

# Dolphin Residency & Site Fidelity

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## *Bibliography*

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## Contents

Background & Scope .....	3
Sources Reviewed .....	3
Citations .....	4

## **Background & Scope**

The goal of this bibliography is to gather resources that describe and measure residency and site fidelity in dolphin populations. The lack of consistent definitions of residency and site fidelity spurred the creation of this bibliography, in an attempt to identify elements common to studies on how dolphin populations routinely do or do not use the same geographic areas. Due to the overlap in these research areas, citations are not sorted into categories but listed chronologically beginning with the most recently published.

## **Sources Reviewed**

The following databases were used to identify sources: Clarivate Analytics' Web of Science: Science Citation Index Expanded and Social Science Index; Biodiversity Heritage Library, BioOne Complete, JSTOR, and ScienceDirect. Only English language materials published after 1990 were included.

## Citations

Balmer, B., Watwood, S., Quigley, B., Speakman, T., Barry, K., Mullin, K., . . . Schwacke, L. (2019). Common Bottlenose Dolphin (*Tursiops Truncatus*) Abundance and Distribution Patterns in St Andrew Bay, Florida, USA. *Aquatic Conservation-Marine and Freshwater Ecosystems*, 29(3), 486-498 <https://doi.org/10.1002/aqc.3001>

Common bottlenose dolphins (*Tursiops truncatus*) are found in temperate and tropical waters of the world across a wide range of habitats. Along Florida's north-western coast, this species resides in the bays, sounds, and estuaries (BSE) and coastal (CST) waters of the northern Gulf of Mexico. The National Marine Fisheries Service has identified one CST (Northern Coastal Stock) and seven adjacent BSE dolphin stocks, including the St Andrew Bay BSE Stock. Baseline data are critical to assess the impacts of ongoing and future anthropogenic stressors on these stocks. Currently, there is no comprehensive abundance estimate for the St Andrew Bay BSE Stock, and there are limited data on distribution patterns and site fidelity for this stock. In addition, little is known about the Northern Coastal Stock hypothesized to range from the Big Bend of Florida to the Mississippi River Delta, inclusive of the CST waters adjacent to St Andrew Bay. The goals of this study were to conduct photographic-identification surveys during 2015 and 2016 to determine abundance, distribution, and site fidelity of common bottlenose dolphins in the St Andrew Bay BSE Stock over four primary periods (July and October 2015, and April and October 2016). St Andrew Bay BSE dolphin abundance was lowest in April 2016 (199, 95% confidence interval [CI] 173-246), followed by July 2015 (249, 95% CI 199-338), and highest in October 2015 (299, 95% CI 259-361) and October 2016 (315, 95% CI 274-378). Few individuals were sighted in both BSE and CST waters (N=25/353; 7%), and this fact, taken in tandem with limited connections between the BSE and CST environments, suggests that there may be minimal overlap between the St Andrew Bay BSE and Northern Coastal Stocks.

Cobarrubia-Russo, S., Barreto, G., Quintero-Torres, E., Molero-Lizarraga, A., & Wang, X. Y. (2019). Occurrence, Abundance, Range, and Residence Patterns of *Tursiops Truncatus* on the Coast of Aragua, Venezuela. *Mammal Research*, 64(2), 289-297 <https://doi.org/10.1007/s13364-018-0401-1>

Throughout the distribution of the bottlenose dolphin *Tursiops truncatus*, the occurrence, abundance, local distribution, and residential patterns are highly variable according to the pressure of the habitat where sighting occurs. In Venezuela, a study has been developed for the first time describing these aspects for the western of Aragua State (central coast of the country). From 2004 to 2008, 100 field surveys (30km long) were conducted; the daily encounter ratio ranged from 0.79 to 1.11 dolphins/survey (Permanova,  $P < 0.01$ ); the abundance was 18.70 (+/- 9.95) dolphins/transect (relative abundance of 0.62 dolphins/km), registering an increase since April 2007 by income of individuals (pseudo-t,  $P < 0.05$ ). The sightings covered 56.63km (2), 90% of study area. Eighty-six dolphins were photo-identified (identification of new dolphins was constant). Residency analysis was limited to September 2006-August 2007 (continuous sampling); 7 (20.59%) residents (part of a group of 12), 9 (26.47%) occasional visitors (neighboring group and outsiders), and 18 (52.94%) transients were found. The study area is an open coast with shelter (bay) and prey that houses a resident group (sighted throughout the study) that was occasionally visited by a neighbor and occasional groups between October and February, and by transients throughout the year. This resident group inhabits the main bay and the coastal axis, and was associated (similar to 75% of sightings) with *Stenella frontalis* (sighted

throughout the year). We point out the importance of the area for both research and conservation due to the presence of dolphins throughout the year.

de Mello, A. B., Molina, J. M. B., Kajin, M., & Santos, M. C. D. (2019). Abundance Estimates of Guiana Dolphins (*Sotalia Guianensis*; Van Beneden, 1864) Inhabiting an Estuarine System in Southeastern Brazil. *Aquatic Mammals*, 45(1), 56-65 <https://doi.org/10.1578/am.45.1.2019.56>

Baseline demographic information is essential for effective conservation and management strategies for most living species. The abundance of Guiana dolphins (*Sotalia guianensis*) is poorly known, yet species conservation is considered a high priority in areas where human activities may induce population declines. This study estimated abundance for Guiana dolphins in the Cananeia estuary (25 degrees 03' S, 47 degrees 55' W) in southeastern Brazil using mark-recapture data and Pollock's Robust Design Model. Systematic boat-based photo-identification surveys were based on data collected in the summer and winter of 2015 and in the summer of 2016. A total of 55 capture events allowed identification of 133 different individuals. The best model indicated a population with random temporary emigration, a time-constant survival rate, and heterogeneous time-varying capture probabilities among primary periods. The temporary emigration rate ( $\gamma = \gamma'$ ) was 0.05 (+/- 0.03). Estimated population sizes were 430(95% CI: 410 to 451) individuals in the summer of 2015, 384 (95% CI: 366 to 403) individuals in the winter of 2015, and 414(95% CI: 392 to 438) individuals in the summer of 2016, indicating that environmental variables among seasons may have a mild effect on the estimated size of this surveyed population. These estimates should stand as an important baseline for future comparisons. Systematic, long-term monitoring of this population is recommended, and is required to accurately assess population trends.

Durden, W. N., O'Corry-Crowe, G., Shippee, S., Jablonski, T., Rodgers, S., Mazzoil, M., . . . Bossart, G. (2019). Small-Scale Movement Patterns, Activity Budgets, and Association Patterns of Radio-Tagged Indian River Lagoon Bottlenose Dolphins (*Tursiops Truncatus*). *Aquatic Mammals*, 45(1), 66-87 <https://doi.org/10.1578/am.45.1.2019.66>

Information on movement patterns and habitat selection for critical activities are fundamental to understanding and managing animal populations. While bottlenose dolphins (*Tursiops truncatus*) inhabiting the Indian River Lagoon (IRL), Florida, are known to exhibit long-term residency, data regarding short-term movement and association patterns, habitat use, and activity budgets are limited. These parameters and the percentage of time dolphins occurred within a predetermined survey strip were evaluated utilizing VHF radio-telemetry. A total of nine IRL dolphins (eight males and one female) were captured and fitted with radio transmitters (summers of 2007 and 2010). Focal follows utilized instantaneous scan samples and standardized behavioral categories. Conspecifics were identified, and the half-weight index was utilized to evaluate association patterns. Radio tags remained adhered for 15 to 97 days (mean: 45.8 +/- 25.3 days), and the tag attachment site influenced attachment longevity. The linear distances traversed by tagged dolphins ranged between 13.4 to 39.4 km (mean: 28.1 +/- 9.49 km). While shallow water (< 1 m) habitats were frequently utilized (42.8% observations), dolphins selected deeper waters based on availability. Activity budgets differed between individuals and age-classes and were associated with water depth. Foraging and play behavior were observed significantly more in the shallowest water (<= 1 m). Dolphins exhibited a high number of low-level associations (mean: 25.0 +/- 14.58; range: 8 to 43 marked individuals), while one male individual exhibited a high-level male association (coefficient of association [COA] = 0.88) and a moderately high-level female association (COA

= 0.67). This study represents the most extensive radio-tracking effort for IRL dolphins; it established radio-telemetry as a useful method to evaluate seasonal ranging patterns and provided important baseline data on short-term association patterns, activity budgets, and habitat use. Future studies that incorporate remote tracking capabilities, increased time and sample sizes, and nocturnal behavior are warranted to expand our understanding of movement patterns and habitat utilization.

Ortega-Ortiz, C. D., Wonneberger, E., Martinez-Serrano, I., Kono-Martinez, T., Villegas-Zurita, F., Paredes, L. M. E., . . . Verduzco-Zapata, M. G. (2019). Consequences Potentially Related to a Meteorological Event on a Resident Group of Bottlenose Dolphins (*Tursiops Truncatus*) from the Mexican Pacific. *Aquatic Mammals*, 45(1), 99-105 <https://doi.org/10.1578/am.45.1.2019.99>

To monitor these bottlenose dolphins, researchers from the University of Colima conducted monthly photo-identification surveys between March 2011 and May 2012, using a 9-m boat with a 75-hp outboard engine. When dolphins were sighted, the group's position was determined using a hand-held GPS (Garmin map76CS), and standard datasheets were completed with information including the date, time of day, group size, and activities (e.g., traveling, resting, socializing, or foraging; Vaughn et al., 2007). We stayed with each group to take pictures of natural marks and scars on dorsal fins, following Urian & Wells (1996), using a digital camera (Canon EOS 50D) with 100-300-mm lens. For photo-identification we selected images that possessed sharp definition (in-focus images); were oriented perpendicular to the dolphin; and showed the complete dorsal fin to distinguish its form, notches, and scars (Urian et al., 2015). A photographic catalogue was created allowed comparisons among individuals using the software.

Santos, M. C. D., Lailson-Brito, J., Flach, L., Oshima, J. E. F., Figueiredo, G. C., Carvalho, R. R., . . . Azevedo, A. F. (2019). Cetacean Movements in Coastal Waters of the Southwestern Atlantic Ocean. *Biota Neotropica*, 19(2) <https://doi.org/10.1590/1676-0611-bn-2018-0670>

Cetaceans were monitored along ca. 700 km of the southeast coast of Brazil (22 degrees S to 25 degrees S) from 1995 to 2014 using photo-identification. The objective of this study was to identify any presence of long-distance movements for monitored cetacean species and discuss implications. Data on long-range movements of four of the monitored species are presented after the analysis of 321,765 photographs taken for individual identification. Seven individuals from four populations of Guiana dolphins (*Sotalia guianensis*) considered resident to particular estuaries or bays were reported in dispersal involving movement between pairs of protected areas over long-range distances varying between 86 and 135 km. Three cataloged rough-toothed dolphins (*Steno bredanensis*), first seen in Guanabara Bay, Rio de Janeiro state (22 degrees 46'S) in November 2011, were sighted 240 km southwards as members of the same group in coastal waters of Sao Paulo state (23 degrees 46'S) in July 2014. Water depth for those sightings ranged from 16 to 52.7 m; local sightings of rough-toothed dolphins in Brazil have frequently been in shallow waters, but the species global distribution is usually associated with deeper waters. In a 27-day interval in the spring of 2012, a group of 16 orcas (*Orcinus orca*) travelled ca. 277 km in shallow coastal waters ranging from 20 to 30 m deep. Orcas are commonly observed between November and February in southeast Brazil, probably in search for prey. In summer months between 2012 and 2014, three Bryde's whales (*Balaenoptera edeni*) sighted in waters ranging from 14 to 49 m deep, moved between 218 and 327 km. Bryde's whales are usually found in local coastal waters where they spend summer months feeding on sardines. To date, these are the longest

estimated movements reported to *S. guianensis*, *S. bredanensis*, *O. orca* and *B. edeni* in the Southwestern Atlantic Ocean.

Alves, F., Ferreira, R., Fernandes, M., Halicka, Z., Dias, L., & Dinis, A. (2018). Analysis of Occurrence Patterns and Biological Factors of Cetaceans Based on Long-Term and Fine-Scale Data from Platforms of Opportunity: Madeira Island as a Case Study. *Marine Ecology-an Evolutionary Perspective*, 39(2) <https://doi.org/10.1111/maec.12499>

Management and conservation issues are addressed through the identification of areas of particular importance, which requires the acquisition of baseline information on species distribution and dynamics. These types of data are particularly difficult to obtain at high resolution for large marine vertebrates like cetaceans, given that dedicated surveys are complex and logistically expensive. This study uses daily presence-absence sighting data of cetaceans collected year-round from whale-watching boats to support the theory that fine-scale data obtained from platforms of opportunity can provide valuable information on species occurrence and group dynamics. Data from 7,551 (daily) sightings comprising 22 species were collected from 3,527 surveyed days over 11 years (mean of 321 days per year, SD = 17) in the pelagic environment of Madeira Island. Cetaceans were observed on 92% of the surveyed days, and a mean of 15.4 (SD = 1.5), 8.2 (SD = 2.0) and 2.1 (SD = 1.2) species were recorded per year, month, and day, respectively. There were significant differences in the number of species per month ( $p < .001$ ), with the highest diversity recorded in June. At least nine species, comprising 96% of all sightings, were found to use the Madeiran waters on a regular basis, such as the Atlantic spotted dolphin (*Stenella frontalis*), the short-beaked common dolphin (*Delphinus delphis*), the bottlenose dolphin (*Tursiops truncatus*), and others featured in the Red List of the International Union for Conservation of Nature as Endangered, Vulnerable, and Data Deficient. In addition, 10 species were found to use the Madeiran waters for travelling, feeding, resting, socializing and calving, which suggests that the southern and southeastern waters of Madeira Island constitute an area of interest for cetaceans. This study characterizes the cetaceans' community structure (occurrence, aggregation sizes, behaviours, proportion of calves, and inter-specific relationships) of a poorly studied region, providing important information for managers. Finally, the advantages and limitations of using fine-scale data from a type of platform of opportunity that is increasing along coastlines globally are discussed.

Bouveroux, T., Melly, B., McGregor, G., & Plon, S. (2018). Another Dolphin in Peril? Photo-Identification, Occurrence, and Distribution of the Endangered Indian Ocean Humpback Dolphin (*Sousa Plumbea*) in Algoa Bay. *Aquatic Conservation-Marine and Freshwater Ecosystems*, 28(3), 723-732 <https://doi.org/10.1002/aqc.2877>

1. In South Africa, the humpback dolphin (*Sousa plumbea*) has been recognized as the most endangered marine mammal, with a low abundance, a discontinuous distribution, and numerous threats. This research was initiated in 2008 to estimate the number of individual humpback dolphins in Algoa Bay, as well as studying their residency patterns and distribution. 2. The last boat-based study on humpback dolphins, conducted 24 years ago, formed an important reference against which to compare current findings. This study reveals that since the 1990s the number of identified animals decreased from 70 to 50 individuals, and the mean group size of humpback dolphins has also decreased, from seven to three animals. 3. Humpback dolphin behaviour was predominantly that of foraging and travelling, although the overall frequency of foraging still seems to have decreased since early 1990s. 4. Although the species was seen almost all year round, the number of sightings per survey was lowest in January,

March, and April. The number of sightings per kilometre surveyed substantially decreased from 0.018 sightings per kilometre in 2008 to 0.004 in 2011, and the number of animals per kilometre also decreased from 0.042 to 0.009. The re-sighting rates were low, ranging from one to eight times, with 52% of identified dolphins seen only once throughout the study period. Only 6% of the individuals were seen more than three times. 5. Reduced humpback dolphin numbers and sighting rates could be indicative of the rise in anthropogenic activities, such as shipping and recreational boating, as well as a rise in pollution from vessels and urban development. 6. Conservation strategies, such as a Biodiversity Management Plan for the species, are urgently needed in Algoa Bay, especially in the south-west part of the bay, between Cape Recife and the Port Elizabeth Harbour, where the species occurs most frequently.

Bouveroux, T. N., Caputo, M., Froneman, P. W., & Plon, S. (2018). Largest Reported Groups for the Indo-Pacific Bottlenose Dolphin (*Tursiops Aduncus*) Found in Algoa Bay, South Africa: Trends and Potential Drivers. *Marine Mammal Science*, 34(3), 645-665 <https://doi.org/10.1111/mms.12471>

This study investigates how group size of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) changes temporally, spatially, and/or with predominant behavior at two discreet sites along the Eastern Cape coastline of South Africa: Algoa Bay and the Wild Coast. The mean group size of bottlenose dolphins was large with an average of 52 animals. Significantly larger groups were observed in Algoa Bay ( $\bar{x}$  over bar = 60, range = 1-600) than off the Wild Coast ( $\bar{x}$  over bar = 32.9, range = 1-250). In Algoa Bay, the mean group size increased significantly over the study period, from an average 18 animals in 2008 to 76 animals in 2016. Additionally, the largest average and maximum group sizes ever reported both in South Africa and worldwide, were recorded in Algoa Bay (maximum group size = 600). Neither season nor behavior had a significant effect on mean group size at both sites. Similarly environmental variables such as the depth and substrate type also had no influence on group size. It remains unclear which ecological drivers, such as predation risk and food availability, are leading to the large groups observed in this area, and further research on abundance and distribution of both predators and prey is necessary.

Brager, S., & Brager, Z. (2018). Range Utilization and Movement Patterns of Coastal Hector's Dolphins (*Cephalorhynchus Hectori*). *Aquatic Mammals*, 44(6), 633-642 <https://doi.org/10.1578/am.44.6.2018.633>

Home range sizes have been determined for few odontocete populations, although the understanding of comparative trends in range utilization is important for conservation. Most of the published knowledge of the Hector's dolphins (*Cephalorhynchus hectori*) of New Zealand, originates from one well-studied population around Banks Peninsula. Its ranging behavior has been described previously by a decades-long photo-identification (ID) study and by a shorter radio-telemetry study. Little is known, however, about how the dolphins utilize their home range in other coastal areas around the South Island of New Zealand. We used an intensive three-year photo-ID study to define the movement patterns of Hector's dolphins over diel and seasonal scales. Significant differences in the average movement behavior between the East Coast populations off Kaikoura and Moeraki and the West Coast populations off Westport-Greymouth and in Jackson Bay are identified. Movement patterns optimizing range utilization in relation to prey abundance and accessibility are discussed. At the Kaikoura study area, the mean distances between consecutive sightings and speeds of dolphins were considerably reduced compared to other coastal areas. Therefore, the photo-ID study was extended off Kaikoura to cover a total of 14 years. Those findings can be explained by the existence of an environmental barrier



(i.e., the deep-water Kaikoura Canyon) that almost completely interrupts Hector's dolphin movements over the short distance of 15 km and very likely has led to a reduced genetic exchange. In conjunction with two recent studies, we present evidence of the impact of an environmental barrier on the population structure and foraging behavior of this shallow-water dolphin.

Carlucci, R., Bas, A. A., Maglietta, R., Reno, V., Fanizza, C., Rizzo, A., . . . Ieee. (2018). *Site Fidelity, Residency and Habitat Use of the Risso's Dolphin Grampus Griseus in the Gulf of Taranto (Northern Ionian Sea, Central-Eastern Mediterranean Sea) by Photo-Identification*. Retrieved from <https://ieeexplore.ieee.org/abstract/document/8657847>

A photo-identification tool was applied to identify and create a catalogue of photo from Risso's dolphins providing evidence of its site fidelity, residency and habitat use in the Gulf of Taranto (Northern Ionian Sea, Central-eastern Mediterranean Sea). Sightings carried out from 2013 to 2016, occurred in a depth range from 436 to 1000 m with a mean depth value of 762 +/- 217 m. A total of 215 specimens of *G. griseus* were observed including 206 adults and juveniles, 7 calves and 2 new-borns. The evidence of calving and nursering females was inferred from calf association without any other sex information. Group size varied between 2 and 30 dolphin specimens, with a mean value of 13 +/- 7 specimens. A total of 54 Risso's dolphins were identified as distinctly marked. Among these, 34 specimens (63%) were sighted only once and 20 specimens (37%) were re-sighted up to 4 times. Rates of re-sighting within single year were relatively high, reaching 23, 18 and 43% during 2013 (3 re-sighted/13 dolphins), 2014 (4 re-sighted/22 dolphins) and 2016 (12 re-sighted/28 dolphins), respectively. The site fidelity reached 0.50, with a mean value of 0.13 0.18. The monthly residency rate varied between 0.11 and 0.44, with a mean value of 0.17 0.09. Among a total of 9 Risso's dolphins considered as "multi-year residents", 7 specimens were re-sighted in two consecutive years and 2 were re-sighted in a period of two non-consecutive years. Although results suggest the need for further studies implementing the photo-identification catalogue for the Risso's dolphin and allowing possible reconstruction of its migration patterns on the Mediterranean and global scale, the Taranto Valley canyon system seems to be a critical habitat to enforce specific conservation measures for the effective protection of the species.

