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Using social media as a cost-effective resource in the photo-identification of a coastal bottlenose dolphin community

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Abstract

1. Bottlenose dolphins encountered around the Irish coast are considered part of a wide-ranging coastal community; however, knowledge on the significance of the north of Ireland for this species is limited by a lack of dedicated effort.

2. Through social media, the opportunity now exists to gather large volumes of citizen science data in the form of high-quality images, potentially extending the spatial and temporal scope of photo-identification studies.

3. The purpose of this study was to investigate social media as a data resource for photo-identification studies and to provide a preliminary assessment of bottlenose dolphins in the north of Ireland. Specifically, the study sought to examine the photo-identification data for spatial clustering.

4. The study identified 54 well-marked individuals and provided evidence of potential year-round occurrence, with successful re-sightings throughout the study period (2007–2016). There was a geographic concentration of re-sightings along the north of Ireland, suggestive of interannual site fidelity. These results provide scientific rationale for strategically targeting the north of Ireland in future research on the Irish coastal community.

5. For effective conservation of the bottlenose dolphin it is imperative that scientific research, and resultant management objectives, consider wide-ranging communities such as the Irish coastal community. Our research highlights data collection via social media as a cost-effective and scientifically valuable tool in the photo-identification of coastal cetaceans. We recommend that this method is used in research on low-density and wide-ranging coastal cetaceans.

KEYWORDS
coastal, distribution, habitats directive, monitoring

1 | INTRODUCTION

Photo-identification is a non-invasive technique commonly used in mark-recapture studies. The resulting data can be used to estimate population size and investigate site fidelity and the social structure of cetacean populations (Mann, Connor, Tyack, & Whitehead, 2000). For example, when cetaceans are sighted visually a portion of the population can be ‘captured’ through photography. The images can then be
analysed to identify individuals through distinctive markings. The method is repeated for subsequent sightings and the number of marked individuals within each visual sighting is counted (Würsig & Jefferson, 1990). In study areas with low animal densities and/or transient or wide-ranging populations, photo-identification research can be challenging because of logistics and time constraints. These studies often require considerable effort to obtain sample sizes suitable for statistical analysis (Cheney et al., 2013). As a result, research in regions with low species density may incur a substantial financial burden. Alternatively, data obtained through citizen science can potentially extend the spatial and temporal scope of photo-identification research. Several studies have used photo-identification data collected by members of the public for a range cetacean species (Beck et al., 2013; Cheney et al., 2013; O’Brien et al., 2010; Ryan et al., 2015). This use of citizen science is a considerable advantage when studying highly mobile cetaceans, which often range across a number of political jurisdictions (O’Brien et al., 2010; Robinson et al., 2012) and thus range outside the remit of many government research organizations and local charitable organizations. Furthermore, in regions where economic conditions provide only limited resources for marine research (Katsanevakis et al., 2015), citizen science may constitute the only feasible method of data collection.

The bottlenose dolphin, *Tursiops truncatus*, is regularly encountered in coastal waters of the eastern North Atlantic (Thompson & Wilson, 2001). This species is widely recognized by the general public and often exhibits noticeable surface active behaviours, and thus is a suitable candidate for photo-identification through citizen science (Cheney et al., 2013; O’Brien et al., 2010; Robinson et al., 2012). Regional-scale studies have differentiated between coastal and pelagic bottlenose dolphin communities (Louis et al., 2014), with evidence of fine-scale population structuring (Louis et al., 2014; Mirimin et al., 2011). Movements between coastal communities have been described between the east and west coast of Scotland (Cheney et al., 2013). In addition, long-distance movements have been documented between the Irish and the British coasts (Nykanen et al., 2018; O’Brien et al., 2010; Robinson et al., 2012). The interchange between coastal communities and the possibility of ephemerality are likely to have direct implications for long-term monitoring and thus conservation management. These considerations have been raised in the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) Intermediate Assessment (Geelhoed, Mitchell, Hanson, Weinberg, & Hawkridge, 2017).

