>, M.A. Weston<sup>a,b,\*</sup><sup>a</sup> Deakin University, Geelong, Australia<sup>b</sup> Centre for Integrative Ecology, Faculty of Science, Engineering and the Built Environment, School of Life and Environmental Sciences, Deakin University, 221 Burwood Hwy, Victoria, 3125, Australia<sup>c</sup> BirdLife Australia, Suite 2-05, the Green Building, 60 Leicester Street, Carlton, Victoria, 3053, Australia<sup>d</sup> The ANIMAL Research Centre: Health + Ecology + Conservation, Faculty of Science, Health & Education, University of the Sunshine Coast, Maroochydore, QLD, 4558, Australia

## ARTICLE INFO

## Keywords:

GPS  
 Off-road vehicles (ORV)  
 Recreation  
 Ocean beaches  
 Zoning

## ABSTRACT

Off-road vehicles (ORVs) on sandy beaches are highly controversial; they cause ecological harm, but at the same time are popular recreational tools. This juxtaposition constitutes a wicked problem in coastal management. Advancing solutions to this problem will require information on what motivates beach driving and what form it takes. To this end, we tracked off-road vehicles and explored the range of motives and purposes of drivers in the south-eastern part of South Australia. Four user groups were evident based on self-reported beach activities: General Recreation (REC), Fishing (FISH), Water-based Recreation (WATER) and Off-road Driving (ORD). Overall, drivers emphasized motivations related to experiencing quiet and remote coastal landscapes, with less emphasis on experiencing wildlife or the capacity to carry equipment or pets. Levels of ‘escapism and exploration’ were higher for ORD, moderate and similar for REC and FISH, and lowest for WATER. Levels of ‘experience and opportunity’ differed between all user groups, being highest for ORD, FISH, REC then WATER. ORD were more likely to make one-way beach trips. There was no difference in track length (km) amongst user groups (means, 3.45–5.21 km). However, the speed of ORD (including stops) was almost double that of other recreational groups (highest speed recorded, 140 kph), and these drivers are estimated to cause wildlife disturbance on 70% of the area of the beaches on which they drove. Those visiting the beach with the express purpose of driving are therefore predicted to cause the most widespread ecological disturbance. The motivations that primarily relate to psychological well-being (i.e. escape) and adventure (i.e. exploration) compared with much less importance being placed on habitats and wildlife poses significant challenges to conservation of beach ecosystems subjected to vehicle traffic. Further research could identify sections of beaches less attractive to drivers and yet important for wildlife, thereby creating conservation areas that could be protected at lower socio-economic costs whilst providing some refuge for beach-dwelling wildlife.