Gladilina, E., Shpak, O., Serbin, V., Kryukova, A., Glazov, D., & Gol'din, P. (2018). Individual Movements between Local Coastal Populations of Bottlenose Dolphins (*Tursiops Truncatus*) in the Northern and Eastern Black Sea. *Journal of the Marine Biological Association of the United Kingdom*, 98(2), 223-229 <https://doi.org/10.1017/s0025315416001296>

The Black Sea subspecies of the bottlenose dolphin (*Tursiops truncatus ponticus*) is threatened and has a small range. Its population structure is little known: it possibly includes a few local coastal populations. We assessed connectivity between coastal groupings in six localities along 800 km of the coastline based on records of photo-identified animals between 2004 and 2014. Abundance of these groupings, as estimated, ranged between 76 and 174 individually distinctive dolphins. In total, there were 350 identified individuals, of which 91 (26%) were resighted within the same areas. However, only three cases of individual movements between local coastal populations were recorded at the distances between 135 and 325 km. Therefore, despite the absence of physical barriers, the coastal Black Sea population is fragmented into numerous resident or locally migrating groupings with site fidelity. These local populations are loosely connected to each other with rare movements between them. This fragmentation can be a factor contributing to short-term fluctuations in abundance of Black Sea

bottlenose dolphins and their decline in some localities, despite the potentially high population growth rate.

Lopez, B. D., Grandcourt, E., Methion, S., Das, H., Bugla, I., Al Hameli, M., . . . Al Dhaheri, S. (2018). The Distribution, Abundance and Group Dynamics of Indian Ocean Humpback Dolphins (*Sousa Plumbea*) in the Emirate of Abu Dhabi (Uae). *Journal of the Marine Biological Association of the United Kingdom*, 98(5), 1119-1127 <https://doi.org/10.1017/s0025315417001205>

The Arabian Gulf is one of the most heavily impacted water bodies raising serious concerns about the conservation status of many marine species. A limited coastal range and near-shore distribution make Indian Ocean humpback dolphins particularly vulnerable to mortality and traumatic injuries from heavy maritime traffic and gill-netting practices. Prior to the present study, no research had focused on the ecology of this species in the Arabian Gulf despite the potential for human impacts. The mark-recapture method of photo-identification, undertaken during 55 boat-based surveys conducted between 2014 and 2015, was used to assess the occurrence, abundance and use of habitat of this endangered species along the coast of the Emirate of Abu Dhabi (UAE). In all, 368 h and 6703 km of observation were carried out over a period of 5 months, and 54 encounters were made with humpback dolphins. The group size ranged from 1 to 24 individuals and group composition showed that 79% of the observed dolphins were adults. Abundance estimates were calculated and fitted with open population models. A review of all available data indicates that the studied population is the largest reported in the world with 701 (95% CI = 473 - 845) individuals. While their occurrence within Abu Dhabi near-shore waters is frequent, the survey area appears to be only a part of a much larger home range for this humpback dolphin population. The observation of multiple threats derived from anthropogenic activities increases our concerns regarding the conservation of this important dolphin population.

Maglietta, R., Reno, V., Cipriano, G., Fanizza, C., Milella, A., Stella, E., & Carlucci, R. (2018). Dolfin: An Innovative Digital Platform for Studying Risso's Dolphins in the Northern Ionian Sea (North-Eastern Central Mediterranean). *Scientific Reports*, 8, 11 <https://doi.org/10.1038/s41598-018-35492-3>

The Risso's dolphin is a widely distributed species, found in deep temperate and tropical waters. Estimates of its abundance are available in a few regions, details of its distribution are lacking, and its status in the Mediterranean Sea is ranked as Data Deficient by the IUCN Red List. In this paper, a synergy between bio-ecological analysis and innovative strategies has been applied to construct a digital platform, DolFin. It contains a collection of sighting data and geo-referred photos of *Grampus griseus*, acquired from 2013 to 2016 in the Gulf of Taranto (Northern Ionian Sea, North-eastern Central Mediterranean Sea), and the first automated tool for Smart Photo Identification of the Risso's dolphin (SPIR). This approach provides the capability to collect and analyse significant amounts of data acquired over wide areas and extended periods of time. This effort establishes the baseline for future large-scale studies, essential to providing further information on the distribution of *G. griseus*. Our data and analysis results corroborate the hypothesis of a resident Risso's dolphin population in the Gulf of Taranto, showing site fidelity in a relatively restricted area characterized by a steep slope to around 800 m in depth, north of the Taranto Valley canyon system.

Meager, J. J., Hawkins, E. R., Ansmann, I., & Parra, G. J. (2018). Long-Term Trends in Habitat Use and Site Fidelity by Australian Humpback Dolphins *Sousa Sahulensis* in a near-Urban Embayment. *Marine Ecology Progress Series*, 603, 227-242 <https://doi.org/10.3354/meps12709>

Habitat use and site fidelity in coastal dolphins can vary in space and time, and are important components in conservation planning and predicting the impacts of environmental change. Little is known of long-term patterns of habitat use and site fidelity in threatened tropical delphinids. Here, we investigate trends in habitat use and site fidelity of Australian humpback dolphins *Sousa sahalensis* in Moreton Bay, a near-urban embayment in Queensland, Australia, using spatially referenced sightings from systematic surveys and government datasets. Data from 1992 to 2016 were assigned to 3 time periods with similar spatial coverage and compared using ecological niche and kernel models. We also used behavioural data collected from 2014 to 2016 to investigate the potential ecological function underpinning recent habitat preferences. A long-term fidelity and consistency in habitat use was evident at an industrialised port at the mouth of the Brisbane River, but patterns of habitat use were more dynamic elsewhere. Models of spatial patterns of behaviour suggested that areas used consistently were mostly foraging habitats. A marked shift in habitat use away from the northwestern side of Moreton Bay was evident after 1999, which we suggest was due to a decline in habitat integrity exacerbated by periodic floods. Our results imply that the optimal conservation strategy for the species would be to focus on areas that are long-term core habitats, whilst safeguarding against environmental change by maintaining habitat integrity across the broader area delineated by their ecological niche.

Nykanen, M., Dillane, E., Englund, A., Foote, A. D., Ingram, S. N., Louis, M., . . . Rogan, E. (2018). Quantifying Dispersal between Marine Protected Areas by a Highly Mobile Species, the Bottlenose Dolphin, *Tursiops Truncatus*. *Ecology and Evolution*, 8(18), 9241-9258 <https://doi.org/10.1002/ece3.4343>

The functioning of marine protected areas (MPAs) designated for marine megafauna has been criticized due to the high mobility and dispersal potential of these taxa. However, dispersal within a network of small MPAs can be beneficial as connectivity can result in increased effective population size, maintain genetic diversity, and increase robustness to ecological and environmental changes making populations less susceptible to stochastic genetic and demographic effects (i.e., Allee effect). Here, we use both genetic and photo-identification methods to quantify gene flow and demographic dispersal between MPAs of a highly mobile marine mammal, the bottlenose dolphin *Tursiops truncatus*. We identify three populations in the waters of western Ireland, two of which have largely non-overlapping core coastal home ranges and are each strongly spatially associated with specific MPAs. We find high site fidelity of individuals within each of these two coastal populations to their respective MPA. We also find low levels of demographic dispersal between the populations, but it remains unclear whether any new gametes are exchanged between populations through these migrants (genetic dispersal). The population sampled in the Shannon Estuary has a low estimated effective population size and appears to be genetically isolated. The second coastal population, sampled outside of the Shannon, may be demographically and genetically connected to other coastal subpopulations around the coastal waters of the UK. We therefore recommend that the methods applied here should be used on a broader geographically sampled dataset to better assess this connectivity.

Orbach, D. N., Pearson, H. C., Beier-Engelhaupt, A., Deutsch, S., Srinivasan, M., Weir, J. S., . . . Wursig, B. (2018). Long-Term Assessment of Spatio-Temporal Association Patterns of Dusky Dolphins

(*Lagenorhynchus Obscurus*) Off Kaikoura, New Zealand. *Aquatic Mammals*, 44(6), 608-619  
<https://doi.org/10.1578/am.44.6.2018.608>

The challenges of monitoring fully aquatic and long-living mammals have limited research on cetaceans that spans several decades to only a few populations. We report the first long-term assessment of association and residency patterns of dusky dolphins (*Lagenorhynchus obscurus*) off Kaikoura, New Zealand. Dorsal fin images, spanning 30 years of data collection, were used for photo-identification and social structure analyses. A total of 4,022 uniquely marked individuals were identified. Most (80%) were sighted only one time. The population of dusky dolphins off Kaikoura appears to be open, with the possibility of immigration and emigration. Dusky dolphins showed preferences for assembly into either large or small groups, which appear to drive association patterns. They did not demonstrate significant preferred or avoided associations with each other, and had overall weak association patterns. Individuals reside in the Kaikoura area for approximately eight years, and also have temporally stable associations lasting approximately eight years. Dusky dolphins fit the model of a fission-fusion society, and their association patterns may reflect unique local ecological conditions and foraging opportunities.

Passadore, C., Moller, L., Diaz-Aguirre, F., & Parra, G. J. (2018). High Site Fidelity and Restricted Ranging Patterns in Southern Australian Bottlenose Dolphins. *Ecology and Evolution*, 8(1), 242-256  
<https://doi.org/10.1002/ece3.3674>

Information on site fidelity and ranging patterns of wild animals is critical to understand how they use their environment and guide conservation and management strategies. Delphinids show a wide variety of site fidelity and ranging patterns. Between September 2013 and October 2015, we used boat-based surveys, photographic identification, biopsy sampling, clustering analysis, and geographic information systems to determine the site-fidelity patterns and representative ranges of southern Australian bottlenose dolphins (*Tursiops cf. australis*) inhabiting the inner area of Coffin Bay, a highly productive inverse estuary located within Thorny Passage Marine Park, South Australia. Agglomerative hierarchical clustering (AHC) of individuals' site-fidelity index and sighting rates indicated that the majority of dolphins within the inner area of Coffin Bay are regular residents ( $n=125$ ), followed by "occasional residents" ( $n=28$ ), and occasional visitors ( $n=26$ ). The low standard distance deviation indicated that resident dolphins remained close to their main center of use (range=0.7-4.7 km,  $X \pm SD=2.3 \pm 0.9$  km). Representative ranges of resident dolphins were small (range=3.9-33.5 km<sup>2</sup>,  $X \pm SD=15.2 \pm 6.8$  km<sup>2</sup>), with no significant differences between males and females (Kruskal-Wallis, (2)=0.426,  $p=.808$ ). The representative range of 56% of the resident dolphins was restricted to a particular bay within the study area. The strong site fidelity and restricted ranging patterns among individuals could be linked to the high population density of this species in the inner area of Coffin Bay, coupled with differences in social structure and feeding habits. Our results emphasize the importance of productive habitats as a major factor driving site fidelity and restricted movement patterns in highly mobile marine mammals and the high conservation value of the inner area of Coffin Bay for southern Australian bottlenose dolphins.

Passadore, C., Moller, L. M., Diaz-Aguirre, F., & Parra, G. J. (2018). Modelling Dolphin Distribution to Inform Future Spatial Conservation Decisions in a Marine Protected Area. *Scientific Reports*, 8, 14 <https://doi.org/10.1038/s41598-018-34095-2>

As marine predators experience increasing anthropogenic pressures, there is an urgent need to understand their distribution and their drivers to inform spatial conservation planning. We used an ensemble modelling approach to investigate the spatio-temporal distribution of southern Australian bottlenose dolphins (*Tursiops cf. australis*) in relation to a variety of ecogeographical and anthropogenic variables in Coffin Bay, Thorny Passage Marine Park, South Australia. Further, we evaluated the overlap between current spatial management measures and important dolphin habitat. Dolphins showed no distinct seasonal shifts in distribution patterns. Models of the entire study area indicate that zones of high probability of dolphin occurrence were located mainly within the inner area of Coffin Bay. In the inner area, zones with high probability of dolphin occurrence were associated with shallow waters (2-4 m and 7-10 m) and located within 1,000 m from land and 2,500 m from oyster farms. The multimodal response curve of depth in the models likely shows how the different dolphin communities in Coffin Bay occupy different embayments characterized by distinct depth patterns. The majority of areas of high (> 0.6) probability of dolphin occurrence are outside sanctuary zones where multiple human activities are allowed. The inner area of Coffin Bay is an important area of year-round habitat suitability for dolphins. Our results can inform future spatial conservation decisions and improve protection of important dolphin habitat.

Raudino, H. C., Douglas, C. R., & Waples, K. A. (2018). How Many Dolphins Live near a Coastal Development? *Regional Studies in Marine Science*, 19, 25-32  
<https://doi.org/10.1016/j.rsma.2018.03.004>

Coastal developments continue to increase in Western Australia (WA) despite limited information on environmental consequences for coastal dolphins. As an example, a gas processing facility was constructed near the town of Onslow in the Pilbara region in 2012-2015. Boat-based surveys to estimate abundance, density and movement patterns of two species of coastal dolphins in waters around the Onslow development site and Thevenard Island began in 2015. Employing POPAN mark-recapture models, the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) total abundance estimate corrected for the unmarked proportion of the population was 79 SE +/- 24 (CI 43-148) for Onslow. There were insufficient resightings of Australian humpback dolphins (*Sousa sahulensis*) to model abundance accurately. The densities were similar between both sites for each species; 0.59 bottlenose dolphins per km<sup>2</sup> in coastal Onslow waters versus 0.83 bottlenose dolphins per km<sup>2</sup> around Thevenard Island and 0.36 humpback dolphins per km<sup>2</sup> at Onslow and 0.38 humpback dolphins per km<sup>2</sup> around Thevenard Island. The density of humpback dolphins, although low, is comparable to estimates across their range. Movements of the two species between the island and coastal waters of the mainland was not detected. The Australian snubfin dolphin was not sighted during these surveys. The study confirms that Indo-Pacific bottlenose and Australian humpback dolphins use the waters near Onslow, however the low re-capture rates suggest that their home ranges are larger than, and only partially overlapping, the 128 km<sup>2</sup> area. More intense sampling effort would be required to precisely estimate abundance for humpback dolphins.

Ribaric, D. (2018). First Report on Abundance and Distribution of Common Bottlenose Dolphins (*Tursiops Truncatus*) in the Natura 2000 Area, Istria, North-Eastern Adriatic Sea. *Journal of the Marine Biological Association of the United Kingdom*, 98(5), 1039-1053  
<https://doi.org/10.1017/s0025315417001424>

The bottlenose dolphin (*Tursiops truncatus* M.) local population off west Istria in the North-eastern Adriatic has received no prior study of abundance and distribution despite the habitat's relevance for the preservation of this key species in the marine ecosystem. The research area comprises part of the NATURA 2000 network which was predominantly established here for these dolphins. Official data regarding the local population's status in the region are currently marked as deficient. Thus, the aim of the present study was to provide the first population data for the area. Boat-based survey work was carried out from April to September 2012-2015 using a mark-recapture photo-identification method. Prior to this period a random data collection was used to study distribution, since 2001, to cover the area of 927 km<sup>2</sup> lying between Umag to lighthouse Albane in the south. 143 bottlenose dolphins were photo-identified to date with the average group size of 9.27 +/- 6.53 animals. Several abundance models were used, from which the Markovian robust model proved the best fit and predicted between 47-142 dolphins along the west Istria coast. A few individuals were also identified in Slovenia, indicating a bigger home range along the 98 km length of the studied area. There is an indication of a regular year round presence of dolphins. The west Istria coast constitutes an important feeding and breeding ground. The region should develop a sustainable plan to manage those human activities negatively impacting the dolphins. Therefore the present study is of relevance for the implementation of management directives for their conservation.

Santos-Carvallo, M., Sepulveda, M., Moraga, R., Landaeta, M. F., Oliva, D., & Perez-Alvarez, M. J. (2018). Presence, Behavior, and Resighting Pattern of Transient Bottlenose Dolphins (*Tursiops truncatus*) in the Humboldt Current System Off North-Central Chile. *Pacific Science*, 72(1), 41-56 <https://doi.org/10.2984/72.1.3>

Biotic and abiotic factors determine presence and habitat use pattern of individuals within a population. In this study, presence, behavior, and resighting patterns of transient bottlenose dolphins (*Tursiops truncatus*) were evaluated in relation to upwelling and downwelling events in a marine reserve in North-Central Chile, between 2005 and 2009. The study period was divided into four phases according to wind direction and intensity: upwelling-favorable (UF), transition I (TI), convergence (Cv) or downwelling, and transition II (TII). Results show that transient bottlenose dolphins are an open population with low resighting rates. Highest occurrence and a largest number of transient dolphins were identified during 2009, probably due to an increase in prey availability. The most frequent behavior observed was traveling, followed by feeding and socializing. Traveling was mainly recorded in individuals seen only once and in years with low productivity. In contrast, feeding was observed in individuals seen two or more times, was similar among phases, and was more frequent in more-productive years. Social behavior was associated with the highest resighting rates. This study documents how transient bottlenose dolphins use the area based on their resighting patterns and suggests that periods of upwelling and downwelling modulate behavior displayed by these dolphins within the area.

Tschopp, A., Ferrari, M. A., Crespo, E. A., & Coscarella, M. A. (2018). Development of a Site Fidelity Index Based on Population Capture-Recapture Data. *PeerJ*, 6 <https://doi.org/10.7717/peerj.4782>

Background: Site fidelity is considered as an animal's tendency to return to a previously occupied place; this is a component of animal behaviour that allows us to understand movement patterns and aspects related to the animal's life history. Although there are many site fidelity metrics, the lack of standardisation presents a considerable challenge in terms of comparability among studies.



Methods: This investigation focused on the theoretical development of a standardised composite site fidelity index and its statistical distribution in order to obtain reliable population-level site fidelity comparisons. The arithmetic and harmonic means were used as mathematical structures in order to create different indexes by combining the most commonly used indicators for site fidelity such as Occurrence, Permanence and Periodicity. The index performance was then evaluated in simulated populations and one real population of Commerson's dolphins (*Cephalorhynchus commersonii* (Lace'pe'de 1804)). In the first case, the indexes were evaluated based on how they were affected by different probability values such as the occurrence of the individual within the study area ( $\phi$ ) and capture probability ( $p$ ). As a precision measure for the comparison of the indexes, the Wald confidence interval (CI) and the mean square error were applied. Given that there was no previous data concerning the distribution parameters of this population, bootstrap CIs were applied for the study case.

Vermeulen, E., Bouveroux, T., Plon, S., Atkins, S., Chivell, W., Cockcroft, V., . . . Elwen, S. H. (2018). Indian Ocean Humpback Dolphin (*Sousa Plumbea*) Movement Patterns Along the South African Coast. *Aquatic Conservation-Marine and Freshwater Ecosystems*, 28(1), 231-240  
<https://doi.org/10.1002/aqc.2836>

The Indian Ocean humpback dolphin was recently uplisted to Endangered' in the recent South African National Red List assessment. Abundance estimates are available from a number of localized study sites, but knowledge of movement patterns and population linkage between these sites is poor. A national research collaboration, the SouSA project, was established in 2016 to address this key knowledge gap. Twenty identification catalogues collected between 2000 and 2016 in 13 different locations were collated and compared. Photographs of 526 humpback dolphins (all catalogues and photos) were reduced to 337 individuals from 12 locations after data selection. Of these, 90 matches were found for 61 individuals over multiple sites, resulting in 247 uniquely, well-marked humpback dolphins identified in South Africa. Movements were observed along most of the coastline studied. Ranging distances had a median value of 120 km and varied from 30 km up to 500 km. Long-term site fidelity was also evident in the data. Dolphins ranging along the south coast of South Africa seem to form one single population at the western end of the species' global range. Current available photo-identification data suggested national abundance may be well below previous estimates of 1000 individuals, with numbers possibly closer to 500. Bearing in mind the poor conservation status of the species in the country, the development of a national Biodiversity Management Plan aimed at ensuring the long-term survival of the species in South Africa is strongly recommended. At the same time, increased research efforts are essential, particularly to allow for an in-depth assessment of population numbers and drivers of changes therein. The present study clearly indicates the importance of scientific collaboration when investigating highly mobile and endangered species.