A recent Ireland-wide photo-identification study suggested that individuals encountered around Irish coasts are likely to form part of a wide-ranging Irish coastal community (Miranda, 2017). The study reported that the greatest number of re-sightings were located along the north-east coast of Ireland (Miranda, 2017). Wide-ranging and/or transient communities are likely to require different management objectives than their resident counterparts. Consequently, if conservation of the bottlenose dolphin is to be effective it is imperative that scientific research encompasses both resident and transient communities. The geographic concentration of re-sightings suggested by Miranda (2017) poses an important question on the potential for philopatry in the Irish coastal community. In particular, if the geographic concentration of re-sightings is the result of interannual site fidelity, the north-east of Ireland could form an important area for research on a wide-ranging bottlenose dolphin community. The findings presented by Miranda (2017) are, however, greatly constrained by the lack of any dedicated effort, with relatively few photo-identification encounters in the north-east of Ireland (County Antrim and County Down) between 2005 and 2016 (n = 17; Miranda, 2017). Through social media, the opportunity now exists to gather large volumes of citizen science data in the form of high-quality images suitable for photo-identification (Barve, 2014; Davies, Stevens, Meekan, Struve, & Rowcliffe, 2013; Giovos, Ganias, Garagouni, & Gonzalez, 2016). Although images obtained via social media may not always provide sufficient information for abundance estimates (although see Davies et al., 2013), they can offer the possibility to study trends in species occurrence and site fidelity. Additionally, as some coastal communities have been considered ephemeral (Geelhoed et al., 2017), the ability to uncover historical data provides an opportunity to investigate the longevity of philopatry in coastal communities. Collectively, data mining through social media can serve to expand the spatial and temporal scope of existing studies and has the potential to be used as a preliminary tool to investigate prospective study areas and to direct dedicated research effort.

The overall aims of this study were, therefore, to investigate social media as a data resource for photo-identification studies and use the data gathered to provide a preliminary assessment of bottlenose dolphins in the north of Ireland that could inform future research. We sought to investigate the occurrence, site fidelity, and social structure of bottlenose dolphins in this area and, through this, examine the findings presented by Miranda (2017), that the north-east of Ireland represents an important reo-sighting area for the Irish coastal community.

## 2 METHODS

Three social media/photo-sharing sites were used in this study: Facebook (www.facebook.com), Twitter (www.twitter.com), and the photo-sharing site Flickr (www.flickr.com). Public access to Facebook was granted in late 2006 (Facebook, 2006); therefore, images from 2007 onwards were included in the search. When possible the photographer(s) or the person responsible for the post was contacted directly to obtain further information (e.g. estimated group size and additional images) and confirm the location. If direct contact was not possible or successful, the location as detailed on the social media post was assumed to be correct. As a result, locations were grouped into categories, e.g. Ramore Head, as opposed to exact coordinates. In addition, all bottlenose dolphin photo-identification data submitted to the Irish Whale and Dolphin Group (IWDG) as part of their cetacean sightings scheme (www.iwdg.ie) were obtained; up-to-date data were
supplied throughout the data collection stage (from 2015 when project started until mid-2017).

A photo-identification protocol was devised to remove poor-quality images from the dataset while still allowing suboptimal resolution and non-perpendicular images of well-marked individuals to be retained in the dataset. Well-marked individuals were defined as those with distinct markings that made them uniquely identifiable. For the purpose of this study, distinct markings included both permanent and temporary markings. A number of factors can influence the correct identification of individuals within photo-identification studies, including image quality, a lack of distinctiveness in individual markings, and changes of markings over time (Stevick, Palsbøll, Smith, Bravington, & Hammond, 2001). The photo-identification protocol used in this study therefore consisted of initial screening, dorsal-fin identification by two independent assessors, and validation by a third assessor.

Initial screening removed duplicates and images that were out of focus. Two independent assessors (DW and CG) then selected all uniquely identifiable dorsal fins within an encounter. Only dorsal fins that were selected by both independent assessors were validated (SB) and considered in the further analysis. For the first encounter, the validated dorsal fins formed the preliminary photo-identification catalogue. In subsequent encounters, validated dorsal fins were matched to the initial catalogue or were assigned a new identification code and added to the catalogue.

Markings can change over time and as individuals with temporary markings were also selected for analysis, encounters were assessed chronologically. Additionally, every image that resulted in a successful identification was archived in a ‘fin folder’: this provided the basis, in a time series of images for each individual, for assessing the permanence of markings and for reviewing re-sightings. The catalogue was continually updated with the best-quality image of each individual, with right and left dorsal fin profiles when possible. Upon completion of the catalogue, two independent assessors (GB and CG) reviewed the catalogue for duplicates and reviewed the ‘fin folders’ of each individual for errors in re-sightings. Only individuals and re-sightings accepted by both independent assessors were retained for further analysis. Information on group size was not available for the majority of encounters, and therefore abundance estimates were not calculated as part of this study.