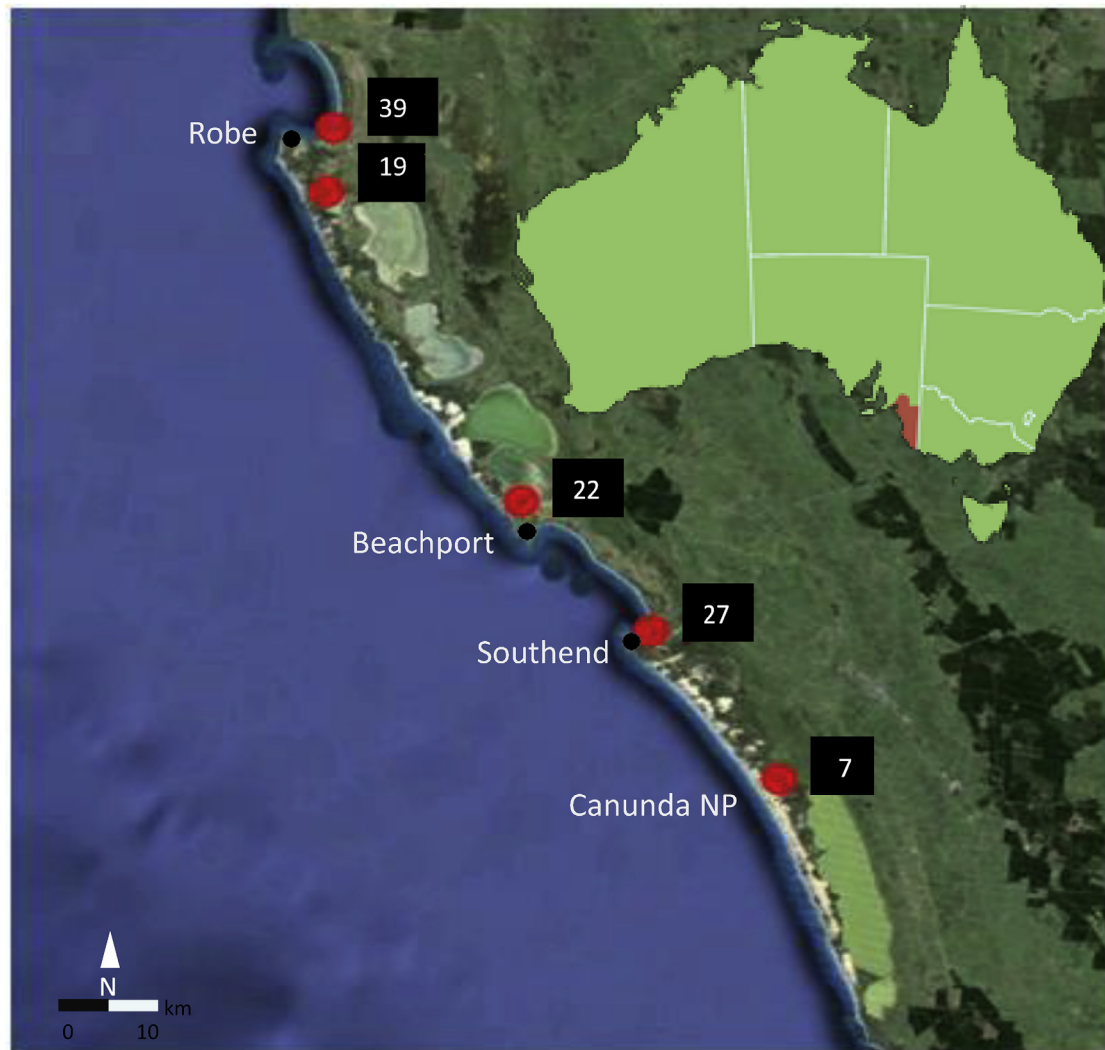
### 1. Introduction

Beach recreation includes a wide variety of leisure pursuits such as swimming, surfing, walking, fishing and driving of off-road vehicles (Maguire et al., 2011; Priskin, 2003a). The recreational use of off-road vehicles (ORVs) on sandy beaches is popular on many shores worldwide, but highly controversial due to the environmental harm it causes (e.g., Priskin, 2003a; Schlacher and Thompson, 2007; Vivian and Schlacher, 2015). Driving on ocean beaches may also facilitate a number of other leisure activities such as swimming, fishing, surfing and sight-seeing (Fisher, 1998). Vehicles on beaches allows drivers to carry more recreational equipment, access otherwise remote locations, and engage in unique driving experiences, thus it is considered a

‘tourism product’ in some places (Mbuteti, 2013).

Driving on beaches poses a number of substantial environmental threats. Vehicles on beaches destroy vegetation (Luckenbach and Bury, 1983) and cause considerable sediment movement and erosion (Ramsdale, 2010; Schlacher and Thompson, 2008). In terms of fauna, vehicles damage habitat (Schlacher and Morrison, 2008; Thompson and Schlacher, 2008) and collide with, and kill, marine fauna such as birds and their eggs and young (Schlacher et al., 2013a, b, c; Williams et al., 2004), turtles (Hosier, 1980), and invertebrates (Davies et al., 2016; Moss and McPhee, 2006; Schlacher et al., 2007a, b; Schlacher et al., 2008a, b; Walker and Schlacher, 2011). Vehicles also cause wildlife disturbance (the physiological and/or behavioral disruption of normal activities such as resting (roosting) and feeding (Schlacher et al., 2013a,

\* Corresponding author. Deakin University, Geelong, Australia.  
 E-mail address: [mweston@deakin.edu.au](mailto:mweston@deakin.edu.au) (M.A. Weston).



**Fig. 1.** Map of the Limestone Coast (red area on inset). Red spots indicate deployment sites and the number of loggers deployed at each site. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

b, c; Spaul and Heath, 2016; Weston et al., 2012b), both directly, and indirectly by transporting people and dogs (Meagher et al., 2012). Drivers on beaches rarely adhere to protocols that reduce their impacts, such as slowing down or steering away from wildlife (Weston et al., 2011).

The number of vehicles on beaches is rising and coastal managers face the challenge of managing vehicle access along coastlines (Priskin, 2003a; Klein et al., 2004; Schlacher et al., 2008a, b). Recreational impacts vary with intensity (frequency of use); driver behavior and consequent vehicle distribution patterns, and spatial distribution of vehicle-based or transported recreational users (Cole, 1994; Schlacher et al., 2008a, b; Sun and Walsh, 1998). Although beach drivers engage in different recreational activities, they are often considered as a homogeneous group (Taylor and Prideaux, 2008).

There is a growing concern that such broad classifications of recreationists may not reflect a more complex situation, such as heterogeneous objectives, motivations and behaviors, and that understanding possible impacts and solutions requires a more nuanced understanding of the recreationists involved (Wang et al., 2016). Arguably, the lack of knowledge regarding beach-driver objectives, motivations and behavior represents a critical information gap for those charged with managing beach environments (Sun and Walsh, 1998).

Information on what motivates individuals to undertake a particular leisure pursuit and what they seek during their activities can provide

useful guidance in developing management objectives and may possibly reduce conflicts amongst recreational user types (Graefe et al., 2000). For example, understanding the motivation of visitors to natural areas can identify specific landscape attributes desired by recreationists and this can underpin spatial zoning and guide infrastructure planning and access provision (Beh and Bruyere, 2007).

One of the primary goals of this study is to identify the motivations of drivers of Off-road Vehicles on ocean shores. In the case of driving on ocean shores, different driver objectives (purposes or goals) may suggest that subpopulations ('recreational units') of beach drivers exist. For example, Schlacher et al. (2013a, b, c) described vehicles on beaches with fishing rods versus those without, and from this inferred the drivers' likely purpose. This is akin to 'market segmentation' among tourists (e.g., Sánchez-Fernández et al., 2016).

Examining heterogeneity amongst drivers enables the identification of 'Management Significant Recreational Units' (MSRUs) i.e. groups of people who have similar objectives and thus are likely to require similar management responses; MSRUs may differ in terms of constituent motivations (McFarlane, 1994; Hvenegarrd, 2002). Therefore, herein we define MSRUs (henceforth, 'user groups') for beach drivers and examine variation in motivations among user groups.

Finally, we postulate that drivers within different MSRUs may behave differently (for example, see Weston et al., 2011), using beach-capes in different ways, thereby creating specific spatial patterns of use.

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