Ball, L., Shreves, K., Pilot, M., & Moura, A. E. (2017). Temporal and Geographic Patterns of Kinship Structure in Common Dolphins (*Delphinus Delphis*) Suggest Site Fidelity and Female-Biased Long-Distance Dispersal. *Behavioral Ecology and Sociobiology*, 71(8)  
<https://doi.org/10.1007/s00265-017-2351-z>

Social structure plays a crucial role in determining a species' dispersal patterns and genetic structure. Cetaceans show a diversity of social and mating systems, but their effects on dispersal and genetic structure are not well known, in part because of technical difficulties in obtaining robust observational data. Here, we combine genetic profiling and GIS analysis to identify patterns of kin distribution over

time and space, to infer mating structure and dispersal patterns in short-beaked common dolphins (*Delphinus delphis*). This species is highly social, and exhibits weak spatial genetic structure in the Northeast Atlantic and Mediterranean Sea, thought to result from fluid social structure and low levels of site fidelity. We found that although sampled groups were not composed of closely related individuals, close kin were frequently found in the same geographic location over several years. Our results suggest that common dolphin exhibits some level of site fidelity, which could be explained by foraging for temporally varying prey resource in areas familiar to individuals. Dispersal from natal area likely involves long-distance movements of females, as males are found more frequently than females in the same locations as their close kin. Long-distance dispersal may explain the near panmixia observed in this species. By analysing individuals sampled in the same geographic location over multiple years, we avoid caveats associated with divergence-based methods of inferring sex-biased dispersal. We thus provide a unique perspective on this species' social structure and dispersal behaviour, and how it relates to the observed low levels of population genetic structure in European waters. Significance statement Movement patterns and social interactions are aspects of wild animal's behaviour important for understanding their ecology. However, tracking these behaviours directly can be very challenging in wide-ranging species such as whales and dolphins. In this study, we used genetic information to detect how patterns of kin associations change in space and time, to infer aspects of movement and social structure. We identified previously unknown site fidelity, and suggested that dispersal usually involves females, travelling long distances from the natal area. Our data analysis strategy overcomes known limitations of previously used genetic inference methods, and provides a new approach to identify differences in dispersal between the sexes, which contribute to better understanding of the species' behaviour and ecology. In this case, we suggest that females are more likely to disperse than males, a pattern unusual amongst mammals.

Bonin, C. A., Lewallen, E. A., van Wijnen, A. J., Cremer, M. J., & Simoes-Lopes, P. C. (2017). Habitat Preference and Behaviour of the Guiana Dolphin (*Sotalia Guianensis*) in a Well-Preserved Estuary Off Southern Brazil. *Pakistan Journal of Zoology*, 49(6), 2235-2242  
<https://doi.org/10.17582/journal.pjz/2017.49.6.2235.2242>

Recent extinctions of coastal dolphin species indicate that marine mammal populations are susceptible to rapid decline. Yet, effective conservation efforts depend on population-level ecological data. To obtain principal baseline data that will inform management efforts, we characterized the habitat and recorded the behaviour of a Guiana dolphin (*Sotalia guianensis*) population within one of the most well-preserved estuaries off southern Brazil. Monthly surveys were conducted for one year (August 1999 - July 2000) within an area of approximately 100 km (2), within the Paranagua Bay Estuary. We employed the group follow protocol, which resulted in 260 h of direct observation. Our results revealed feeding as the most frequent activity in the estuary, totaling nearly two thirds of all records. We also identified two sites of Guiana dolphin habitat preference in our study area, where sightings remarkably totalled > 62% of observation records. These sites (especially Guaraquecaba Bay) were not only important for feeding, but also for *S. guianensis* socialization. The detection of these key areas should facilitate both local and broad-scale efforts to preserve critical habitats for this population of dolphins, and by extension may help inform management plans for ecologically vulnerable *S. guianensis* populations in other parts of their distribution.

Bossley, M. I., Steiner, A., Rankin, R. W., & Bejder, L. (2017). A Long-Term Study of Bottlenose Dolphins (*Tursiops Aduncus*) in an Australian Industrial Estuary: Increased Sightings Associated with



Environmental Improvements. *Marine Mammal Science*, 33(1), 277-290  
<https://doi.org/10.1111/mms.12368>

Delphinids are long-lived, have delayed maturity and low reproductive rates which necessitate long-term monitoring programs to detect changes in abundance. Between 1990 and 2013, an observational study of bottlenose dolphins (*Tursiops aduncus*) was conducted in the Port River estuary (Adelaide, Australia). The estuary has received pollution from industry, sewage plants and storm water. In recent years, pollution entering the system has reduced and the establishment of the Adelaide Dolphin Sanctuary (ADS) increased dolphin protection from harassment and deliberate attacks. Nevertheless, the estuary remains a busy port. Over a 24 yr period, we conducted boat-based surveys (n = 735) for dolphin groups (n = 3,634) along a predetermined route in the Inner and Outer Estuary of Adelaide's Port River estuary. It is our conjecture that major infrastructure changes and pollution abatement have yielded a more favorable marine environment for dolphins, resulting in an estimated 6% annual increase in sightings, from a near absence of sightings in the 1980s. Increased dolphin numbers were likely the result of improved water quality, augmented by surveillance and education arising from the proclamation of the ADS. This study highlights the importance of long-term monitoring and has implications for dolphin conservation in heavily impacted urban areas and their protection via protected areas.

Chabanne, D. B. H., Finn, H., & Bejder, L. (2017). Identifying the Relevant Local Population for Environmental Impact Assessments of Mobile Marine Fauna. *Frontiers in Marine Science*, 4, 17  
<https://doi.org/10.3389/fmars.2017.00148>

Environmental impact assessments must be addressed at a scale that reflects the biological organization for the species affected. It can be challenging to identify the relevant local wildlife population for impact assessment for those species that are continuously distributed and highly mobile. Here, we document the existence of local communities of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) inhabiting coastal and estuarine waters of Perth, Western Australia, where major coastal developments have been undertaken or are proposed. Using sighting histories from a 4-year photo-identification study, we investigated fine-scale, social community structure of dolphins based on measures of social affinity, and network (Half-Weight Index HWI, preferred dyadic association tests, and Lagged Association Rates LAR), home ranges, residency patterns (Lagged Identification Rates LIR), and genetic relatedness. Analyses revealed four socially and spatially distinct, mixed-sex communities. The four communities had distinctive social patterns varying in strength, site fidelity, and residency patterns. Overlap in home ranges and relatedness explained little to none of the association patterns between individuals, suggesting complex local social structures. The study demonstrated that environmental impact assessments for mobile, continuously distributed species must evaluate impacts in light of local population structure, especially where proposed developments may affect core habitats of resident communities or sub-populations. Here, the risk of local extinction is particularly significant for an estuarine community because of its small size, limited connectivity with adjacent communities, and use of areas subject to intensive human use. In the absence of information about fine-scale population structure, impact assessments may fail to consider the appropriate biological context.

Chan, S. C. Y., & Karczmarski, L. (2017). Indo-Pacific Humpback Dolphins (*Sousa Chinensis*) in Hong Kong: Modelling Demographic Parameters with Markrecapture Techniques. *PloS One*, 12(3), 28  
<https://doi.org/10.1371/journal.pone.0174029>

Indo-Pacific humpback dolphins (*Sousa chinensis*) inhabiting Hong Kong waters are thought to be among the world's most anthropogenically impacted coastal delphinids. We have conducted a 5-year (2010-2014) photo-ID study and performed the first in this region comprehensive mark-recapture analysis applying a suite of open population models and robust design models. Cormack-Jolly-Seber (CJS) models suggested a significant transient effect and seasonal variation in apparent survival probabilities as result of a fluid movement beyond the study area. Given the spatial restrictions of our study, limited by an administrative border, if emigration was to be considered negligible the estimated survival rate of adults was 0.980. Super-population estimates indicated that at least 368 dolphins used Hong Kong waters as part of their range. Closed robust design models suggested an influx of dolphins from winter to summer and increased site fidelity in summer; and out flux, although less prominent, during summer-winter intervals. Abundance estimates in summer ( $N = 144-231$ ) were higher than that in winter ( $N = 87-111$ ), corresponding to the availability of prey resources which in Hong Kong waters peaks during summer months. We point out that the current population monitoring strategy used by the Hong Kong authorities is ill-suited for a timely detection of a population change and should be revised.

Dulau, V., Estrade, V., & Fayon, J. (2017). Identifying Key Demographic Parameters of a Small Island-Associated Population of Indo-Pacific Bottlenose Dolphins (Reunion, Indian Ocean). *PloS one*, 12(6), 19 <https://doi.org/10.1371/journal.pone.0179780>

Photo-identification surveys of Indo-Pacific bottlenose dolphins were conducted from 2009 to 2014 off Reunion Island (55 degrees E33'/21 degrees S07'), in the Indian Ocean. Robust Design models were applied to produce the most reliable estimate of population abundance and survival rate, while accounting for temporary emigration from the survey area (west coast). The sampling scheme consisted of a five-month (June-October) sampling period in each year of the study. The overall population size at Reunion was estimated to be 72 individuals (SE = 6.17, 95% CI = 61-85), based on a random temporary emigration ( $\gamma''$ ) of 0.096 and a proportion of 0.70 (SE = 0.03) distinct individuals. The annual survival rate was 0.93 (+/- 0.018 SE, 95% CI = 0.886-0.958) and was constant over time and between sexes. Models considering gender groups indicated different movement patterns between males and females. Males showed null or quasi-null temporary emigration ( $\gamma'' = \gamma' < 0.01$ ), while females showed a random temporary emigration ( $\gamma''$ ) of 0.10, suggesting that a small proportion of females was outside the survey area during each primary sampling period. Sex-specific temporary migration patterns were consistent with movement and residency patterns observed in other areas. The Robust Design approach provided an appropriate sampling scheme for deriving island-associated population parameters, while allowing to restrict survey effort both spatially (i.e. west coast only) and temporally (five months per year). Although abundance and survival were stable over the six years, the small population size of fewer than 100 individuals suggested that this population is highly vulnerable. Priority should be given to reducing any potential impact of human activity on the population and its habitat.

Hunt, T. N., Bejder, L., Allen, S. J., Rankin, R. W., Hanf, D., & Parra, G. J. (2017). Demographic Characteristics of Australian Humpback Dolphins Reveal Important Habitat toward the Southwestern Limit of Their Range. *Endangered Species Research*, 32, 71-88 <https://doi.org/10.3354/esr00784>

The paucity of information on the recently described Australian humpback dolphin *Sousa sahalensis* has hindered assessment of its conservation status. Here, we applied capture recapture models to photo-identification data collected during boat-based surveys between 2013 and 2015 to estimate the abundance, site fidelity and residence patterns of Australian humpback dolphins around the North West Cape (NWC), Western Australia. Using Pollock's closed robust design, abundance estimates varied from 65 to 102 individuals, and POPAN open modelling yielded a super-population size of 129 individuals in the 130 km<sup>2</sup> study area. At approximately 1 humpback dolphin per km<sup>2</sup>, this density is the highest recorded for this species. Temporary emigration was Markovian, suggesting seasonal movement in and out of the study area. Hierarchical clustering showed that 63% of individuals identified exhibited high levels of site fidelity. Analysis of lagged identification rates indicated dolphins use the study area regularly, following a movement model characterised by emigration and re-immigration. These density, site fidelity and residence patterns indicate that the NWC is an important habitat toward the southwestern limit of this species' range. Much of the NWC study area lies within a Marine Protected Area, offering a regulatory framework on which to base the management of human activities with the potential to impact this threatened species. Our methods provide a methodological framework to be used in future environmental impact assessments, and our findings represent a baseline from which to develop long-term studies to gain a more complete understanding of Australian humpback dolphin population dynamics.

Morteo, E., Rocha-Olivares, A., & Abarca-Arenas, L. G. (2017). Abundance, Residency, and Potential Hazards for Coastal Bottlenose Dolphins (*Tursiops Truncatus*) Off a Productive Lagoon in the Gulf of Mexico. *Aquatic Mammals*, 43(3), 308-319 <https://doi.org/10.1578/am.43.3.2017.308>

Movements of many cetacean species are commonly related to temporal and spatial variations in food resources and human activities. Worldwide evidence shows that anthropogenic pressures faced by coastal dolphin populations are increasing; however, the lack of reliable baseline information generally prevents the assessment of such interactions. We studied the temporal dynamics in abundance, site fidelity, and residency of bottlenose dolphins (*Tursiops truncatus*) off the productive Alvarado lagoon in the Gulf of Mexico, and we assessed the potential hazards posed by human activities and natural predators. This 2-y study (2006 to 2008) was based on the photographic identification of 174 individuals from 871 high-quality dorsal fin photographs obtained during 41 surveys totaling 225.4 h of observation. Overall monthly abundance averaged 125 (SD = 52) dolphins, whereas naturally marked individuals averaged 106 (SD = 25); abundance values were somewhat consistent within and between years, but the community was composed of different dolphins at any given time. Seasonal site fidelity and residency were higher during the dry (March to June) and rainy (July to October) seasons. Previous studies from Alvarado and elsewhere suggest long-term residency (up to 7 y) but also widespread movements (100 to 300 km) for some individuals. Physical evidence of attacks by large predators was exclusively found in nonresident adult dolphins (3.5%), suggesting a seasonal incursion to the area by individuals from deeper waters. Also, dolphins bearing marks of interactions with fisheries were more common in adult residents (11.5%). Despite these threats, dolphins are recurrent in the area, possibly due to high prey abundance and availability, which may constitute the main factors driving their distribution and abundance.

Papale, E., Ceraulo, M., Giardino, G., Buffa, G., Filiciotto, F., Grammauta, R., . . . Buscaino, G. (2017). Association Patterns and Population Dynamics of Bottlenose Dolphins in the Strait of Sicily

(Central Mediterranean Sea): Implication for Management. *Population Ecology*, 59(1), 55-64  
<https://doi.org/10.1007/s10144-016-0566-x>

An understanding of the population dynamics and social organization of cetaceans is essential to manage the influence of anthropogenic activities. In this study, the population size, site fidelity and social interactions of bottlenose dolphins in the Strait of Sicily (Italy) were investigated to provide recommendations for their conservation. Mark-recapture analysis was based on the encounter histories of 103 marked dolphins from 2004 to 2015. The POPAN formulation of the Jolly-Seber model in MARK software was used to estimate the size of the super-population. Site fidelity and social organization were estimated for individuals re-sighted  $\geq 3$  times. The estimated population size was 140 (SE = 15.75; 95% CI = 106-164). Dolphins had low site fidelity, and both adults and sub-adults move outside the study area. Females with calves used the area longer than other individuals. Based on our results, dolphins' home range likely extended beyond the study area. The mean value of the Half-Weight Association Index was low and the preferred association was by casual acquaintance. However, we found a distinct aggregation of post-parturition females during the final 2 years of the study. Therefore, the pattern of association was apparently a response to an ecological requirement, which was the possibility to breed in high productivity waters. Whether these individuals are part of a larger pelagic population is unknown; however, we can conclude that the management of only coastal waters is insufficient for the conservation of dolphins in the Strait of Sicily.

Vermeulen, E., Balbiano, A., Belenguer, F., Colombil, D., Failla, M., Intrieri, E., & Brager, S. (2017). Site-Fidelity and Movement Patterns of Bottlenose Dolphins (*Tursiops truncatus*) in Central Argentina: Essential Information for Effective Conservation. *Aquatic Conservation-Marine and Freshwater Ecosystems*, 27(1), 282-292 <https://doi.org/10.1002/aqc.2618>

The effectiveness of conservation measures such as marine protected areas (MPAs) for the conservation of cetaceans is determined by how well their home range or critical habitat is covered. The present study seeks to provide information on the site-fidelity and movement patterns of individual bottlenose dolphins (*Tursiops truncatus*) in central Argentina. Between 2007 and 2013, photo-identification data of bottlenose dolphins were collected in four study sites some 90-200km apart from each other along the central Argentinean coast. Results show long-term site-fidelity (over 5years) in one of the study areas. Re-sighting rates further suggest the existence of different sub-populations of bottlenose dolphins, but also confirm some connectivity (with movements over 200-290km) and thus potential for gene flow within the region. Considering the population declines of bottlenose dolphins in Argentina, information on site-fidelity and movement patterns will be of value to improve the effectiveness of existing MPAs for the conservation of the species as well as prioritizing areas for increased research.

Wells, R. S., Schwacke, L. H., Rowles, T. K., Balmer, B. C., Zolman, E., Speakman, T., . . . Wilkinson, K. A. (2017). Ranging Patterns of Common Bottlenose Dolphins *Tursiops truncatus* in Barataria Bay, Louisiana, Following the Deepwater Horizon Oil Spill. *Endangered Species Research*, 33, 159-180  
<https://doi.org/10.3354/esr00732>

Common bottlenose dolphins *Tursiops truncatus* were present in Barataria Bay, Louisiana, USA, before, during, and after the 2010 Deepwater Horizon oil spill. Health assessments conducted on dolphins in Barataria Bay in 2011, 2013, and 2014, after the capping of the well, found disease conditions consistent with petroleum hydrocarbon exposure and toxicity. Satellite-linked transmitters were affixed to dolphins

during these health assessments for assessing the potential for continued exposure to petroleum-associated products, estimating survival rates, and planning potential restoration. In total, 44 tags were deployed, transmitting for 48 to 260 d. The dolphins exhibited multi-year site fidelity to small home ranges. Most tagged dolphin locations were inside the bay. On average, the dolphins that entered the Gulf coastal waters remained within 1.75 km of shore. No dolphins were documented more than 14 km beyond their 95% utilization distribution (UD) overall home ranges. Individual variation in the use of specific regions and habitats of Barataria Bay suggests the occurrence of community structure. All but 3 of the dolphins (93%) were tracked or observed during more than 1 yr in Barataria Bay, with 20 (45%) recorded each year from 2010 to 2014. All but 6 dolphins (86%) were tracked during multiple seasons. Home range sizes were comparable to those reported for bottlenose dolphins elsewhere. These findings suggest the occurrence of long-term, year-round residency. Residency patterns suggest potential for continued exposure to petroleum-associated products that may have remained in Barataria Bay after the spill.

Wilson, R. M., Tyson, R. B., Nelson, J. A., Balmer, B. C., Chanton, J. P., & Nowacek, D. P. (2017). Niche Differentiation and Prey Selectivity among Common Bottlenose Dolphins (*Tursiops Truncatus*) Sighted in St. George Sound, Gulf of Mexico. *Frontiers in Marine Science*, 4, 13  
<https://doi.org/10.3389/fmars.2017.00235>

Two groups of common bottlenose dolphins (*Tursiops truncatus*) have been identified within St. George Sound, Florida, USA: high site-fidelity individuals (HSF) which are individuals sighted multiple times in the region (i.e.,  $\geq 2$  months,  $\geq 2$  seasons, and  $\geq 2$  years), and low site-fidelity individuals (LSF), which are individuals sighted fewer than 2 months, in 2 different seasons among 2 different years. Our goal was to determine whether differences in foraging behaviors were correlated with differences in sighting frequency and overall usage of St. George Sound by the two groups. We used carbon, nitrogen, and sulfur stable isotopes and niche hyper volume metrics to model the food web of St. George Sound. Mixing model results indicated that croaker, mojarra, pigfish, pinfish, and silver perch were the most important prey items for dolphins. The hyper volume metrics demonstrate niche partitioning between HSFs and LSFs, with the HSFs relying more heavily on pinfish, pigfish, and mojarra, while the LSFs relied more on silver perch. Plankton, benthic diatoms, seagrass, and epiphytes all contributed to secondary production within St. George Sound. This diversity of source utilization by seagrass-associated consumers supported by a high rate of total production likely sustains high secondary productivity despite the potential for competition in this system. Zooplankton was the most important basal source to the system, followed by seagrass and benthic primary production (as indicated by a sand dollar proxy). The reliance of dolphins on seagrass-dependent prey indicates that alteration of seagrass habitat would significantly impact the dolphin community foraging in St. George Sound and suggests that preservation of seagrass habitat is an important component of an effective management strategy for dolphin populations in the region.

Atkins, S., Cantor, M., Pillay, N., Cliff, G., Keith, M., & Parra, G. J. (2016). Net Loss of Endangered Humpback Dolphins: Integrating Residency, Site Fidelity, and Bycatch in Shark Nets. *Marine Ecology Progress Series*, 555, 249-260 <https://doi.org/10.3354/meps11835>

Fisheries bycatch-the incidental catch of non-target species during fishing-is problematic for large marine vertebrates. Bather protection programmes that use gillnets to kill sharks cause the incidental mortality of humpback dolphins *Sousa* spp., potentially impacting the long-term survival of these

threatened species. Understanding dolphins' spatial and temporal use of gillnetted areas is critical for designing effective mitigation strategies. We photo-identified dolphins over 8 yr in a high-bycatch area (Richards Bay, South Africa) to assess the residency, site fidelity, and movement patterns of Indian Ocean humpback dolphins *S. plumbea* and evaluate how emigration, immigration, and mortality rates influence the use of Richards Bay at various temporal scales. Overall, residency was low but site fidelity was high, leading to high population turnover in the short term but low turnover over 6 mo and longer. There was clear individual variation in visitation but no evidence of seasonality. By considering such movements, the net loss of dolphins from the area became evident. While dolphins naturally emigrate from the area, the recognition of several catalogued individuals among the bycaught dolphins indicated that mortality in the shark nets contributes to the permanent loss of both residents and transients. Richards Bay may represent an ecological trap: high site fidelity indicates dolphins perceived the area as ecologically attractive, but high mortality due to shark nets makes it risky. We examined these results relative to gillnet bycatch mitigation methods and recommend that stakeholders collaborate as a mitigation team to prioritise management actions to reduce bycatch without compromising bather safety.