The citizen science photographs of bottlenose dolphins were used in social-structure analyses, carried out in SOCPROG 2.8 (Whitehead, 2017) through MATLAB (The MathWorks Inc., 2017). NETDRAW (Borgatti, 2002) was used for graphical representation of the strength of interactions between individuals. The sampling period was set as ‘Encounter’, this considered identifications of the same individual on separate days as separate identification events. As data were obtained from 20 citizen scientists around the north of Ireland, however, it was possible that multiple identifications of the same individual could occur within the same day from different locations, and thus represent different encounters. Prior to analysis, data were investigated for multiple identification events during the same day and if necessary assigned separate encounter ID. Association was set as ‘Group Variable’ and was defined as ‘grouped in sampling period’. In SOCPROG the association is a numerical value (either 1 or 0) assigned for each pair of individuals in a sampling period (Whitehead, 2017), and individuals will be assigned a score of 1 (associated) if they are seen at least once in the same group during the sampling period and a score of 0 (not associated) if they are not seen in the same group during the sampling period (Whitehead, 2017). It is recommended that social analyses include only individuals that have been sighted in five or more encounters (Whitehead, 2017). As a result of the small sample size, however, individuals that were rarely seen were not excluded from the analysis presented here. This decision was a trade-off between an increased bias in the social analysis and obtaining a computationally feasible sample size. It should be noted that the social structure presented here may not capture the true social system of this community and represents a preliminary assessment. The half-weight index (HWI) was used to determine the strength of associations between individuals (a dyad). This index is commonly used when investigating the social structure of cetacean communities as it accounts for bias in photo-identification studies, where only a portion of the individuals in each encounter are identified (Cairns & Schwager, 1987). The social structure within the community was then illustrated using a sociogram of the dyadic HWI indices.

The cumulative number of individuals identified was determined for the entire study period and annual re-sighting rates were determined for each uniquely identifiable bottlenose dolphin. Individuals were assigned to one of three site-fidelity categories based on re-sighting rates (adapted from Brereton, Jones, Leeves, Lewis, Davies, & Russel, 2018). The present study was prone to temporal biases, with seasonal peaks coinciding with optimal weather conditions for citizen scientists. To reduce the effect of this bias, site-fidelity classifications did incorporate seasonal information. To better reflect long-term philopatry, further restrictions were imposed on interannual re-sightings for the transient classification.

1. Probable resident: re-sighted on at least four occasions during the study period.
2. Occasional visitor: re-sighted on one to three occasions during the study period, but not if these encounters occurred in different years (i.e. not including interannual re-sightings).
3. Transient: no re-sightings or one re-sighting in different years (i.e. interannual) during the study period.

3 | RESULTS

Data obtained from the IWDG and via social media resulted in 117 encounters with bottlenose dolphins around the north of Ireland between 2007 and mid-2016. Bottlenose dolphin sightings were concentrated in County Donegal (n = 65) and County Antrim (n = 42). The most frequently reported locations were all contained within the northernmost region of the study area, from Malin Head, Donegal, to the Giants Causeway, Antrim (Figure 1). The encounters were reported every year during the study period and were distributed throughout all calendar months, with a notable
FIGURE 1  Map depicting the grouped locations of bottlenose dolphin encounters around the north of Ireland. Larger circles indicate a higher frequency of encounters at that location. The geographic concentration of sightings between Malin Head, Donegal, and Giant's Causeway, Antrim, is highlighted with black hatching.

FIGURE 2  Individuals with severe deformities, referred to as NI0016 (a) and NI0033 (b) in the Agri-Food & Biosciences Institute's (AFBI) catalogue. Photo credits: (a) Irish Whale and Dolphin Group; (b) Gary Burrows, Department of Environment, Agriculture and Rural Affairs.
peak during the summer months of June, July, August, and September \((n = 81)\). Images that could potentially be used for photo-identification were found in 61 encounters. Fifty-four well-marked individual bottlenose dolphins have been included in the final catalogue. The catalogue includes two individuals with severe deformities: NI0016 and NI0033 (Figure 2). The discovery rate for all newly identified individuals (Figure 3) illustrates a steady increase between 2007 and 2010, plateauing until a second increase between 2013 and 2016. There were only three encounters reported for 2011 and 2012, and no acceptable images of individuals were identified for inclusion in the catalogue.