Barker, J., & Berrow, S. (2016). Temporal and Spatial Variation in Group Size of Bottlenose Dolphins (*Tursiops Truncatus*) in the Shannon Estuary, Ireland. *Biology and Environment-Proceedings of the Royal Irish Academy*, 116B(1), 63-70 <https://doi.org/10.3318/bioe.2016.5>

Bottlenose dolphin group size is known to be determined by food availability, social interactions and predator defense. This paper analyses data gathered over seven years from dolphin tour boats operating in the Shannon Estuary and examines whether there were any temporal or spatial trends in group size of the resident group of bottlenose dolphins in the region. Findings indicate that dolphin group size varied significantly between years (ANOVA,  $F = 4.55$ ,  $P = 0.0001$ ), and increased during the months of July, September and October (ANOVA,  $F = 8.921$ ,  $P < 0.0001$ ). Findings also reveal that group size of dolphins encountered in the middle part of the estuary was greater than the outer or inner estuary (ANOVA,  $F = 4.176$ ,  $P < 0.001$ ). The seasonal change in group size is thought to be primarily caused by dolphins switching to different prey species.

Brown, A. M., Beider, L., Pollock, K. H., & Allen, S. J. (2016). Site-Specific Assessments of the Abundance of Three Inshore Dolphin Species to Inform Conservation and Management. *Frontiers in Marine Science*, 3, 18 <https://doi.org/10.3389/fmars.2016.00004>

Assessing the abundance of wildlife populations is essential to their effective conservation and management. Concerns have been raised over the vulnerability of tropical inshore dolphins in waters off northern Australia to anthropogenic impacts on local populations, yet a lack of abundance data precludes assessment of their conservation status and the management of threats. Using small vessels as cost-effective research platforms, photo-identification surveys and capture-recapture models were applied to provide the first quantitative abundance data for Australian snubfin (*Orcaella heinssohni*), Australian humpback (*Sousa sahalensis*), and Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) at five sites in the Kimberley region of north-western Australia. The abundance of each species was highly variable between different sites, likely reflecting species-specific habitat preferences. Within the c. 130 km (2) study sites, the estimated abundance of most species was  $\leq 60$  individuals (excluding calves), and fewer than 20 humpback dolphins were identified at each site in any one 3-5 week sampling period. However, larger estimates of c. 130 snubfin and c. 160 bottlenose dolphins were obtained at two



different sites. Several local populations showed evidence of site fidelity, particularly snubfin dolphins. By implementing a standardized, multi-site approach, data on local populations were provided within a broader, regional context, and indicated that each species is patchily distributed in the region. This highlights the need for site-specific baseline data collection using appropriate survey techniques to quantitatively assess the potential impacts of threatening activities to local populations. These findings further illustrate the need to gain a greater understanding of known and potential threats to inshore dolphin populations, their relative impacts, and to mitigate where necessary. An ideal candidate site for a long-term study of snubfin dolphin population dynamics is identified, where trends in abundance and their influencing factors could be investigated. The methods employed herein provide an example of rigorous, site-specific population assessments of inshore dolphins that are broadly applicable to such studies elsewhere.

Dinis, A., Alves, F., Nicolau, C., Ribeiro, C., Kaufmann, M., Canadas, A., & Freitas, L. (2016). Bottlenose Dolphin *Tursiops truncatus* Group Dynamics, Site Fidelity, Residency and Movement Patterns in the Madeira Archipelago (North-East Atlantic). *African Journal of Marine Science*, 38(2), 151-160 <https://doi.org/10.2989/1814232x.2016.1167780>

The bottlenose dolphin *Tursiops truncatus* is one of the most frequently sighted cetacean species in the Madeira Archipelago (North-East Atlantic); however, little is known about its population ecology in these waters. Photo-identification undertaken during systematic, non-systematic and opportunistic surveys conducted between 2001 and 2012 was used to assess group dynamics, site fidelity, residency and movement patterns of bottlenose dolphins in the archipelago. Three different patterns of residency were assigned, based on individual sighting histories. Group size ranged between 2 and 90 individuals (median 12), with no significant monthly difference in group size. All resident dolphins formed a core, complex network with migrant and transient dolphins. In contrast, satellite clusters were formed exclusively by transient individuals. The lagged identification rate (LIR) model indicated that a dolphin remained in the area for an average of 90 days, whereas the average time an individual spent outside the study area was approximately 313 days. The Madeira Archipelago appears to be only a section of a much larger home range for this population, with the dolphins exhibiting three different patterns of occurrence that associate with each other. The information gained about this poorly studied population contributes to the overall knowledge of bottlenose dolphins in insular oceanic habitats.

Genov, T., Angelini, V., Hace, A., Palmisano, G., Petelin, B., Malacic, V., . . . Mazzariol, S. (2016). Mid-Distance Re-Sighting of a Common Bottlenose Dolphin in the Northern Adriatic Sea: Insight into Regional Movement Patterns. *Journal of the Marine Biological Association of the United Kingdom*, 96(4), 909-914 <https://doi.org/10.1017/s0025315415001241>

Understanding animal movement patterns is not only important for providing insight into their biology, but is also relevant to conservation planning. However, in aquatic and wide-ranging species such as cetaceans, this is often difficult. The common bottlenose dolphin (*Tursiops truncatus*) is the most common cetacean in the northern and central Adriatic Sea and has been the focus of long-term studies in some areas. All of the studied local populations show a relatively high degree of site fidelity, but their movements, ranging patterns or connectivity are not well understood. On 24 and 26 April 2014 a single adult bottlenose dolphin was observed and photographed alive off the Slovenian coast. The same individual was found dead on the shores of Goro, Italy, on 5 May 2014, about 130 km from the two sighting locations. The well-marked dorsal fin made the identification straightforward. The dolphin was

found freshly dead, suggesting it had died very recently prior to being found. This indicates that the reported movement was a real one, rather than an artefact of currents. Although single cases cannot provide the basis for making population-level inferences, our observation shows that northern Adriatic bottlenose dolphins can make substantial movements in short periods of time and suggests that such movements could be more common than currently documented. Comparisons among photo-ID catalogues and stranding events can be highly informative, as they can provide useful information with implications for the cross-border conservation of mobile marine predators.

Gonzalvo, J., Lauriano, G., Hammond, P. S., Viaud-Martinez, K. A., Fossi, M. C., Natoli, A., & Marsili, L. (2016). The Gulf of Ambracia's Common Bottlenose Dolphins, *Tursiops truncatus*: A Highly Dense and yet Threatened Population. In *Advances in Marine Biology, Vol 75: Mediterranean Marine Mammal Ecology and Conservation*. G. N. DiSciara, M. Podesta, & B. E. Curry (Eds.), (Vol. 75, pp. 259-296). San Diego: Elsevier Academic Press Inc  
<https://doi.org/10.1016/bs.amb.2016.07.002>

The common bottlenose dolphin (*Tursiops truncatus*) is the only cetacean present in the semiclosed waters of the Gulf of Ambracia, Western Greece. This increasingly degraded coastal ecosystem hosts one of the highest observed densities in the Mediterranean Sea for this species. Photo-identification data and tissue samples collected through skin-swabbing and remote biopsy sampling techniques during boat-based surveys conducted between 2006 and 2015 in the Gulf, were used to examine bottlenose dolphin abundance, population trends, site fidelity, genetic differentiation and toxicological status. Bottlenose dolphins showed high levels of year-round site fidelity throughout the 10-year study period. Dolphin population estimates mostly fell between 130 and 170 with CVs averaging about 10%; a trend in population size over the 10 years was a decline of 1.6% per year (but this was not significant). Genetic differentiation between the bottlenose dolphins of the Gulf and their conspecifics from neighbouring populations was detected, and low genetic diversity was found among individuals sampled. In addition, pesticides were identified as factors posing a real toxicological problem for local bottlenose dolphins. Therefore, in the Gulf of Ambracia, high dolphin density does not seem to be indicative of favourable conservation status or pristine habitat.

Mason, S., Kent, C. S., Donnelly, D., Weir, J., & Bilgmann, K. (2016). Atypical Residency of Short-Beaked Common Dolphins (*Delphinus Delphis*) to a Shallow, Urbanized Embayment in South-Eastern Australia. *Royal Society Open Science*, 3(9), 18 <https://doi.org/10.1098/rsos.160478>

Short-beaked common dolphins (*Delphinus delphis*) are typically considered highly mobile, offshore delphinids. This study assessed the residency of a small community of short-beaked common dolphins in the shallow, urbanized Port Phillip Bay, south-eastern Australia. The ability to identify common dolphins by their dorsal fin markings and coloration using photo-identification was also investigated. Systematic and non-systematic boat surveys were undertaken between 2007 and 2014. Results showed that 13 adult common dolphins and their offspring inhabit Port Phillip Bay, of which 10 adults exhibit residency to the bay. The majority of these adults are reproductively active females, suggesting that female philopatry may occur in the community. Systematic surveys conducted between 2012 and 2014 revealed that the dolphins were found in a median water depth of 16 m and median distance of 2.2 km from the coast. The shallow, urbanized habitat of this resident common dolphin community is atypical for this species. As a result, these common dolphins face threats usually associated with inshore bottlenose dolphin communities. We suggest that the Port Phillip Bay common dolphin community is



considered and managed separate to those outside the embayment and offshore to ensure the community's long-term viability and residency in the bay.

Oshima, J. E. D., & Santos, M. C. D. (2016). Guiana Dolphin Home Range Analysis Based on 11 Years of Photo-Identification Research in a Tropical Estuary. *Journal of Mammalogy*, 97(2), 599-610 <https://doi.org/10.1093/jmammal/gyv207>

Home range studies provide significant insights on social organization and interactions, limiting resources and habitat use. Knowledge on home range and habitat use by Guiana dolphins, *Sotalia guianensis*, is still scarce. The aim of this study was to identify and analyze individual's home ranges of Guiana dolphins in the Cananeia Estuary (similar to 25 degrees 03'S, 47 degrees 55'W), located in southeastern Brazil. Photo-identification efforts were conducted between 2000 and 2010. From a total of 135,918 pictures taken, 34,086 (25%) were useful for individual identification. Two-hundred and five individuals were cataloged based on permanent notches along dorsal fin borders. Of the cataloged individuals, 31 had been identified a minimum of 20 times, on distinct dates, prior to this analysis. Home ranges were estimated for these individuals using 4 methods: minimum convex polygon (MCP), adaptive kernel with least-squares cross-validation (AKLSCV), fixed kernel with reference bandwidth (FKHREF), and fixed kernel with least-squares cross-validation (FKLSCV). The sizes of the estimated home ranges varied between 2.2 and 43.8 km<sup>2</sup> ((X) over bar = 17.5 km<sup>2</sup>) with MCP, between 0.8 and 82.5 km<sup>2</sup> ((X) over bar = 15.6 km<sup>2</sup>) with AKLSCV, between 3.9 and 244 km<sup>2</sup> ((X) over bar = 72.4 km<sup>2</sup>) with FKHREF, and from 0.6 to 70.6 km<sup>2</sup> ((X) over bar = 13.5 km<sup>2</sup>) with FKLSCV. Significant differences in size and shape of the generated areas were detected when comparing the 4 tested methods. Variation of individual's home range sizes and an extensive overlap among home ranges of different Guiana dolphins in the Cananeia Estuary provide evidence that the region supports important resources for this species. Therefore, preventing habitat loss in this region is essential to guaranteeing the persistence of this population.

Perez-Jorge, S., Gomes, I., Hayes, K., Corti, G., Louzao, M., Genovart, M., & Oro, D. (2016). Effects of Nature-Based Tourism and Environmental Drivers on the Demography of a Small Dolphin Population. *Biological Conservation*, 197, 200-208 <https://doi.org/10.1016/j.biocon.2016.03.006>

Many marine top predators are experiencing significant declines due to anthropogenic impacts, and therefore reliable monitoring is essential to understand their population dynamics. We used Pollock's robust design capture recapture modelling to assess the influence of oceanographic variables, artisanal fisheries and human disturbance on several demographic parameters (abundance, temporary emigration and survival) of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), using long-term data on marked individuals from East Africa. Photo identification data was collected over 551 boat-based surveys between 2006 and 2009, with 137 individuals identified. Our best fitting model indicated that exposure to tourism (represented by the number of tourist boats) increased the probability of dolphins seasonally emigrating from the study area. The return rate of temporary emigrants was negatively linked to the seasonal sea surface temperature, probably associated with food availability. That model supported the existence of heterogeneity in annual local survival estimates, with transient dolphins showing a lower value than resident individuals (0.78 and 0.98, respectively). Furthermore, abundance estimates showed a small population size ranging from 19 individuals (95% CI: 11-33) to a maximum of 104 dolphins (95% CI: 78-139). This small population, together with their high site fidelity and coastal distribution, might be particularly vulnerable to human disturbances. This study highlights the influence

of environmental and anthropogenic factors on dolphin demography and population dynamics and the need to integrate these drivers to provide robust evidences for conservation stakeholders in an adaptive management framework.

Sprogis, K. R., Pollock, K. H., Raudino, H. C., Allen, S. J., Kopps, A. M., Manlik, O., . . . Bejder, L. (2016). Sex-Specific Patterns in Abundance, Temporary Emigration and Survival of Indo-Pacific Bottlenose Dolphins (*Tursiops Aduncus*) in Coastal and Estuarine Waters. *Frontiers in Marine Science*, 3, 15 <https://doi.org/10.3389/fmars.2016.00012>

Inherent difficulties in determining the sex of free-ranging, sexually monomorphic species often prevents a sex-specific focus on estimating abundance, movement patterns and survival rates. This study provides insights into sex-specific population parameters of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*). Systematic, boat-based photo-identification surveys ( $n = 417$ ) were conducted year-round from 2007 to 2013 in coastal and estuarine waters off Bunbury, Western Australia. Pollock's Robust Design was used to quantify population parameters for three datasets: (i) adults and juveniles combined, (ii) adult females and, (iii) adult males. For all datasets, abundance estimates varied seasonally, with general highs during summer and/or autumn, and lows during winter. Dolphins had seasonally structured temporary emigration rates with similar trends between sexes. The derived return rate ( $1 - \gamma$ ) of temporary emigrants into the study area was highest from winter to spring, indicating that dolphins had a high probability of return into the study area during spring. We suggest that the return of dolphins into the study area and increase in abundance is influenced by the breeding season (summer/autumn). Prey availability is likely a main driver responsible for the movement of dolphins out of the study area during winter. Seasonal apparent survival rates were constant and high (0.98-0.99) for all datasets. High apparent survival rates suggest there is no permanent emigration from the study area. Our sex-specific modeling approach offers a comprehensive interpretation of the population dynamics of a top predator in a coastal and estuarine environment and acts as a model for future sex-based population studies on sexually monomorphic species.

Wang, J. Z., Yang, Y. T., Yang, F., Li, Y. L., Li, L. J., Lin, D. R., . . . Liu, W. H. (2016). A Framework for the Assessment of the Spatial and Temporal Patterns of Threatened Coastal Delphinids. *Scientific Reports*, 6, 12 <https://doi.org/10.1038/srep19883>

The massively accelerated biodiversity loss rate in the Anthropocene calls for an efficient and effective way to identify the spatial and temporal dynamics of endangered species. To this end, we developed a useful identification framework based on a case study of locally endangered *Sousa chinensis* by combining both LEK (local ecological knowledge) evaluation and regional boat-based survey methods. Our study investigated the basic ecological information of *Sousa chinensis* in the estuaries of eastern Guangdong that had previously been neglected, which could guide the future study and conservation. Based on the statistical testing of reported spatial and temporal dolphins sighting data from fishermen and the ecological monitoring analyses, including sighting rate, site fidelity and residence time estimations, some of the current *Sousa chinensis* units are likely to be geographically isolated and critically endangered, which calls for much greater conservation efforts. Given the accelerated population extinction rate and increasing budgetary constraints, our survey pattern can be applied in a timely and economically acceptable manner to the spatial and temporal assessment of other threatened coastal delphinids, particularly when population distributions are on a large scale and traditional sampling methods are difficult to implement.

Zanardo, N., Parra, G. J., & Moller, L. M. (2016). Site Fidelity, Residency, and Abundance of Bottlenose Dolphins (*Tursiops* Sp.) in Adelaide's Coastal Waters, South Australia. *Marine Mammal Science*, 32(4), 1381-1401 <https://doi.org/10.1111/mms.12335>

Little is known about the ecology and behavior of southern Australian bottlenose dolphins (*Tursiops* sp.). This hinders assessment of their conservation status and informed decision-making concerning their management. We used boat-based surveys and photo-identification data to investigate site fidelity, residency patterns, and the abundance of southern Australian bottlenose dolphins in Adelaide's coastal waters. Sighting rates and site fidelity varied amongst individuals, and agglomerative hierarchical cluster analysis led to the categorization of individuals into one of three groups: occasional visitors, seasonal residents, or year-round residents. Lagged identification rates indicated that these dolphins used the study area regularly from year to year following a model of emigration and re-immigration. Abundance estimates obtained from multi-sample closed capture-recapture models ranged from 95 individuals (SE +/- 45.20) in winter 2013 to 239 (SE +/- 54.91) in summer 2014. The varying levels of site fidelity and residency, and the relatively high number of dolphins found throughout the study area highlights the Adelaide metropolitan coast as an important habitat for bottlenose dolphins. As these dolphins also appear to spend considerable time outside the study area, future research, conservation, and management efforts on this population must take into account anthropogenic activities within Adelaide's coastal waters and their adjacencies.

Blasi, M. F., Giuliani, A., & Boitani, L. (2015). Influence of Trammel Nets on the Behaviour and Spatial Distribution of Bottlenose Dolphins (*Tursiops Truncatus*) in the Aeolian Archipelago, Southern Italy. *Aquatic Mammals*, 41(3), 295-310 <https://doi.org/10.1578/am.41.3.2015.295>

We studied the influence of trammel nets on the behaviour and spatial distribution of bottlenose dolphin in the Aeolian Archipelago, Southern Italy. Ninety-six dolphin groups were followed for 98.75 h from 2005 to 2011 during 400 boat surveys. Thirty-three dolphins were photo-identified, and their age and sex were estimated. The encounter rates, residency times, and group sizes were used to model the spatial distribution of dolphins with trammel nets and physiographic variables. Principal Component Analyses were applied to find the habitats selected for different behavioural activities. Encounter rates were significantly higher in early summer when trammel nets were more abundant. Residency times were spatially correlated to the mean number of trammel nets. Group sizes increased with distance from coast but decreased with abundance of trammel nets. Males preferred smaller groups than females, and groups with calves were larger than the other groups. Resting, socializing, and playing groups were larger than groups of dolphins engaged in travelling, foraging, and feeding. Spatial segregation between groups of dolphins with different sizes was observed. Although dolphins benefit from taking fish in trammel nets, this interaction can be dangerous because the fishermen can use harmful methods to deter dolphins from the net. Herein, we proposed that males prefer habitats where they have a higher probability of locating/capturing a desirable prey such as coastal areas with a greater amount of trammel nets; while for other activities, they may move into safer areas. On the contrary, females prefer habitats for reasons not associated with prey such as social behaviours, resting, or calf care/learning; and they may spend more time in the safest areas, at a distance from the coast, simply feeding when the opportunity presents itself. This study showed that group size/composition data are of critical importance for modeling dolphin-habitat relationships with significant consequences in terms of conservation strategies.

Brough, T. E., Guerra, M., & Dawson, S. M. (2015). Photo-Identification of Bottlenose Dolphins in the Far South of New Zealand Indicates a 'New', Previously Unstudied Population. *New Zealand Journal of Marine and Freshwater Research*, 49(1), 150-158  
<https://doi.org/10.1080/00288330.2014.984728>

Declines in the abundance of bottlenose dolphins in the Bay of Islands and in Doubtful Sound have contributed to the species being classified as Nationally Endangered in New Zealand waters. Updated information on distribution and abundance nationwide is therefore a high priority. This study presents data from the first photo-identification surveys of Paterson Inlet, Stewart Island, conducted to document bottlenose dolphin presence, abundance and residency. Open-population mark-recapture models indicate that 18 (95%CI = 15-20) dolphins regularly use Paterson Inlet. Photo-identification of dolphins from unknown populations during two chance encounters in Otago Harbour and Dusky Sound included 11 individuals previously identified at Stewart Island. These results indicate that dolphins found regularly at Stewart Island are part of a larger, wide ranging southern population with a minimum population abundance of 92 (95%CI = 80-111) individuals.