Of the uniquely identifiable individuals sighted during the 8-year study period, 41% \((n = 22)\) were re-sighted. Re-sighting intervals ranged from 0 to 8 years, with the majority of re-sightings occurring within a year. Interannual re-sightings were recorded for 19% \((n = 10)\) of the individuals. The majority of individuals \((n = 37)\) were considered to be ‘transient’, a further 16 individuals were considered ‘occasional visitors’, and one individual, NI0004, was considered a ‘probable resident’. Forty-four individuals (81% of catalogue) were found to be interconnected: i.e. each individual was captured in one or more photographic encounters with at least one of the other 44 individuals (Figure 4). Ten individuals were not connected with the wider study

**FIGURE 3** Discovery curve showing the cumulative number of uniquely identifiable individuals by year (black line) with the number of photo-identification encounters per year (blue bars)

**FIGURE 4** Social network of all individuals photo-identified around the north coast of Ireland. Nodes represent individual bottlenose dolphins and the lines between the nodes indicate that the individuals have been photographed associated together in a group or aggregation. The strength of the social ties are represented by the thickness of the lines between the individuals using the half-weight index (HWI)
group, however: these individuals were not captured in any photographic encounters containing one of the 44 interconnected individuals (Figure 4).

4 | DISCUSSION

Bottlenose dolphin encounters were reported throughout all calendar months, suggestive of year-round occurrence of this species in the waters surrounding the north of Ireland. Encounters were concentrated along a stretch of coastline from Malin Head, Donegal, to the Giants Causeway, Antrim. This area of coast has a relatively high concentration of boating activity (both recreational and fishing) and a few boat tour companies operate in this area, which may have had an effect on the concentration of encounters. The North Antrim, Londonderry, and Donegal coastline is also a popular tourist destination, with many coastal paths providing opportunities for chance sightings of coastal cetaceans. This area, spanning less than 100 km of coastline, could be targeted for future dedicated research. The results can be used to inform policymakers of the presence of bottlenose dolphins in this area, in order to equip them to mitigate against any potential negative impacts from future developments in the area. A peak in bottleneck encounters during the summer months is likely to represent an increase in bottleneck dolphin occurrence during this season; however, it is important to note that this study considered presence-only data. The observed summer peak may therefore reflect a reliance on the general public for data, which may result in skewed observational effort favouring fair-weather conditions (see Berrow, 2008; Pikesley et al., 2011). Sixty-one photo-identification encounters were verified during this study, which has more than tripled the previously reported photo-identification data for the same time period in this region. Fifty-four uniquely identifiable individuals were included in the final coastal bottleneck dolphin catalogue. The rate of discovery for this community has not yet plateaued, however, suggesting that more individuals are yet to be identified. In addition, as the quality of images was highly variable, a small number of encounters that obtained high-quality images could result in a substantial increase in uniquely identifiable individuals. This was observed in 2016 when six encounters resulted in 13 new individuals. Conversely, in 2014, 16 encounters contained images suitable for photo-identification yet only two new individuals were added to the catalogue. Caution should therefore be applied to avoid any overinterpretation of discovery curves derived from citizen science-generated data.

Environmental legislation, namely the European Union’s Habitats Directive (92/43/EEC), has strict reporting requirements in which to assess the conservation status of the Annex-II listed bottlenose dolphin in European waters. Signatories report in 6-year cycles on a country-by-country basis. As a result, the highly mobile nature of this species, with the potential to range across political borders, can be overlooked. Cheney et al. (2013) previously noted that this has, perhaps inadvertently, created a negative bias in recording highly dispersed or low-density cetacean populations. Previous peer-reviewed work in Ireland and Northern Ireland reflects this, with the majority of research effort focused on the resident population of the Shannon estuary (Berrow & Holmes, 1999; Berrow, Holmes, & Kiely, 1996; Berrow, O’Brien, Groth, Foley, & Voigt, 2012; Foley, McGrath, Berrow, & Gerritsen, 2010; Hickey, Berrow, & Goold, 2009; Ingram & Rogan, 2002; Levesque, Reusch, Baker, O’Brien, & Berrow, 2016; O’Brien et al., 2016; Philpott, Englund, Ingram, & Rogan, 2007), in comparison with the wider coastal and offshore populations (Louis et al., 2014; O’Brien et al., 2010; Oudejans, Visser, Englund, Rogan, & Ingram, 2015; Robinson et al., 2012). Studies on these wide-ranging communities typically require considerable financial and logistical support over prolonged time scales across regions (Kaschner, Quick, Jewell, Williams, & Harris, 2012), and results on population parameters (e.g. abundance) are often prone to low statistical power.

Of the uniquely identifiable individuals sighted, 41% were re-sighted; 16 individuals were classified as ‘occasional visitors’ and one individual was classified as a ‘probable resident’. The geographic concentration of re-sightings suggests that the north of Ireland coast is an important location to target further research of this wide-ranging bottlenose dolphin community. A maximum of one re-sighting was recorded for the majority of individuals (59%), classified as ‘transient’ within this study. This finding may be, in part, an artefact of the citizen science data collection process; however, it is probable that this indicates a home range that is greater than the study area. This would further corroborate the findings of previous studies that bottlenose dolphins encountered in the north of Ireland waters are part of a larger coastal population that range throughout Northern Irish and Irish waters (Miranda, 2017; Nykanen et al., 2018; O’Brien et al., 2010). There have also been verified links of this wider population with Scottish waters (Robinson et al., 2012). With the geographical position of the north of Ireland, it is possible that many individuals encountered in this region also range into Scottish and potentially Manx waters. This would be within the maximum 1,277-km dispersal distance documented for bottlenose dolphins in European waters (Robinson et al., 2012). Further research could consider the cross-matching of existing photo-identification catalogues to explore connectivity with neighbouring communities. This would provide a greater understanding of this local community in a broader regional context of the North-East Atlantic and may form a basis for future collaborative conservation management and reporting within the UK and Ireland.

Evidence of potential year-round occurrence and a contextually high re-sighting rate of the 54 well-marked individuals documented in this study can be used as a baseline for future work, and for policymakers and developers to help mitigate against any negative effects of potential activities in this area. This study provides support for dedicated photo-identification research in the north of Ireland. This would improve the quality of images for the individuals already documented, facilitating robust cross-matching with neighbouring catalogues, and would likely result in an increase in the total number of well-marked individuals encountered in the region. This study further substantiates the initial finding by Miranda (2017) that the north-east of Ireland represents a geographic concentration of sightings and re-
sightings of the Irish coastal bottlenose dolphin community, and refines the spatial extent of this region to an area spanning the coastline from Malin Head, Donegal, to the Giants Causeway, Antrim. The authors recommend that future research should be focused on this small stretch of coastline during the summer months. Nevertheless, research throughout the entire calendar year (where weather conditions allow for surveys) would provide further substantiation of the suspected summer peak in bottlenose dolphin occurrence.

The catalogue includes two individuals with severe deformities: NI0016 and NI0033 (Figure 2). Images of NI0016 indicate a back deviation and images of NI0033 show a beak/rostrum deformity. These individuals are both very distinctive and are not likely to be misidentified. Additionally, abnormalities are likely to draw attention from citizen scientists, increasing the likelihood of photographic capture if present within an encounter. There are several reports of cetaceans with deformities, which can be caused by injury, disease, or trauma (Bertulli et al., 2015; DeLynn, Lovewell, Wells, & Early, 2011). It is difficult to assess from the images whether NI0016 has a form of spinal deviation, whether it has a defect in the blubber, or whether the deformity is a result of trauma. It is possible that these types of deformities could have an impact on survival. NI0016 was sighted on only one occasion, so it is not possible to speculate further. Conversely, the beak deformity observed in NI0033 may not have a negative effect on survival, as is the case with beaked whales (Dinis, Baird, Mahaffy, Martin, & Alves, 2017). NI0033 was sighted on three occasions from 2015 to 2016; however, data collection for NI0033 stopped after this time. It would be valuable to include a targeted data-mining exercise on social media for both NI0016 and NI0033 in future research on this community.

This study used publicly available data from citizens who were perhaps unaware that their images contributed to a scientific study. This raises a number of ethical questions in the use of social networking and photo-sharing sites for scientific research. In all instances we attempted to contact data holders to request permission to use the posted images. On no occasion were we denied this permission, and so we are optimistic that the general public are willing to support this initiative and other similar ventures.