Hartman, K. L., Fernandez, M., Wittich, A., & Azevedo, J. M. N. (2015). Sex Differences in Residency Patterns of Risso's Dolphins (*Grampus Griseus*) in the Azores: Causes and Management Implications. *Marine Mammal Science*, 31(3), 1153-1167 <https://doi.org/10.1111/mms.12209>

Knowledge of the residency patterns of marine mammals is an important element for management and conservation strategies. Here we investigate a population of *Grampus griseus* off Pico Island, Azores. Our data set covers the period 2004-2007, based on at-sea observations of 1,250 individually identified animals, 303 of known or assumed sex. Using photo identification and GPS locations we calculated mean monthly sighting rates and lagged identification rates to analyze temporal patterns, and estimated kernel density to study the home range. Our results show site fidelity and relatively restricted home ranges, which corroborate the existence of a resident population on the study site. We further document sex differences, including a higher number of males present in the area at any given time but females staying for longer consecutive periods, and male home ranges with significantly less overlap than those of females. These observations are consistent with a mating system based on multimale pods defending areas where females periodically return. We hypothesize that squid distribution is a major factor in structuring these patterns. These findings reinforce the need for a precautionary management approach that would include limiting pressure from commercial activities.

James, B. S., Bester, M. N., Penry, G. S., Gennari, E., & Elwen, S. H. (2015). Abundance and Degree of Residency of Humpback Dolphins *Sousa Plumbea* in Mossel Bay, South Africa. *African Journal of Marine Science*, 37(3), 383-394 <https://doi.org/10.2989/1814232x.2015.1083477>

Indian Ocean humpback dolphins *Sousa plumbea* inhabit nearshore waters from South Africa to eastern India. Humpback dolphins are vulnerable to conservation threats due to their naturally small population sizes and use of nearshore habitats, where human activities are highest. We investigated the abundance and residency of this species inhabiting Mossel Bay, South Africa, using photographic mark-recapture. Data were collected during 81 surveys in Mossel Bay between 2011 and 2013. Open population modelling using the POPAN parameterisation produced a 'super-population' estimate of 125 individuals

(95% CI: 61-260) and within-year estimates of between 33 and 86 individuals (2011: 71 [95% CI: 30-168]; 2012: 33 [15-73], 32 [15-70]; 2013: 46 [20-108]). Although less appropriate, closed capture models were also run for comparison with previous studies in the region and generated similar, but slightly smaller, population estimates within each year. We compared our catalogue with opportunistic data collected from East London, Plettenberg Bay, De Hoop and Gansbaai. The only catalogue matches attained were between Plettenberg Bay (n = 44 identified) and Mossel Bay (n = 67 identified), separated by 140 km. Population exchange was moderate, with nine individuals resighted in multiple years between these two areas. This study supports previous findings of long-range movements for this species and provides a baseline from which to assess future impacts on the population.

Palmer, C., Brooks, L., Parra, G. J., Rogers, T., Glasgow, D., & Woinarski, J. C. Z. (2015). Estimates of Abundance and Apparent Survival of Coastal Dolphins in Port Essington Harbour, Northern Territory, Australia (Vol 41, Pg 35, 2014). *Wildlife Research*, 42(4), 371-U311  
[https://doi.org/10.1071/wr14031\\_co](https://doi.org/10.1071/wr14031_co)

Three dolphin species occur in coastal waters of monsoonal northern Australia: the Australian snubfin (*Orcaella heinsohni*), humpback (*Sousa* sp.) and the bottlenose (*Tursiops* sp.). Their overall population size and trends are poorly known, and their conservation status has been difficult to resolve, but can be expected to deteriorate with likely increased development pressures. Aims. We sought to provide an estimate of abundance, and apparent survival, of the three dolphin species at the largely undeveloped harbour of Port Essington (325 km<sup>2</sup>), Northern Territory, with repeated sampling over a 2.9-year period. Given increasing obligations to undertake population assessments for impact studies at proposed development sites, we assess the strengths and limitations of a systematic sampling program. Methods. We used photo-identification data collected during systematic boat-based transect surveys undertaken from 2008 to 2010 and Pollock's robust capture-recapture design model. Key results. Total abundance estimates for the three species were variable across different sampling periods. The estimated number of individuals in the sampled area varied per sampling episode from 136 (s.e. 62) to 222 (s.e. 48) for snubfin, from 48 (s.e. 7) to 207 (s.e. 14) for humpbacks and from 34 (s.e. 6) to 75 (s.e. 9) for bottlenose dolphins. Apparent survival was estimated for snubfin at 0.81 (s.e. 0.11), humpbacks at 0.59 (s.e. 0.12) and bottlenose at 0.51 (s.e. 0.17) per annum. Key conclusions. (1) The values derived here provide some of the only estimates of local population size for these species across monsoonal northern Australia; (2) population-size estimates varied considerably among seasons or sampling episodes; (3) the low apparent survival probabilities indicated that many individuals may move at scales larger than the study area; (4) density of snubfin and humpback dolphins in the present study area exceeded the few other estimates available for these species elsewhere in Australia. Implications. The present study provided the first baseline estimates of abundance and apparent survival for three coastal dolphin species in monsoonal northern Australia. Such information is becoming increasingly important as development pressures intensify in coastal areas. Sampling protocols for future monitoring and impact assessment need an enhanced consideration of seasonality and scale issues.

Webster, I., Cockcroft, V. G., & Cadinouche, A. (2015). Spinner Dolphins *Stenella Longirostris* Off South-West Mauritius: Abundance and Residency. *African Journal of Marine Science*, 37(1), 115-124  
<https://doi.org/10.2989/1814232x.2015.1017004>

Spinner dolphins *Stenella longirostris longirostris* off the south-west coast of Mauritius are subject to ongoing anthropogenic disturbance in the form of daily dolphin tourism, which has intensified since

1998. Abundance of this species was estimated using photo-identification data and mark-recapture analysis. Between April 2008 and June 2010, identification photographs were collected from dolphins occurring along a 30 km length of the coast of south-west Mauritius. A total of 250 groups were encountered over 229 survey days. Mark-recapture analyses were performed on a photographic dataset of more than 8 000 good- and excellent-quality images and 83 animals were identified as distinctively marked individuals. The majority (85.5%) were seen more than once and resightings indicated a resident population. The compiled version of SOCPROG 2.4 was used to investigate the lagged identification rate. The fitted model supported a mostly resident population with additional animals moving in and out of the study area. The estimated abundance of the total population in the study area ranged between 138 and 399 individuals. Our results can be used for monitoring the population for fluctuations and for encouraging both the enforcement of laws regarding dolphin watching and the development of further means of management needed to ensure the long-term presence of this population.

Weir, C. R. (2015). Photo-Identification and Habitat Use of Atlantic Humpback Dolphins *Sousa Teuszii* around the Rio Nunez Estuary in Guinea, West Africa. *African Journal of Marine Science*, 37(3), 325-334 <https://doi.org/10.2989/1814232x.2015.1069757>

Ecological data for the Atlantic humpback dolphin *Sousa teuszii* are scant. Six on-effort *Sousa teuszii* sightings were recorded during 817.6 km of boat-based effort in the Rio Nunez region of Guinea during October and November 2013. Two incidental sightings were also reported. Groups comprised 1-25 animals. Photo-identification produced a minimum population estimate of 47 animals. Most sightings (n = 5) were located close (<1 km) to shore along a 5.7 km stretch of coast on the west side of Ile de Taidi, primarily over shallow, sand-mud habitat. Two very distinctive individuals were present in all four Taidi photo-identification encounters, suggesting high site fidelity and stable associations. Two sightings occurred in the outer Rio Nunez Estuary much farther from the coast (5-12 km) but in relatively shallow water (<= 15 m) over sand-mud sediment. Focal follows (n = 5: 0.2-3.8 h duration) produced 9.02 h of behavioural data. Travel (51%), foraging (39%) and feeding (9.2%) dominated, with Taidi dolphins spending more time foraging and feeding than the outer estuary groups. Three individuals had linear-severed dorsal fins consistent with injuries from fishing line. Some management implications of variation in habitat, site fidelity and movements of *Sousa teuszii* groups are discussed.

Batista, R. L. G., Alvarez, M. R., dos Reis, M. D. S., Cremer, M. J., & Schiavetti, A. (2014). Site Fidelity and Habitat Use of the Guiana Dolphin, *Sotalia Guianensis* (Cetacea: Delphinidae), in the Estuary of the Paraguacu River, Northeastern Brazil. *North-Western Journal of Zoology*, 10(1), 93-100 Retrieved from <http://biozoojournals.ro/nwyz/content/v10n1.html>

Site fidelity is the tendency of individuals to return to the same area repeatedly or to remain in a certain area for an extended period of time. Site fidelity has been documented in a number of species, including *Sotalia guianensis*. The aim of this study was to describe and estimate the range size of *S. guianensis* individuals and to determine its site fidelity. The study was conducted in the estuary of the Paraguacu River and adjacent areas in the state of Bahia, northeastern Brazil. Field surveys were conducted during September and October 2005, August and October to December 2006, and July and August 2007, using a powerboat. Groups/individuals were approached cautiously to allow photographing the dorsal fin and position was recorded with GPS. Nicks and notches on the dorsal fin were used for individual identification. A total of 30 field surveys were conducted and 30 individuals were identified. A total of 135 groups were recorded, ranging in size from one to 55 individuals (median = 7, mean = 9.07 +/- 6.12). The inclusion of new individuals ranged from zero (no record of new animals) to six; twenty-eight



individuals have been identified with 50% of the field surveys performed. The study revealed evidence of site fidelity and it may be observed that the individuals had been using the estuary for five or six years. The spatial distribution of the groups in the study area was not homogeneous. A total of 60.39% of the sightings occurred in areas with depths of 20 to 30 m ( $p < 0.05$ ), 45.88% occurred over gravel substrate and 44.41% occurred over silty clay substrate ( $p < 0.01$ ). The smallest individual range was 0.97 km<sup>2</sup> and the largest stretched out on 8.76 km<sup>2</sup>; individuals' ranges overlapped by approximately 0.50 km<sup>2</sup> (mean = 4.88, SD = 2.44). However, animals with overlapping areas were seen together more than once in these sites. Considering the frequency of sightings for *S. guianensis* in the estuary of the Paraguacu River, it seems that this population shows site fidelity. Moreover, the presence of some individuals in the area for at least six years indicates long-term site fidelity. The use of a small area and site fidelity draws one's attention to the vulnerability of the Guiana dolphin and possible alterations that may occur in the habitat.

Blasi, M. F., & Boitani, L. (2014). Complex Social Structure of an Endangered Population of Bottlenose Dolphins (*Tursiops Truncatus*) in the Aeolian Archipelago (Italy). *PloS one*, 9(12), 26  
<https://doi.org/10.1371/journal.pone.0114849>

We investigated social structure and association patterns for a small population of Mediterranean bottlenose dolphins, *Tursiops truncatus*, inhabiting the Aeolian Archipelago (southern Italy). Specifically we evaluate the role of sex and age composition, residency patterns and interaction with trammel nets on this social organization. Association data for 23 regularly sighted individuals were obtained from summer photoidentification surveys collected from 2005-2012. Using a combined cluster and social network analysis approach, we found associations between dolphins were hierarchically structured, where two mixed-sex social units were subdivided into smaller temporarily dynamic groups. We found non-random and long-term preferred associations in the population; however, the degree of social cohesion, residence pattern and interaction with trammel nets differed considerably between the two social units. Six of eight females occurred in the more resident social unit-1; in addition, social unit-1 individuals had significantly stronger associations, higher preferred associates, lived in larger groups and occurred less frequently with trammel nets. Nine of eleven males were clustered in social unit-2 and five of these males, interacting with trammel nets, formed small groups and preferred associations. We propose that female and male groups associate in the study area during the breeding season and that some males choose to interact with reproductive females forming a distinct but interrelated social unit. Other males may be associating in a larger fission-fusion network, which consists of dolphins that appear to temporarily join the network from the coastal population. We cannot exclude that some males specialized in trammel net foraging, suggesting that this foraging technique may favor a solitary lifestyle. Large group sizes and high degree of social cohesion for females could be an indication of greater protection and more efficiency in detecting, deterring or repelling anthropogenic pressures. Most likely dolphins' social organization depends on a combination of socio-ecological, demographic and anthropogenic factors.

Courbis, S., Baird, R. W., Cipriano, F., & Duffield, D. (2014). Multiple Populations of Pantropical Spotted Dolphins in Hawaiian Waters. *Journal of Heredity*, 105(5), 627-641  
<https://doi.org/10.1093/jhered/esu046>

Understanding gene flow and dispersal patterns is important for predicting effects of natural events and anthropogenic activities on animal populations. In Hawaii, most species of odontocetes are managed as single populations. Recent exceptions include false killer whales, spinner dolphins, and common

bottlenose dolphins, for which studies have shown fidelity to individual islands or groups of islands. Our study focused on pantropical spotted dolphins. We analyzed mitochondrial control region and 11 microsatellite loci from 101 individuals from 4 areas: Hawaii, Maui/Lanai, Oahu, and Kauai/Niihau. We examined F-ST, F'(ST), R-ST, Jost's D, and Phi(ST) and used TESS to estimate number of populations and assignment probabilities. Our results support genetic differentiation among Hawaii, Maui/Lanai, and Oahu and suggest that pantropical spotted dolphins near Kauai/Niihau are likely transient and in low numbers. Between island regions, F-ST for microsatellites ranged from 0.016 to 0.045 and for mtDNA, from 0.011 to 0.282. F'(ST), ranged from 0.098 to 0.262 for microsatellites and 0.019 to 0.415 for mtDNA. R-ST and Phi(ST) showed similar results to F-ST for microsatellites and mtDNA respectively, and Jost's D fell between F-ST and F'(ST). TESS supported 3 populations, and greatest mean assignment probability by island region ranged from 0.50 to 0.72. The private alleles method indicated migration rates among regions from 1.49 to 3.45, and effective population size of the island of Hawaii was estimated to be 220. There was no strong evidence to support sex-biased dispersal or group fidelity. Considering this study in the larger context of other odontocete population studies and studies of connectivity, we suggest genetic differentiation may be mediated by behavior adapted to differing habitat types and niches.

Frantzis, A., Alexiadou, P., & Gkikopoulou, K. C. (2014). Sperm Whale Occurrence, Site Fidelity and Population Structure Along the Hellenic Trench (Greece, Mediterranean Sea). *Aquatic Conservation-Marine and Freshwater Ecosystems*, 24, 83-102 <https://doi.org/10.1002/aqc.2435>

Twelve summer surveys conducted each year between 1998 and 2009 along the Hellenic Trench have been analysed to provide information about a previously unknown sperm whale population unit. Sperm whales were detected acoustically 238 times; 178 of these led to a visual encounter with social units (96), male aggregations (45), solitary males (32) or unclassified groups (5). The overall detection rate was 10.9 detections per 1000 km of acoustic effort. A pronounced peak in sperm whale density was observed along the 1000 m depth contour: 74% of visual encounters (corrected for effort) were within 3 km of this contour. Density decreased both in shallower waters and deeper waters further offshore. One hundred and eighty-one whales were photo-identified. Fifty-seven percent of 136 social unit members and 36% of 25 males segregated from social units were encountered in multiple years. Social units were resighted in up to six different years spanning 9 years (15 if opportunistic photo-identifications are included). Several males were resighted in three different years usually spanning up to 4 years. This indicates a high level of site fidelity. The mean group size was 2.47 (range=1-5) for males and 8.21 (range=4-13) for social units. Maximum group size reached 15 whales when casual visitors were included. The 16 identified social units were generally stable although some individuals moved between social units, and some social units split or mixed. Female to male sex ratio was 1.55:1 within social units and 1.06:1 overall. Calves (2 years old) were present in 79% of social unit encounters, accounting for 16.6% of social unit members. Observations of 15 newborns indicate a mid-summer calving season. This study indicates that the Hellenic Trench is core habitat for the eastern Mediterranean sperm whale sub-population. This population, which is very small, is believed not to exceed a few hundred individuals. Given the endangered status of the entire Mediterranean population, managing threats in this area and creating a marine protected area for sperm whales along the Hellenic Trench is a conservation priority.

Gonzalvo, J., Forcada, J., Grau, E., & Aguilar, A. (2014). Strong Site-Fidelity Increases Vulnerability of Common Bottlenose Dolphins *Tursiops Truncatus* in a Mass Tourism Destination in the Western



Mediterranean Sea. *Journal of the Marine Biological Association of the United Kingdom*, 94(6), 1227-1235 <https://doi.org/10.1017/s0025315413000866>

The local population of common bottlenose dolphin in the Balearic Islands coastal waters, a mass tourism destination in the western Mediterranean subject to increasing anthropogenic pressures, was monitored over a three-year period. Photo-identification surveys provided a relatively small population estimate, even though the islands are considered to be a hotspot for the species in the Mediterranean. Dolphins showed strong site-fidelity and relatively limited mobility across the archipelago, which makes them highly dependent on waters which are severely affected by overfishing, habitat degradation and boat disturbance resulting from a continuously-growing tourism and shipping industry. Ecosystem-based management actions are urgently needed to ensure the conservation of this fragile population of bottlenose dolphins. Conservation measures should be developed within the already-existing political and legal marine biodiversity conservation framework and in collaboration with local authorities and stakeholders.

Morteo, E., Rocha-Olivares, A., & Abarca-Arenas, L. G. (2014). Sexual Segregation of Coastal Bottlenose Dolphins (*Tursiops Truncatus*) in the Southwestern Gulf of Mexico. *Aquatic Mammals*, 40(4), 375-385 <https://doi.org/10.1578/am.40.4.2014.375>

Cetaceans are highly mobile species with complex social structures, aspects that play an important role in their fitness such as survival and offspring production. Population dispersal influences the dynamics of social species, which may vary with age, sex, or individual status, thus resulting in segregation; however, sex-related dispersal and social affiliations have been studied only in a handful of species at few locations. We conducted a 2-y photographic survey in an open habitat off the coast of Mexico to determine if site fidelity, residency, and social affiliations in male and female bottlenose dolphins (*Tursiops truncatus*) revealed sexual segregation. Forty-one surveys yielded 167 h of field effort and 61 h of observations. From 174 different individuals, we sexed 38 females and 11 males (45% positively and 55% tentatively). Females were more resident ( $p < 0.05$ ), had higher site fidelity ( $p < 0.05$ ), and had weaker associations ( $p < 0.05$ ) with a higher number of partners ( $p < 0.05$ ) than males and putative males. Associations were not dictated by differences in sample size or temporal patterns between sexes, and 53% of recorded partnerships were preferred/avoided relationships. Although the composition of social interactions in the community was highly dynamic, it unveiled evidence of sexual segregation. Temporal and social patterns suggest that males may be primarily responsible for gene flow among adjacent locations. Female associations occurred within a large but unstable network, potentially resembling "bands"; conversely, males and putative males only grouped in pairs or trios, showing significant temporal changes in their relationships, and potentially resembling first-and second-order alliances. Detailed behavioral and genetic data are needed to unravel the social dynamics of this dolphin community and the mechanisms driving their evolutionary change.

Pulcini, M., Pace, D. S., La Manna, G., Triossi, F., & Fortuna, C. M. (2014). Distribution and Abundance Estimates of Bottlenose Dolphins (*Tursiops Truncatus*) around Lampedusa Island (Sicily Channel, Italy): Implications for Their Management. *Journal of the Marine Biological Association of the United Kingdom*, 94(6), 1175-1184 <https://doi.org/10.1017/s0025315413000842>

This paper represents the first quantitative assessment of the distribution and abundance of bottlenose dolphins (*Tursiops truncatus*) inhabiting the waters around Lampedusa Island, Italy. Eleven years of

photo-identification data, collected from 1996 to 2006 by three different research groups, were brought together, reviewed and analysed to fulfil the following objectives: (i) to obtain baseline information on the abundance and residency of the local bottlenose dolphin putative population; (ii) to review the current Marine Protected Area (MPA) boundaries, especially those referred to waters around Lampedusa Island, with a view to establish a new Special Area of Conservation (SAC); and (iii) to explore the potential and limits of analysing heterogeneous datasets to improve future data collection methods. The most resident dolphins were regularly observed in six specific areas around Lampedusa Island. From a total of 148 photo-identified bottlenose dolphins, 102 were classified as well-marked. The capture histories and the distribution of sightings clearly show a number of dolphins regularly use the study area. Best estimates for the first period within the 'core study area' were obtained for 1998 data. The 2005 estimate was significantly larger than the 1998 estimates ( $z = 2.160$ ;  $P < 0.05$ ) compared to that of 1998. Implications of our results for the current MPA, for transboundary conservation initiative involving Italy, Malta and Tunisia and for directing future research within and outside the MPA are fully discussed.

Pusineri, C., Barbraud, C., Kiszka, J., Caceres, S., Mougnot, J., Daudin, G., & Ridoux, V. (2014). Capture-Mark-Recapture Modelling Suggests an Endangered Status for the Mayotte Island (Eastern Africa) Population of Indo-Pacific Bottlenose Dolphins. *Endangered Species Research*, 23(1), 23-33 <https://doi.org/10.3354/esr00555>

We evaluated whether the Indo-Pacific bottlenose dolphins around the fast-developing island of Mayotte are threatened. We used opportunistic photo-identification data and capture-mark-recapture models to estimate key demographic parameters and then assessed the conservation status of the species using the IUCN Red List regional criteria. The population home range was estimated with the minimum convex polygon method as 978 km<sup>2</sup>, the annual abundance was estimated from closed population models as 82 +/- 19 SE individuals and the annual survival rate was estimated using a Cormack-Jolly-Seber model as 0.937 +/- 0.059 SE. From the data available, we believe migrations of individuals between Mayotte and its neighbouring islands are likely but would not exceed a few individuals per year. Based on IUCN guidelines for classification at local scales, we classified Indo-Pacific bottlenose dolphins around Mayotte as Endangered. We strongly recommend the establishment of a long-term population-monitoring program and the implementation of management measures.

Tobena, M., Escanez, A., Rodriguez, Y., Lopez, C., Ritter, F., & Aguilar, N. (2014). Inter-Island Movements of Common Bottlenose Dolphins *Tursiops truncatus* among the Canary Islands: Online Catalogues and Implications for Conservation and Management. *African Journal of Marine Science*, 36(1), 137-141 <https://doi.org/10.2989/1814232x.2013.873738>

A total of 313 individual common bottlenose dolphins *Tursiops truncatus* was photo-identified in four Special Areas of Conservation (SACs) in the western Canary Islands, Spain (El Hierro, La Palma, La Gomera and Tenerife), over a 10-year period (2001-2011). Of these, 36 individuals were resighted subsequently off two or more different islands, determined using online and conventional photo-identification catalogues. This study provides the first evidence of regular, long-distance movements undertaken by common bottlenose dolphins in the Canary Islands. Distances travelled ranged from 30 to 130 km between islands, demonstrating that the species is highly mobile within the archipelago. These results have important implications for the conservation and management of this species in this region and highlight the need to evaluate the efficiency of existing SACs and to further explore residency patterns.

Webster, I., Cockcroft, V. G., & Cadinouche, A. (2014). Abundance of the Indo-Pacific Bottlenose Dolphin *Tursiops aduncus* Off South-West Mauritius. *African Journal of Marine Science*, 36(3), 293-301  
<https://doi.org/10.2989/1814232x.2014.946448>

The abundance of Indo-Pacific bottlenose dolphins *Tursiops aduncus* off the south-west coast of Mauritius was estimated using capture-mark-recapture modelling. Over the past two decades this population has been subjected to ongoing anthropogenic disturbance in the form of extensive coastal development. Furthermore, daily dolphin tourism, which started in 1998, has rapidly increased in intensity. Identification photographs were collected between April 2008 and June 2010 from dolphins occurring along a 30 km length of coast where a dolphin tourism industry is concentrated. A total of 137 groups were encountered over 229 survey days. Over 5 000 photographs were taken, from which 35 individuals were considered to be sufficiently distinctively marked to use in mark-recapture analyses. The majority (85.7%) were seen more than once and resighting frequencies indicated a resident population. Three newborn calves were recorded during the study. Open population models produced abundance estimates of <100 individuals in the population. These results will be used to make recommendations for the conservation and management of this small, resident population, which is a valuable economic resource for the island but is currently under threat from high levels of human activity.

Lopez, B. D., Addis, A., & Fabiano, F. (2013). Ecology of Common Bottlenose Dolphins Along the North-Western Sardinian Coastal Waters (Italy). *Thalassas*, 29(2), 35-44 Retrieved from  
<https://dialnet.unirioja.es/servlet/articulo?codigo=4614127>

In this paper, the temporal distribution of dolphins, group dynamics, site fidelity and abundance of common bottlenose dolphins along the North-western coastal waters of Sardinia (Italy) was assessed through mark recapture photographic-identification techniques. Prior to this study, no research has previously focused on bottlenose dolphins within these waters, despite the potential for human impacts on this species. A total of 196 days with boat-based observations, spanning 28 months and 11 seasons, were spent at sea between September 2008 and March 2011. Common bottlenose dolphins were observed in all seasons, though seasonality was evident, with more encounters during the autumn and winter, and larger groups sighted during spring. The average number of photographic recaptures per individual was 4.6 +/- 0.7, with only 9 individuals (12%) resighted over 10 times. The abundance estimate of approximately 55 bottlenose dolphins represents an approximation of dolphins occurring within these waters. The movement of prey species and interaction with marine fin fish aquaculture could be potential explanations for the seasonal variation in the presence of bottlenose dolphins. Moreover, photo-identification studies show that few individuals used the north-western coast of Sardinia on a regular basis, while others were present less often. While their occurrence in these waters is frequent, it appears to be only a component of a much larger area of distribution for this bottlenose dolphin population.

Minton, G., Peter, C., Poh, A. N. Z., Ngeian, J., Braulik, G., Hammond, P. S., & Tuen, A. A. (2013). Population Estimates and Distribution Patterns of Irrawaddy Dolphins (*Orcaella Brevirostris*) and Indo-Pacific Finless Porpoises (*Neophocaena Phocaenoides*) in the Kuching Bay, Sarawak. *Raffles Bulletin of Zoology*, 61(2), 877-888 Retrieved from <https://lkcnhm.nus.edu.sg/rbz/volume-612/>

Small boat surveys were conducted in the Kuching Bay area of Sarawak, East Malaysia, in order to determine the distribution and abundance of coastal cetaceans. Photographic data collected from Jul.2007 through Oct.2010 was used to generate mark-recapture abundance estimates of Irrawaddy dolphins in the study area, and provided insights into ranging patterns and site fidelity. Between Apr.2010 and Oct.2011, line transect surveys were conducted, and abundance estimates for Irrawaddy dolphins and Indo-Pacific finless porpoises were generated using distance sampling. The best mark-recapture estimate for Irrawaddy dolphins based on a weighted mean of estimates derived from photographs of left sides and right sides of dorsal fins was 233 (CV = 22.5%, 95% CI 151-360). Re-sighted individuals showed a high degree of site-fidelity, with less than 10 km between sighting locations over a period of four years for some individuals. A smaller proportion of re-sighted individuals ranged further with a maximum straight-line distance of 26 km between sighting locations. The best line-transect estimate for Irrawaddy dolphins was 149 individuals (CV = 28%, 95% confidence interval 87-255). The line-transect estimate for finless porpoises was 135 individuals (CV = 31%, 95% confidence interval 74-246). Finless porpoise abundance varied seasonally, with higher densities observed between Mar. and May, coinciding with the occurrence of larger groups with very small calves. The line transect and mark-recapture derived estimates for Irrawaddy dolphins are compared, and viewed in the context of mapped relative densities that reveal key areas of habitat for the species. These abundance estimates provide a critical step toward the assessment of both species' local conservation status and can be used in the design of effective management strategies.

Pereira, A., Martinho, F., Brito, C., & Carvalho, I. (2013). Bottlenose Dolphin *Tursiops Truncatus* at Sao Tome Island (Sao Tome and Principe) - Relative Abundance, Site Fidelity and Social Structure. *African Journal of Marine Science*, 35(4), 501-510  
<https://doi.org/10.2989/1814232x.2013.850444>

Although the bottlenose dolphin *Tursiops truncatus* is one of the most common cetacean species around Sao Tome Island, Gulf of Guinea, little research has focused on this species in this region. This study investigated the population of bottlenose dolphins around Sao Tome Island by estimating the minimum population size, site fidelity and social structure. During a total of 226 surveys between 2002 and 2006, and in 2012, 51 sightings were recorded but only 33 had photographic data suitable for rigorous analysis. The minimum annual total population size, based on permanently marked dolphins, was 37 individuals, and the discovery curve indicated that a large part of the population remained undiscovered. The annual sighting rate for 76 highly distinctive adult animals ranged from 0.20 (seen in one year only) to 1.0 (seen every year of the study period). Resighted individuals demonstrated low association values; the dolphins seemed to form a single group with a fluid structure.

Cribb, N., Miller, C., & Seuront, L. (2012). Site Fidelity and Behaviour of Spinner Dolphins (*Stenella Longirostris*) in Moon Reef, Fiji Islands: Implications for Conservation. *Journal of the Marine Biological Association of the United Kingdom*, 92(8), 1793-1798  
<https://doi.org/10.1017/s0025315412000033>

Spinner dolphins (*Stenella longirostris*) were observed to frequent a tropical reef complex off the coast of Fiji on a regular basis. Boats from surrounding tourist destinations visit this reef on a nearly daily basis to observe the dolphins and partake in various tourist activities, such as snorkelling. The aim of the study was to determine whether this reef is a resting habitat for this population. Specifically, we objectively

and quantitatively investigated whether spinner dolphins were primarily resting whilst present within the reef and also assessed whether the same individuals revisited the reef over time. Photo-identification techniques and boat based observations were conducted over two study periods (September 2009 and May 2010). Fifty-six recognizable individuals were identified during this period, with 70% resighted on 2 or more occasions. Resting was identified as the most consistent behaviour dolphins engaged in whilst present inside the reef. These preliminary results provide vital information which can be used as a tool in the development and implementation of conservation initiatives as well as providing a basis for future studies investigating the habitat characteristics of this reef.

Morteo, E., Rocha-Olivares, A., & Morteo, R. (2012). Sensitivity Analysis of Residency and Site Fidelity Estimations to Variations in Sampling Effort and Individual Catchability. *Revista Mexicana De Biodiversidad*, 83(2), 487-495 Retrieved from <https://www.redalyc.org/html/425/42523421020/>

Mark-recapture techniques are fundamental for assessing marine mammal population dynamics and individual temporal patterns. Since biases imposed by field conditions are generally unknown, we simulated variations in sampling effort ( $m$ ) and maximum individual catchability ( $r(\max)$ ) to analyze their effects on residency levels measured through the number of recaptures (occurrence,  $O$ ), duration of stay (permanence,  $P$ ), and average recurrence (periodicity,  $I$ ) relative to a reference level of exhaustive daily sampling frequency. The number of recorded individuals ( $D-r$ ) was also used to determine the performance of the simulations. Results for standardized ( $s$ ) parameters showed that occurrences ( $O-s$ ) were proportional to  $m$  and were not influenced by  $r(\max)$ . Individual permanence ( $P-s$ ) and individual periodicity ( $I-s$ ) were 8-49% and 3-11.74 times lower than expected, respectively, depending on  $m$  and  $r(\max)$ . Also,  $O-s$ ,  $P-s$ , and  $I-s$  were not influenced by study duration, thus inter-study comparisons are feasible if  $m$  and  $r(\max)$  are similar.  $D-r$  was 68-92% ( $r(\max) = 0.01$ ) and 1-8% ( $r(\max) = 1.0$ ) lower than expected depending on  $m$ . Longer studies were more accurate but greater effort did not significantly increase  $D-r$  estimates. The use of bimonthly sampling frequencies ( $m = 0.07$ ) was barely accurate and predictions for incomplete datasets were poor. Survey field data were also analyzed from 14 published studies on 4 dolphin species and compared to daily sampling frequencies; resulting values for  $O-s$ ,  $P-s$ , and  $D-r$  were 62.4-93.3%, 11.6-66.4%, and 2.4-33.8% lower than expected, respectively; also  $I-s$  was 2.3-7.3 times lower than expected. The model produced  $D-r$  values that were similar to population estimates from empirical data, and bias was smaller than 15% in 87.5% of the cases, thus simulation accuracy was deemed acceptable.

Nery, M. F., & Simao, S. M. (2012). Capture-Recapture Abundance Estimate of Guiana Dolphins in Southeastern Brazil. *Ciencias Marinas*, 38(3), 529-541 <https://doi.org/10.7773/cm.v38i3.2012>

The objective of this study was to estimate the abundance of *Sotalia guianensis* in Sepetiba Bay, southeastern Brazil, based on photographic identification of animals. Estimates of population size were obtained using capture-recapture models for a closed population. Photo-identification data were analyzed using a model-fitting approach in the computer programs CAPTURE and MARK, and the Schnabel and Schumacher-Eschmeyer estimators were used to calculate the abundance of individuals with natural marks. These estimates were corrected to include unmarked individuals using data of the proportion of identifiable individuals in this population. During the surveys conducted between April 2006 and April 2007, a total of 9990 photographs of dolphins were taken and, of these, 2567 images were of sufficient quality for analysis; 382 dolphins were identified and catalogued from distinctive nicks and notches on their dorsal fins and, among them; 153 dolphins were photographed on more than one

occasion. The resulting abundance estimates, corrected to account for the proportion (0.47) of unmarked dolphins in the population, showed an overlap among estimators ranging from 1004 to 1099 individuals. This is the largest estimated abundance for a population of *S. guianensis* reported to date using the capture-recapture technique.

Xu, X. R., Zhang, Z. H., Ma, L. G., Li, P., Yang, G., & Zhou, K. Y. (2012). Site Fidelity and Association Patterns of Indo-Pacific Humpback Dolphins Off the East Coast of Zhanjiang, China. *Acta Theriologica*, 57(2), 99-109 <https://doi.org/10.1007/s13364-011-0058-5>

This study examined the population of Indo-Pacific humpback dolphins, *Sousa chinensis*, inhabiting the waters off the east coast of Zhanjiang, China. A total of 116 dolphins were identified during 147 boat-based surveys, completed between June 2005 and June 2007. Abundance estimates indicated that a small population of 268 dolphins (95% CI = 189-413) inhabited this coastal area. The sighting frequencies of identified dolphins varied between one and five when the 2006 and 2007 data were organized into six occasions. Twenty-three percent (27 individuals) of the cataloged dolphins were identified in more than one calendar year. The two animals (ZJ001, ZJ011) with the highest degree of site fidelity were present in the study area for a period of 23 months. The most frequently (15 times) sighted dolphin (ZJ046) was recorded in nine (56%) of the 16 months surveyed. This evidence indicates the interannual site fidelity of *S. chinensis* to the area off the eastern coast of Zhanjiang City. Range sizes of eight identified individuals calculated by the minimum convex polygon varied from 2.07 to 331.20 km<sup>2</sup>. Associations between 34 individuals sighted at least three times and more than three times were measured by the half-weight index and SOCPROG program. The majority of these dolphins (80.57%) were not seen together during surveys and the mean association rate between dyads was low at 0.05. Temporal analyses for all the individuals were conducted using a lagged association rate. The results indicated a non-random social structure made by constant companions.

Cagnazzi, D. D., Harrison, P. L., Ross, G. J. B., & Lynch, P. (2011). Abundance and Site Fidelity of Indo-Pacific Humpback Dolphins in the Great Sandy Strait, Queensland, Australia. *Marine Mammal Science*, 27(2), 255-281 <https://doi.org/10.1111/j.1748-7692.2009.00296.x>

This study examined the population of Indo-Pacific humpback dolphins, *Sousa chinensis*, inhabiting the Great Sandy Strait Marine Park, Queensland, Australia. A total of 106 dolphins were identified during 228 boat-based surveys, completed between April 2004 and April 2007. Based on the distribution of resighted individuals and the pattern of associations, it was established that this population consists of two largely geographically distinct communities, referred to as the Northern Community (NC) and the Southern Community (SC). The only recorded interaction between the two groups was a single pod composed of one member of the NC and 11 dolphins from the SC. Abundance was estimated for the entire population and by geographical area using open population models. Estimates for the Great Sandy Strait indicate that about 150 dolphins (N-GSS = 148.4, SE = 8.3, 95% CI: 132.5-165.2) used this area during the study. The NC and SC total population sizes was estimated to be 76 (N-NGSS = 75.80, SE = 3.88, 95% CI = 71-86) and 75 (N-SGSS = 74.98, SE = 4.43, 95% CI: 66-83), respectively. Analysis of residence patterns indicates that a majority of the identified dolphins are long-term residents.

Cremer, M. J., Hardt, F. A. S., Tonello, A. J., & Simoes-Lopes, P. C. (2011). Distribution and Status of the Guiana Dolphin *Sotalia Guianensis* (Cetacea, Delphinidae) Population in Babitonga Bay, Southern



Brazil. *Zoological Studies*, 50(3), 327-337 Retrieved from <http://zoolstud.sinica.edu.tw/Journals/50.3/327.pdf>

Marta J. Cremer, Fernando A.S. Hardt, Antonio J. Tonello Jr, and Paulo Cesar Simoes-Lopes (2011) Distribution and status of the Guiana dolphin *Sotalia guianensis* (Cetacea, Delphinidae) population in Babitonga Bay, southern Brazil. *Zoological Studies* 50(3): 327-337. The Guiana dolphin *Sotalia guianensis* is one of the most endangered small cetaceans in the southern Atlantic Ocean. The population abundance and density of this species were estimated in Babitonga Bay in 2000-2003. Sampling was random and stratified, and a line transect method with distance sampling was applied in an area of 160 km<sup>2</sup>. The total length of transects covered was 1251.9 km, with 163 groups of dolphins recorded. Group sizes varied 2-30 (mean, 5.3; SD, 5.6) individuals. Some areas were preferred by the population, and area 3 was considered the core area of *S. guianensis* in Babitonga Bay. The abundance was estimated to be 245 (95% confidence interval (CI): 142-422) individuals between Dec. 2000 and Nov. 2001, 186 (95% CI: 93-374) individuals between Apr. 2002 and Feb. 2003, and 179 (95% CI: 93-344) individuals between Mar. and Dec. 2003, and the densities were estimated at 1.6 (95% CI: 1-2.7), 1.2 (95% CI: 0.6-2.4), and 1.3 (95% CI: 0.5-3.4) individuals/km<sup>2</sup>, respectively. The highest density was recorded in the central area of the bay.

Martinez-Serrano, I., Serrano, A., Heckel, G., & Schramm, Y. (2011). Distribution and Home Range of Bottlenose Dolphins (*Tursiops Truncatus*) Off Veracruz, Mexico. *Ciencias Marinas*, 37(4), 379-392 <https://doi.org/10.7773/cm.v37i4A.1860>

With the goal of gathering ecological data to develop future cetacean management and conservation plans, the distribution, home range, and residency of bottlenose dolphins (*Tursiops truncatus*) were studied in the central-north Mexican Gulf of Mexico. Between July 2005 and June 2008, 59 boat surveys were carried out for a total of 313 h of effort at sea. During these surveys, 471 individuals were observed in 88 different groups. Photographs of naturally marked animals resulted in 275 different individuals photo-identified. Their distribution was homogeneous throughout the study area at a mean distance from the coast of 2.5 km (SD = 2.9, n = 471) and depths less than 20 m. Of the total of dolphins identified, 202 (73%) had a low sighting rate and were considered transients, whereas 34 individuals (12%) had medium and high sighting rates and were considered resident animals. At the population level, home range estimates calculated using the minimum convex polygon method showed a mean of 2771 +/- 1116 km<sup>2</sup>. Using the adaptive kernel method, the mean size of home range was 1199 +/- 143 km<sup>2</sup>, with five core areas identified. These areas decreased in size during the rainy season because dolphins remained close to the river plumes. At individual level, the mean home range was 129.2 km<sup>2</sup> (n = 66), concurring with other reports from the Gulf of Mexico (Texas and Florida) in spite of habitat differences. The main component determining the size of the home range was the presence of rivers, rather than the geomorphology of the coast.