Citizen science not only helps to engage the local community and build earth stewardship (Dickinson et al., 2012), but is a cost-effective method of gathering data that allows us to explore the social networks, movements, and site fidelity of highly mobile and wide-ranging species (Embling, Walters, & Dolman, 2015; Miranda, 2017). There are some biases to be aware of when using citizen science data and it is important to take these into account when undertaking analysis (Dickinson et al., 2012). Sampling bias as a result of variation in spatial and temporal effort is one caveat (i.e. difficult-to-access areas will not be fairly sampled compared with highly accessible areas and favourable weather conditions are more likely to be sampled than unfavourable conditions). In this study we did not have access to information on group size for the majority of encounters; as this was not a reliably recorded parameter, it was decided that no further analysis or investigation would be carried out using group size. Another potential limitation of citizen science data involving a wide-ranging species, such as the bottlenose dolphin, is the lack of encounters for social-structure analysis (Whitehead, 2017). In this study we used all individuals in the social analysis and this decision was a trade-off between an increased bias in the social analysis and obtaining a computationally feasible sample size.

In conclusion, this study has demonstrated that citizen science, and the use of social networking sites for data gathering, can deliver a preliminary assessment of a coastal bottlenose dolphin community while simultaneously promoting marine conservation. These findings provide a foundation to direct future research and highlight a cost-effective mechanism to supplement dedicated survey effort. This study shows that bottlenose dolphins are frequently encountered along a stretch of busy coastline in the north of Ireland. The findings provide a scientific rationale for focused research efforts along a specific stretch of coastline. The results can be used to inform policymakers and developers to ensure effective mitigation takes place for any future potentially damaging activities in this area.

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REFERENCES

Barve, V. (2014). Discovering and developing primary biodiversity data from social networking sites: A novel approach. *Ecological Informatics*, 24, 194–199. https://doi.org/10.1016/j.ecoinf.2014.08.008
Beck, S., Foote, A. D., Köttner, S., Harries, O., Mandleberg, L., Stevick, P. T., ... Durban, J. W. (2013). Using opportunistic photo-identifications to detect a population decline of killer whales (*Orcinus Orca*) in British and Irish waters. *Journal of the Marine Biological Association of the United Kingdom*, 94, 1–7. https://doi.org/10.1017/S0025315413001124
Berrow, S. D. (2008) Review of cetacean sightings and strandings data from Northern Ireland, with recommendations for the designation of special areas of conservation, Kilorush. Berrow, S. D., & Holmes, B. (1999). Tour boats and dolphins: A note on quantifying the activities of whalewatching boats in the Shannon estuary, Ireland. *Journal of Cetacean Research Management*, 1, 199–204.
Robinson, K. P., O’Brien, J., Berrow, S. D., Cheney, B., Costa, M., Eisfeld, S. M., ... Whooley, P. (2012). Discrete or not so discrete: Long distance movements by coastal bottlenose dolphins in UK and Irish waters. *Journal of Cetacean Research and Management, 12*, 365–371.

Ryan, C. G., Whooley, P., Berrow, S. D., Barnes, C., Massett, N., Strietman, W. J., ... Schmidt, C. (2015). A longitudinal study of humpback whales in Irish waters. *Journal of the Marine Biological Association of the United Kingdom, 96*, 877–883. https://doi.org/10.1017/S0025315414002033

Stevick, P. T., Palsbøll, P. J., Smith, T. D., Bravington, M., & Hammond, P. S. (2001). Errors in identification using natural markings: Rates, sources, and effects on capture – recapture estimates of abundance. *Canadian Journal of Fisheries and Aquatic Science, 58*, 1861–1870. https://doi.org/10.1139/cjfas-58-9-1861

The MathWorks Inc. (2017). MATLAB. Natick, Massachusetts: The MathWorks Inc.

Thompson, P. M., & Wilson, B. (2001). Bottlenose dolphins revised Ed. Minnesota: Worldlife Library.

Whitehead, H. (2017). SOCPROG 2.8. Halifax: Dalhousie University.

Würsig, B., & Jefferson, T. A. (1990). Methods of photo-identification for small cetaceans. *Reports of the International Whaling Commission, 12*, 43–52.

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