Rayment, W., Clement, D., Dawson, S., Slooten, E., & Secchi, E. (2011). Distribution of Hector's Dolphin (*Cephalorhynchus Hectori*) Off the West Coast, South Island, New Zealand, with Implications for the Management of Bycatch. *Marine Mammal Science*, 27(2), 398-420 <https://doi.org/10.1111/j.1748-7692.2010.00407.x>

To support decision making on placement of protected areas for Hector's dolphin on New Zealand's South Island west coast, we conducted three aerial surveys documenting the species' distribution in this

area. The first survey was designed to quantify alongshore distribution and abundance, and revealed a patchy distribution with a central zone of high density. Two further surveys, in summer and winter, focused on this central zone to quantify offshore distribution in detail. Dolphin density decreased with increasing distance offshore, with no dolphins sighted more than 6 nmi from the coast or in water deeper than 60 m. There was no significant difference in offshore distribution between summer and winter surveys conducted in 2003 ( $G = 2.15$ ,  $df = 5$ ,  $P = 0.83$ ). Partial Mantel tests showed that dolphin distribution was best explained by distance from the coast, in both summer ( $r(M) = 0.088$ ,  $P = 0.0001$ ) and winter ( $r(M) = 0.054$ ,  $P = 0.0004$ ). Spatial contouring techniques showed that small (ca. 5 km) and medium scale (ca. 50 km) patterns of density in the central zone were remarkably consistent, suggesting year-round residency. Based on these data, the current restrictions on commercial gillnetting protect 60% or less of the dolphin population for 3 mo of the year.

Rosel, P. E., Hohn, A. A., Mullin, K., Garrison, L. P., Schwacke, L. H., Adams, J., . . . Eguchi, T. (2011). Photo-Identification Capture-Mark-Recapture Techniques for Estimating Abundance of Bay, Sound and Estuary Populations of Bottlenose Dolphins Along the U.S. East Coast and Gulf of Mexico, a Workshop Report. Retrieved from <https://repository.library.noaa.gov/view/noaa/4014>

Bay, sound and estuary (BSE) populations of bottlenose dolphins are common along the U.S. Atlantic and Gulf of Mexico coasts. NOAA Fisheries currently identifies 9 BSE stocks in the Atlantic and 32 in the northern Gulf of Mexico. Accurate abundance estimates for these stocks are an essential component of MMPA-mandated stock assessment, yet only three of these BSE stocks have up-to-date abundance estimates. Abundance estimates based on data more than 8 years old are not considered valid for management (i.e., to estimate PBR) under the MMPA and those more than 5 years old drop a stock assessment from adequate to inadequate under the NOAA Fisheries Stock Assessment Improvement Plan. For most stocks in U.S. waters, aerial and/or large vessel line-transect surveys provide the platforms for abundance estimation. Line-transect “distance” analysis methods from vessels and planes are relatively well understood and these methods are more or less standardized. While line-transect surveys using small boats may be appropriate for some estuarine systems, such surveys are not suitable when working inside estuarine waters with complex topography and turbid waters. As a result, alternative methodologies have been utilized, most centered around the use of photo-identification (photo-ID) capture-mark-recapture (CMR) techniques. However, CMR studies using photo-ID are more complex in terms of design constraints and analytical methods and do not have a well-defined “standard” approach for populations of cetaceans residing in topographically complex estuarine habitats. Furthermore, the areas inhabited by most BSE stocks often experience influxes of non-resident animals, further complicating the ability to obtain an abundance estimate for the resident stock alone. In many cases, field methods for collecting photo-ID data, definitions of residency and analytical tools are not standardized across studies of different BSE stocks. These differences in methodologies affect resulting abundance estimates and make comparison of abundance estimates and PBR calculations across different BSE stocks difficult. The Workshop sought to develop agreed upon best practices for fieldwork, photo processing and analytical practices for estimating abundance for estuarine bottlenose dolphin populations in the Southeast United States using CMR method.

Toth, J. L., Hohn, A. A., Able, K. W., & Gorgone, A. M. (2011). Patterns of Seasonal Occurrence, Distribution, and Site Fidelity of Coastal Bottlenose Dolphins (*Tursiops truncatus*) in Southern



New Jersey, USA. *Marine Mammal Science*, 27(1), 94-110 <https://doi.org/10.1111/j.1748-7692.2010.00396.x>

Coastal bottlenose dolphins (*Tursiops truncatus*) form a mosaic of resident and seasonal migratory populations along the United States Atlantic seaboard. Seasonal, poorly known migrants (identified as a separate stock) move as far north as New Jersey. During 2003-2005, 73 boat-based photo-identification surveys were conducted in southern New Jersey to discern seasonal occurrence, distribution, and patterns of movement and site fidelity. Neonates, young-of-year, and adults occurred in the study area from late May through late September, corresponding to water temperatures of 14.0-16.3 degrees C. Of 205 individuals identified, 44% (n = 90) were sighted multiple times within or among years, including 10% (n = 20) of individuals identified in all 3 yr. Almost half (47%) of the multiple sightings were observed along a core area encompassed by the southern part of the Jacques Cousteau National Estuarine Research Reserve. In contrast to stocks studied in southern coastal areas of the U.S. Atlantic and Gulf of Mexico, estuaries were used significantly less than open-beach habitat, which is consistent with the relative prey abundance in these habitats. Research at additional sites will help confirm whether bottlenose dolphins at the northern end of their migratory range exhibit local site fidelity and habitat preferences similar to those found in this study.

Valdes-Arellanes, M. P., Serrano, A., Heckel, G., Schramm, Y., & Martinez-Serrano, I. (2011). Abundance of Two Populations of Bottlenose Dolphins (*Tursiops Truncatus*) in Northern Veracruz, Mexico. *Revista Mexicana De Biodiversidad*, 82(1), 227-235 Retrieved from <http://www.revista.ib.unam.mx/index.php/bio/article/view/367>

In Mexico, the population size of the bottlenose dolphin (*Tursiops truncatus*) is unknown, due to the fact that they are highly mobile, and occasionally there are exchanges of individuals between populations. The objective of this study was to determine the abundance of dolphins in the north of Veracruz. From March 2005 to December 2007 were 50 surveys with a total effort of 236.7 hours. The results of the photo-identification of dolphins were used in the Jolly-Seber model, and with this model we estimated a total of  $N = 302 \pm 113$  dolphins throughout the study area. For Tamiahua a population estimate of  $N = 177 \pm 10$  dolphins, and for Tuxpan  $N = 161 \pm 68$  dolphins. These results suggest that there is minimal exchange of dolphins between areas; therefore it is assumed that populations are not isolated but dolphins have a preference for certain areas, and confirms that there is fidelity to the site of 13 years from the photo-recapture of some individuals in the area of Tamiahua. The fidelity may be a consequence of the high primary productivity present in the area, therefore is an ideal place for breeding and shelter.

Especie, M. D., Tardin, R. H. O., & Simao, S. M. (2010). Degrees of Residence of Guiana Dolphins (*Sotalia Guianensis*) in Ilha Grande Bay, South-Eastern Brazil: A Preliminary Assessment. *Journal of the Marine Biological Association of the United Kingdom*, 90(8), 1633-1639 <https://doi.org/10.1017/s0025315410001256>

The Guiana dolphin, *Sotalia guianensis*, is a small delphinid found in coastal areas from northern Honduras to southern Brazil. Little is known about the ecology of this species in several areas of its geographical distribution. In this paper, we present new data about the residency of Guiana dolphins in Ilha Grande Bay, south-eastern Brazil. Boat surveys were conducted at the study area from May 2007 to March 2008. Applying the photo-identification technique, we took pictures of dolphins' dorsal fins,

looking for natural markings on them. A total of 17,969 photographs were taken, from which was created a databank of 462 distinct dolphins. Individuals showed different degrees of residency in the bay. More than 50% of the catalogued dolphins were considered non-residents and/or showed a low degree of residence. The average interval between resightings was 35 +/- 27.4 days. Animals without markings (calves and juveniles) accounted for 45% (N = 2917) of photographs taken. These results indicate that this population has a fluid structure including different individuals over time. We suggest a possible relationship between the presence of some individuals and local resource availability, such as prey and protected areas.

Vermeulen, E., & Cammareri, A. (2009). *Residency Patterns, Abundance, and Social Composition of Bottlenose Dolphins (Tursiops truncatus) in Bahía San Antonio, Patagonia, Argentina* (Vol. 35). <https://doi.org/10.1578/AM.35.3.2009.378>

Residency patterns, abundance, and social composition of bottlenose dolphins (*Tursiops truncatus*) were assessed from 2006 to 2008 in Bahía San Antonio (BSA), Patagonia, Argentina. A total of 714 survey hours resulted in 132 contact hours with 224 bottlenose dolphin groups. Results indicated that dolphins can be seen year-round on average every 4 h, with sighting periods lasting an average of 45 min. A total of 57 bottlenose dolphins were positively identified in the bay, of which 56% showed a degree of residency, including almost all mother and calf pairs. Using the closed time heterogeneity model (Mth), and accounting for the proportion of unidentifiable individuals, calculations resulted in a corrected abundance estimate of 83 individuals for the study area. Further analysis revealed that individual dolphins associated at random and that the entire community exhibits rapid disassociations and two levels of casual acquaintances. Data suggest that the shallow waters of BSA support a relatively resident community of bottlenose dolphins, living in a fission-fusion society in which companionships frequently change. The relative constant presence of calves in more than 50% of the dolphin groups and the observed presence of neonates might furthermore indicate that dolphins specifically use this area, among others, to give birth and nurse their young. In addition, a reported decline in bottlenose dolphin sightings in the larger area of the Argentinean coast might indicate that BSA is one of the last remaining refuges of the species in the country. Further research seems vital for their conservation.

Weir, C. R. (2009). Distribution, Behaviour and Photo-Identification of Atlantic Humpback Dolphins *Sousa Teuszii* Off Flamingos, Angola. *African Journal of Marine Science*, 31(3), 319-331 <https://doi.org/10.2989/ajms.2009.31.3.5.993>

Atlantic humpback dolphins *Sousa teuszii* are a priority for research due to their restricted geographic range, narrow ecological niche and the paucity of existing information. The distribution and behaviour of *S. teuszii* off Flamingos, southern Angola, was investigated during summer and winter 2008 using boat- and shore-based surveys. In all, 71 *S. teuszii* sightings were recorded, ranging from one to eight animals. *Sousa teuszii* inhabited shallow, nearshore waters throughout the region, with the exception of southern areas adjacent to fishing villages. Small bays, sheltered waters behind reef-breaks and areas off dry river mouths were used for foraging/feeding behaviour, whereas most travelling occurred along exposed coast. Ten individual *S. teuszii* were photo-identified. Multiple resightings (and absence of unmarked animals) indicate that all individuals present at the time of the surveys were photo-captured, exhibited high site fidelity and had year-round occurrence. Association indices of 0.77-1.0 indicated strong social affiliation between eight individuals, particularly in winter. Off Flamingos, *S. teuszii* occurs in small numbers and exhibits high site fidelity to a relatively small stretch of nearshore habitat, making

the species vulnerable to local extirpation. Wider-scale surveys and development of a management plan are crucial to ensuring the long-term conservation of *S. teuszii* off Flamingos.

Baird, R. W., Webster, D. L., Mahaffy, S. D., McSweeney, D. J., Schorr, G. S., & Ligon, A. D. (2008). Site Fidelity and Association Patterns in a Deep-Water Dolphin: Rough-Toothed Dolphins (*Steno bredanensis*) in the Hawaiian Archipelago. *Marine Mammal Science*, 24(3), 535-553  
<https://doi.org/10.1111/j.1748-7692.2008.00201.x>

In the Pacific, rough-toothed dolphins (*Steno bredanensis*) are typically found in the open ocean and in deep waters around oceanic islands. We examined habitat use, site fidelity, movements, and association patterns of this species in the main Hawaiian Islands. Sighting rates were highest in depths > 1,500 m. There were frequent within- and between-year resightings off the island of Hawai'i, indicating a small population size with high site fidelity. Resighting rates were lower off Kaua'i/Ni'ihau, indicating a larger population size, but with some site fidelity. Two individuals were documented moving from Kaua'i to Hawai'i, a distance of 480 km, but were not seen to associate with dolphins off Hawai'i. Observed movements were consistent with at most 2% dispersal per year between these two areas. Differences in group sizes, habitat use, and behavior imply that movements among the islands may be limited. Little is known about the diet of rough-toothed dolphins in Hawai'i, but they are thought to feed primarily on near-surface species. High fidelity to deep-water areas off the island of Hawai'i likely reflects an increase in the predictability of prey associated with upwelling due to the island mass effect, wind stress curl and cyclonic eddies that form off the island.

Fury, C. A., & Harrison, P. L. (2008). Abundance, Site Fidelity and Range Patterns of Indo-Pacific Bottlenose Dolphins (*Tursiops aduncus*) in Two Australian Subtropical Estuaries. *Marine and Freshwater Research*, 59(11), 1015-1027 <https://doi.org/10.1071/mf08109>

Bottlenose dolphins are widely studied in marine habitats, but information on estuarine populations is very limited. The present study provides the first published data on bottlenose dolphins in Australian estuaries. Abundance estimates, site fidelity and individual ranging patterns were examined over a 3-year period for Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) inhabiting the Clarence River (CR) and Richmond River (RR) estuaries in northern New South Wales, Australia. Mark-recapture analyses estimated 71 (62 -81 95% CI) dolphins utilised the CR whereas 34 (19 49 95% CI) used the RR. Differences in site fidelity were observed between the estuaries, with 60% and 37% of identified dolphins determined as residents, 26% and 21% as occasional visitors and 14% and 42% as transients for the CR and RR respectively. Resource partitioning was apparent in both estuaries with the mean distance resident dolphins were found upstream from the river mouth being greater than occasional visitors and transients. The Clarence River sustains a larger, predominantly resident dolphin community compared with the Richmond River, which supports a relatively small dolphin community with lower site fidelity. Management of future increased anthropogenic disturbances is needed to ensure the long-term survival of these dolphin populations.

Nery, M. F., Espécie, M. D., & Simao, S. M. (2008). Site Fidelity of *Sotalia Guianensis* (Cetacea : Delphinidae) in Sepetiba Bay, Rio De Janeiro, Brazil. *Revista Brasileira De Zoologia*, 25(2), 182-187 <https://doi.org/10.1590/s0101-81752008000200004>

Estuarine dolphins, *Sotalia guianensis* (Van Beneden, 1864), were identified in Sepetiba Bay (22 degrees 35'S, 44 degrees 03'W), state of Rio de Janeiro, Brazil, between February 1994 and July 2006 using the photo-identification method. A total of 72 Surveys resulted in the identification and cataloguing of 217 individual dolphins. Seventy-nine (36%) were resighted at least once during the study period. The average interval between resightings was 40,6 +/- 31,1 months. Large numbers of mother-and-calf pairs were recorded during the 12 years and new individuals were frequently encountered in the photographic records. These results suggest that part of the dolphin population is more consistently found in Sepetiba Bay, probably for feeding and reproduction, while other individuals use the Bay only sporadically.

Kuczaj, S. A., & Yeater, D. B. (2007). Observations of Rough-Toothed Dolphins (*Steno Bredanensis*) Off the Coast of Utila, Honduras. *Journal of the Marine Biological Association of the United Kingdom*, 87(1), 141-148 <https://doi.org/10.1017/s0025315407054999>

Local dive shop operators and fishermen report that rough-toothed dolphins (*Slew bredanensis*) are frequently encountered off the coast of Utila, Honduras, (160 degrees 5'46.5"N 86 degrees 55'47.81V). Our observations suggest that at least some of these animals may constitute a resident population, although the extent of the resident group's home range has not been determined. Twenty-eight rough-toothed dolphins were identified using photo-identification techniques, 15 of which were re-sighted on two or more occasions. The 12 animals that were re-sighted four or more times were typically seen together, suggesting that they constitute a stable social group. At least one of these dolphins is an adult male, and his continued presence in this social group may reflect a social structure for rough-toothed dolphins that differs from that described for other dolphin species. Social interactions often involved tactile behaviours such as pectoral fin rubbing and side rubbing. The observed dolphins sometimes expressed interest in the research vessel and other boats by approaching, and on separate occasions examined a hydrophone and slow moving propeller visually and echoically. Overall, our behavioural observations suggest: (1) synchronous behaviours and 'tight' groupings are common while rough-toothed dolphins are travelling; (2) tactile contact is an important aspect of social interactions for rough-toothed dolphins; (3) cooperative behaviour occurs during play; and (4) rough-toothed dolphins are curious.

Rossi-Santos, M. R., Wedekin, L. L., & Monteiro-Filho, E. L. (2007). Residence and Site Fidelity of *Sotalia Guianensis* in the Caravelas River Estuary, Eastern Brazil. *Journal of the Marine Biological Association of the United Kingdom*, 87(1), 207-212 <https://doi.org/10.1017/S0025315407055683>

Between April 2002 and April 2005, 210 estuarine dolphin groups were sighted, with 58 animals individually identified. Fifteen dolphins were photo-identified just once, while only two animals were sighted in 15 different months. Some individuals showed long-term residence (more than 3 y). Residence rates showed heterogeneity in the dolphin's permanence of the estuary, with 60% of the individuals with low numbers (<10) and only 7% showing high values for residence (maximum=45.9). Continued resightings of some dolphins support the regular use of the study area by the animals, despite some individuals that, after a long time without resightings were registered again. Individual range analysis showed that dolphins shared the same common area, the Caravelas River Estuary. A marked fluctuation in the number of photo-identified dolphins was observed in the study area, revealed by the high number of individuals with just a few resightings. The majority of the dolphins (60%) present

a yearly residence pattern, as observed in other areas, suggesting that a few individuals show high fidelity for the area, while many other dolphins move constantly between different areas for unknown reasons.

Elwen, S., Meyer, M. A., Best, P. B., Kotze, P. G. H., Thornton, M., & Swanson, S. (2006). Range and Movements of Female Heaviside's Dolphins (*Cephalorhynchus Heavisidii*), as Determined by Satellite-Linked Telemetry. *Journal of Mammalogy*, 87(5), 866-877 <https://doi.org/10.1644/05-mamm-a-307r2.1>

Heaviside's dolphin (*Cephalorhynchus heavisidii*) is a coastal delphinid with a limited inshore distribution off the west coast of southern Africa. Knowledge of its habitat usage is an essential precursor to assessing its potential vulnerability to fisheries interactions. Six Heaviside's dolphins (1 male and 5 females) were fitted with satellite-linked transmitters in 2004, and tracked for up to 54 days. The 5 tags fitted to female dolphins transmitted continuously, allowing for analysis of movements at a fine temporal scale. Four dolphins showed an initial avoidance of the capture site by moving over a wider area in the first 2-5 days posttagging than later in the deployment period. All dolphins had used their full home ranges (determined as 100% minimum convex polygons) 5-20 days before tag failure, suggesting measured home ranges were stable at this temporal scale. Home-range estimates using local convex hulls ranged from 301.9 to 1,027.6 km<sup>2</sup> (90% isopleths) and 875.9 to 1,989.6 km<sup>2</sup> using the 100% isopleths and scaled positively with body size but varied in shape, usage, and number of core-use areas. Although the distance from shore and depth at which individual dolphins moved varied greatly, all dolphins showed a strong onshore-offshore diurnal movement pattern, generally being closest inshore between 0600 h and noon, and farthest offshore between 1500 h and 0500 h. This pattern is assumed to be related to the movements of their principal prey, juvenile shallow-water hake (*Merluccius capensis*), which migrate into the upper water column at night. Movements inshore may be associated with rest, socializing, and predator avoidance.

Parra, G. J., Corkeron, P. J., & Marsh, H. (2006). Population Sizes, Site Fidelity and Residence Patterns of Australian Snubfin and Indo-Pacific Humpback Dolphins: Implications for Conservation. *Biological Conservation*, 129(2), 167-180 <https://doi.org/10.1016/j.biocon.2005.10.031>

Very little is known about the ecology of snubfin *Orcaella heinsohni* and Indo-Pacific humpback dolphins *Sousa chinensis* in Australian waters. We used photo-identification data collected between 1999 and 2002 in Cleveland Bay, northeast Queensland, to estimate abundance, site fidelity and residence patterns of these species in order to make recommendations for their effective conservation and management. Our abundance estimates indicate that less than a hundred individuals of each species inhabit this coastal area. Even with relatively unbiased and precise abundance estimates population trends will be extremely difficult to detect in less than three years unless changes in population size are very high (>20% p.a.). Though both species are not permanent residents in Cleveland Bay, they both used the area regularly from year to year following a model of emigration and reimmigration. Individuals of both species spend periods of days to a month or more in coastal waters of Cleveland Bay before leaving, and periods of over a month outside the study area before entering the bay again. Because of their small population sizes and movement patterns, snubfin and humpback dolphins are particularly vulnerable to local extinction. Our results illustrate that: (1) detection of population trends should not be a necessary criterion for enacting conservation measures of both species in this region, and (2)

efforts to maintain viable populations of both species in Cleveland Bay must include management strategies that integrate anthropogenic activities in surrounding areas.

Bearzi, G., Politi, E., Agazzi, S., Bruno, S., Costa, M., & Bonizzoni, S. (2005). Occurrence and Present Status of Coastal Dolphins (*Delphinus Delphis* and *Tursiops Truncatus*) in the Eastern Ionian Sea. *Aquatic Conservation-Marine and Freshwater Ecosystems*, 15(3), 243-257  
<https://doi.org/10.1002/aqc.667>

1. Boat surveys aimed at studying short-beaked common dolphins and common bottlenose dolphins in eastern Ionian Sea coastal waters were conducted between 1993 and 2003. During 835 survey days, 24771 km of total effort was distributed within an area of 480km<sup>2</sup>, resulting in 428 common dolphin and 235 bottlenose dolphin sightings. 2. Individual photo-identification was performed extensively throughout this study, making it possible to monitor the number of animals seen in the study area each year and their long-term residency patterns. 3. Common dolphins declined across the study period, from 2.18 encounters/100 km in 1997 to 0.40 encounters/100km in 2003. In contrast, there was a relatively stable presence of bottlenose dolphins, some individuals showing high levels of site fidelity and others using the area only occasionally. 4. The local decline of common dolphins and the low density of bottlenose dolphins appeared to reflect the general status of these cetacean species in the wider Mediterranean region, where common dolphins were classified as endangered in the IUCN Red List in 2003. 5. Based on the available evidence, we infer that the present unfavourable status of common dolphins in eastern Ionian Sea coastal waters is largely a consequence of prey depletion.

Kerr, K. A., Defran, R. H., & Campbell, G. S. (2005). Bottlenose Dolphins (*Tursiops Truncatus*) in the Drowned Cayes, Belize: Group Size, Site Fidelity and Abundance. *Caribbean Journal of Science*, 41(1), 172-177 Retrieved from <http://eprints.uberibz.org/1545/>

Group size, site fidelity and abundance of bottlenose dolphins, *Tursiops truncatus*, were assessed during 392 photo-identification surveys conducted during 1997-1999 in the Drowned Cayes region, near Belize City, Belize, Central America. During this study 2155 dolphins were sighted across 736 groups. Mean group size was 2.9 (SD = 2.32) which is one of the smallest reported for bottlenose dolphins. One hundred and fifteen individual dolphin were photographically identified, with sighting frequencies ranging from one to fifty ( $\bar{X}$  over bar = 8.1, SD = 9.05). Thirty percent of identified dolphins were judged to be residents, while 23% were photographed only once. Chao's M-th model for closed populations was used to derive an abundance estimate of 122 dolphins (95% CI = 114-140). This low abundance estimate and a leveling trend in the rate of newly identified individuals, indicates that the Drowned Cayes dolphin population is both small and finite. Group size, abundance, and site fidelity comparisons were made with a 4-yr photo-identification study conducted at nearby Turneffe Atoll. Both the Drowned Cayes and Turneffe Atoll studies had similarly small group sizes, low and variable levels of site fidelity and low abundance estimates, but there was no overlap between individual sightings in the two areas. The observed behavioral patterns and similarities between the two studies raise concerns that increasing pressures on Belize's marine resources may pose a threat to its bottlenose dolphins.

Lusseau, D. (2005). Residency Pattern of Bottlenose Dolphins *Tursiops* Spp. In Milford Sound, New Zealand, Is Related to Boat Traffic. *Marine Ecology Progress Series*, 295, 265-272  
<https://doi.org/10.3354/meps295265>



A population of bottlenose dolphins inhabits 7 of the 14 fjords that compose Fiordland, New Zealand. One of these fjords, Milford Sound, supports a large tourism industry that results in intense boat traffic. Bottlenose dolphins regularly visited Milford Sound and tour boats interacted with them during these visits. I studied the factors affecting the frequency of visits to Milford Sound by relating the residency pattern of dolphins in this fjord to oceanographic parameters and variations in boat traffic between December 1999 and February 2002. Boat traffic was the only variable that could explain the frequency of dolphin visits to Milford Sound. Dolphins spent less time in Milford Sound during seasons of intense boat traffic. Moreover, when dolphins visited this fjord, they spent more time at the entrance of the fjord when boat traffic was intense, out of the reach of tour boats. It seems that dolphins avoid Milford Sound when traffic is heavy. This avoidance could have long-term implications for the demography of the population.

Irwin, L.-J., & Würsig, B. (2004). A Small Resident Community of Bottlenose Dolphins, *Tursiops truncatus*, in Texas: Monitoring Recommendations. *Gulf of Mexico Science*, 22(1), 2  
<https://doi.org/10.18785/goms.2201.02>

A small community of bottlenose dolphins (*Tursiops truncatus*) in western Galveston Bay, Texas, was first studied in 1990 with subsequent study from 1995 through 2001. These animals showed strong site fidelity with seasonal variation in habitat use. From 1997 to 2001, three methods of assessing dolphin occurrence and abundance in this location were compared for efficiency and accuracy: photoidentification (photo-ID) for occurrence patterns and counts of individual animals; capture–recapture analyses from photo-ID data for abundance estimates; and line transect surveys for dolphin density estimates. Our line transect data were thought to be positively biased and that method is not recommended for this location. Counts of animals with site fidelity were consistent with abundance estimates of all dolphins using the bay from capture–recapture analysis. Resident animal counts ranged from 28 to 34 in different survey years. Abundance estimates for all dolphins using the bay, including nonresident animals, ranged from 28 to 38. Specific recommendations are made for long-term low-level monitoring of dolphins in this study area. These guidelines may be useful to researchers studying similar small coastal dolphin communities when appropriately modified and applied to their research sites.

Martin, A. R., & da Silva, V. M. F. (2004). Number, Seasonal Movements, and Residency Characteristics of River Dolphins in an Amazonian Floodplain Lake System. *Canadian Journal of Zoology*, 82(8), 1307-1315 <https://doi.org/10.1139/z04-109>

The size and structure of a community of Amazon river dolphins or botos, *Inia geoffrensis* (de Blainville, 1817), was investigated using boat surveys and long-term observations of recognisable animals. Year-round, some 260 botos occurred in or near the 225-km<sup>2</sup> Mamirauá várzea floodplain lake system, of which half were permanent residents by our definition. Seasonal variation in water levels influenced distribution between habitats but not the overall number of botos. Ninety percent of marked botos encountered within the lake system were permanent residents. There appeared to be a cline in site fidelity between those that always live in or near the system and those that visit at intervals of years. We estimated that 270 botos were "significant users" of the lake system (i.e., occurred within it for sufficient periods in a year to be observed at least once) and that many others visited for short periods. Individuals moved many tens to hundreds of kilometres along the rivers, but there was no broad-scale seasonal migration. The boto population of the central Amazon, at least, may be structured on the basis

of floodplain lake systems, with extensive animal movement between systems. We estimate that 13 000 botos occur in the 11 240 km<sup>2</sup> Mamirauá Sustainable Development Reserve, which covers an estimated 11%–18% of várzea habitat in Brazil.

Rogers, C. A., Brunnick, B. J., Herzing, D. L., & Baldwin, J. D. (2004). The Social Structure of Bottlenose Dolphins, *Tursiops truncatus*, in the Bahamas. *Marine Mammal Science*, 20(4), 688-708  
<https://doi.org/10.1111/j.1748-7692.2004.tb01188.x>

The social structure of coastal ecotype bottlenose dolphins, *Tursiops truncatus*, is largely unknown as they inhabit regions far from shore. This study reports on a community of bottlenose dolphins greater than or equal to 27 km from Grand Bahama Island (May–September, 1993–2002). Resident and non-resident dolphins occurred in the area. Some dolphins traveled over 320 km between communities; others showed long-term site fidelity up to 17 yr. Average group size was 3–5, and was significantly larger with calves present and significantly smaller when traveling. The half-weight index was used to determine coefficients of association (COA) for individuals of known sex annually and for pooled years. Permutation tests revealed non-random associations and presence of preferred/avoided companions in all data sets. Annual COAs were low: female-female  $x = 0.31$ , male-male  $x = 0.30$ , and mixed-sex  $x = 0.26$ . Mother-calf associations showed the highest values. Some males formed strong, long-term bonds. Female COAs fluctuated with reproductive status. Using pooled data, COAs were lower and the same basic trends were evident. However, strong associations seen in the annual data were not evident in pooled data. Bottlenose dolphins that inhabit offshore, shallow water show many of the same social structure characteristics as in well-studied coastal populations.

Chilvers, B. L., & Corkeron, P. J. (2003). Abundance of Indo-Pacific Bottlenose Dolphins, *Tursiops aduncus*, Off Point Lookout, Queensland, Australia. *Marine Mammal Science*, 19(1), 85–95  
<https://doi.org/10.1111/j.1748-7692.2003.tb01094.x>

Managing escalating human impacts on nearshore cetaceans requires information on a species' demography and distribution patterns at appropriate spatial scales. Identification photographs of individuals of a population of inshore Indo-Pacific bottlenose dolphins, *Tursiops aduncus*, were obtained in the open coastal waters off North Stradbroke Island, Australia and used to estimate population density and residency. Five hundred and eighty-one individuals were identified from 342 school sightings during 1998 and 1999. Mark-recapture analysis using closed population models estimated a population size of between 700 and 1,000 individuals within the study area during winter, with evidence that the population contained resident individuals. This represents an extremely high number of dolphins within a small area, which requires a pre-emptive management strategy to ensure their continued occupancy.

Brager, S., Dawson, S. M., Slooten, E., Smith, S., Stone, G. S., & Yoshinaga, A. (2002). Site Fidelity and Along-Shore Range in Hector's Dolphin, an Endangered Marine Dolphin from New Zealand. *Biological Conservation*, 108(3), 281–287 [https://doi.org/10.1016/s0006-3207\(02\)00124-6](https://doi.org/10.1016/s0006-3207(02)00124-6)

To document site fidelity and the alongshore range of individual Hector's dolphins we analysed sightings of 32 photographically identified dolphins, each seen greater than or equal to 10 times at Banks Peninsula, New Zealand, between 1985 and 1997. The furthest two sightings of an individual were 106

km apart. All other individuals ranged over less than 60 km ( $\bar{x}$  over bar  $\pm$  SE = 31.0 km, SE = 2.43) of coastline. Gender did not significantly influence alongshore range (female ( $\bar{x}$  over bar  $\pm$  SE = 30.4 km, SE = 3.21,  $n$  = 18; male  $\bar{x}$  over bar  $\pm$  SE = 27.4 km, SE = 5.68,  $n$  = 5). Site fidelity was high: for example, on average, individuals were seen in Akaroa Harbour for about two thirds of the years they were known to be alive. These data suggest that impacts on Hector's dolphins are most appropriately managed on a small spatial scale.

Gubbins, C. (2002). Use of Home Ranges by Resident Bottlenose Dolphins (*Tursiops truncatus*) in a South Carolina Estuary. *Journal of Mammalogy*, 83(1), 178-187 [https://doi.org/10.1644/1545-1542\(2002\)083<0178:Uohrbr>2.0.Co;2](https://doi.org/10.1644/1545-1542(2002)083<0178:Uohrbr>2.0.Co;2)

Abundance, distribution, and ranging patterns of bottlenose dolphins (*Tursiops truncatus*) in the western Atlantic Ocean are not well understood. As part of an initial attempt to understand their ecology and social system, I examined the ranging patterns of coastal resident dolphins in South Carolina. From October 1994 through December 1998, I conducted 209 surveys in Calibogue Sound and adjoining coastal waters. Individual dolphins were identified by distinctive fin characteristics and categorized as resident or transient inhabitants based on resighting patterns. Home range boundaries and core use areas were defined for 20 resident dolphins. Resident dolphins occurred in inshore waters, were moderately mobile, exhibited strong site-fidelity, and showed distinct patterns of core use within their home ranges. Ranging patterns exhibited geographic partitioning along environmental and social parameters within the resident population.

Keith, M., Peddemors, V. M., Bester, M. N., & Ferguson, J. W. H. (2002). Population Characteristics of Indo-Pacific Humpback Dolphins at Richards Bay, South Africa: Implications for Incidental Capture in Shark Nets. *South African Journal of Wildlife Research*, 32(2), 153-162 Retrieved from <https://journals.co.za/content/wild/32/2/EJC117148>

The population characteristics of Indo-Pacific humpback dolphins (*Sousa chinensis*) were investigated at Richards Bay, South Africa, from April to October 1998. This area has the highest incidental catches of humpback dolphins in shark nets on the KwaZulu-Natal coast. A minimum of 181 individuals were individually identified in a boat-based photo-identification study and this sampled population appeared to be open in nature. Long-term photo-identification suggested that some humpback dolphins display long-distance movement patterns (up to 150 km), while other individuals display long-term residency within the KwaZulu-Natal area. Investigation into the associations between individual humpback dolphins yielded low and varying levels of affiliations. Unfamiliarity and naivete of individual dolphins to netted areas seemed to be the main factors affecting captures in shark nets.

Möller, L., Allen, S., & Harcourt, R. (2002). Group Characteristics, Site Fidelity and Seasonal Abundance of Bottlenosed Dolphins (*Tursiops aduncus*) in Jervis Bay and Port Stephens, South-Eastern Australia. *Australian Mammalogy*, 24(1), 11-22 <https://doi.org/10.1071/AM02011>

Social organisation and abundance of bottlenose dolphins (*Tursiops aduncus*) in Jervis Bay (JB) and Port Stephens (PS), NSW, were investigated through behavioural/photo-identification surveys between May 1997 and April 2000. Mean group size was significantly larger at JB ( $12.3 \pm 0.87$ ,  $n$  = 167) compared to PS ( $6.8 \pm 0.37$ ,  $n$  = 218). At both sites, groups were significantly larger when calves were present. Group size

varied with activity, being smallest when feeding and largest when socialising. While mean group size of feeding dolphins did not vary between sites, travelling and socialising groups were significantly larger in JB. Site fidelity was assigned based on sighting rates and presence across seasons. Sighting rates varied significantly between areas, but the proportion of dolphins categorised as residents, occasional visitors and transients did not. Minimum abundance by season, based on mark-resighting of recognisable individuals, ranged from  $61 \pm 3.2$  to  $108 \pm 7.1$  in JB and  $143 \pm 8.1$  to  $160 \pm 8.1$  in PS. Differences in group size at the two sites may relate to social factors and/or human impacts, while differences in abundance may be associated with habitat size and complexity. The lack of dolphin matches between areas suggests that they represent distinct populations.

Neumann, D. R., Leitenberger, A., & Orams, M. B. (2002). Photo-Identification of Short-Beaked Common Dolphins (*Delphinus Delphis*) in North-East New Zealand: A Photo-Catalogue of Recognisable Individuals. *New Zealand Journal of Marine and Freshwater Research*, 36(3), 593-604  
<https://doi.org/10.1080/00288330.2002.9517115>

Photo-identification has been established as a helpful tool in cetacean research. However, no study to date has attempted to apply this method to short-beaked common dolphins (*Delphinus delphis* L.). We present here the results of two studies that were conducted concurrently in Mercury Bay and the Hauraki Gulf on the north-east coast of New Zealand's North Island. Methods for distinguishing between individual dolphins are discussed. Sighting records of recognisable individuals indicate that some common dolphins move between Mercury Bay and the Hauraki Gulf (100 km distance), as well as between Mercury Bay and Whakatane (200 km distance). Common dolphin abundance and site fidelity appeared to be greater in the Hauraki Gulf than in Mercury Bay. A selection of photographs of distinct individuals is presented to allow future studies to compare their sighting records to ours, which may help establish the extent of home ranges, site fidelity, and possibly even longevity for common dolphins.

Shirakihara, M., Shirakihara, K., Tomonaga, J., & Takatsuki, M. (2002). A Resident Population of Indo-Pacific Bottlenose Dolphins (*Tursiops Aduncus*) in Amakusa, Western Kyushu, Japan. *Marine Mammal Science*, 18(1), 30-41 <https://doi.org/10.1111/j.1748-7692.2002.tb01016.x>

Residency patterns and population size were examined for Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in the coastal waters of Amakusa-Shimoshima Island, western Kyushu, Japan, from Summer 1991 to fall 1998. A total of 203 individuals were identified. The number of newly identified individuals barely increased after the first 1.5 yr. The identified individuals in one season were frequently resighted with percentages of mostly over 60% during the subsequent seasons. Most of the dolphins off Amakusa were year-round residents, although the total range of their habitat was unknown. Tilt: population size estimated by the mark-recapture technique was 218 individuals with a CV of 5.41% in 1995-1997. The group commonly consisted of more than 100 individuals. The large group size was thought to be a response to feeding on schooling fishes.

Zolman, E. S. (2002). Residence Patterns of Bottlenose Dolphins (*Tursiops Truncatus*) in the Stono River Estuary, Charleston County, South Carolina, U.S.A. *Marine Mammal Science*, 18(4), 879-892  
<https://doi.org/10.1111/j.1748-7692.2002.tb01079.x>

Residence patterns of inshore bottlenose dolphins (*Tursiops truncatus*) in the Stono River estuary, Charleston County, South Carolina were investigated as part of a larger effort to better understand stock structure of these dolphins along the east coast of the United States. Eighty-seven small-boat surveys for bottlenose dolphins were conducted from October 1994 through January 1996. Dolphins were sighted during all surveys. Approximately 304 h were spent surveying the study area; 64% (n= 196 h) of this time was spent observing and videotaping dolphins. A catalog, containing 112 individually identified dolphins was compiled. Thirty-two percent (n= 36) of identified dolphins were sighted once, while 28% (n= 31) were sighted five or more times. Nineteen percent (n= 21) of identified dolphins were determined to be year-round residents; eight percent (n= 9) seasonal residents. The majority (64%, n= 72) of identified dolphins were sighted in the study area during a single season or in two consecutive seasons and were classified as transients. This study documents the northernmost known site of a resident bottlenose dolphin community on the east coast of the United States, suggesting a complex bottlenose dolphin stock structure.

Bejder, L., & Dawson, S. (2001). Abundance, Residency, and Habitat Utilisation of Hector's Dolphins (*Cephalorhynchus Hectori*) in Porpoise Bay, New Zealand. *New Zealand Journal of Marine and Freshwater Research*, 35(2), 277-287 <https://doi.org/10.1080/00288330.2001.9516998>

Theodolite tracking and boat based photo identification surveys were carried out in the austral summers of 1995/96 and 1996/97 to assess abundance, residency, and habitat utilisation of Hector's dolphins (*Cephalorhynchus hectori* van Beneden 1881) in Porpoise Bay, on the south-east corner of the South Island of New Zealand. Data are consistent with the model of a small resident population that is visited occasionally by members of neighbouring populations. Mark-recapture analysis of photographically identified individuals, along with data on the proportion of animals bearing identifying marks, indicates a local population of 48 dolphins (95% CI = 44-55) in 1996/97. Dolphins spent a large proportion of their time in a small area inside the bay. Dolphin sightings were more congregated in successive time periods from early morning to late afternoon. No pattern of diurnal movement into and out of the bay was observed.

Santos, M. C. D., Acuna, L. B., & Rosso, S. (2001). Insights on Site Fidelity and Calving Intervals of the Marine Tucuxi Dolphin (*Sotalia Fluvialilis*) in South-Eastern Brazil. *Journal of the Marine Biological Association of the United Kingdom*, 81(6), 1049-1052 <https://doi.org/10.1017/S0025315401005045>

Ecological aspects of the marine tucuxi dolphin, *Sotalia fluvialilis* (Cetacea: Delphinidae), remain poorly known. Important information can be gathered in long-term studies using photo-identification. Using this methodology, the authors present the first evidence of site fidelity for marine tucuxis in the Cananeia Estuary (25degrees03'S 48degrees01'W), south-eastern Brazil. A total of 86 easily recognizable individuals was catalogued from June 1996 to August 2001, but most of them have been sighted from May 2000. From June 1997 to August 2001, three female tucuxis were sighted on nine (KN #19), 22 (KN #30) and 28 (KN #10) different days in a relatively small area (similar to 16 km<sup>2</sup>). Each of them was observed with a calf in 1997-1998 and again with a new offspring in 2000-2001. Thirteen other individuals were reported on eight to 19 different days in the same area between May 2000 and August 2001. Our observations lead to conclusions on the evidence of site fidelity and indicate that calving intervals may range between two and three years for this species in the surveyed area.

Defran, R. H., & Weller, D. W. (1999). Occurrence, Distribution, Site Fidelity, and School Size of Bottlenose Dolphins (*Tursiops Truncatus*) Off San Diego, California. *Marine Mammal Science*, 15(2), 366-380 <https://doi.org/10.1111/j.1748-7692.1999.tb00807.x>

The occurrence, distribution, site fidelity, and school size of bottlenose dolphins (*Tursiops truncatus*) in the coastal waters of north San Diego County, California were assessed during a six-year boat-based photoidentification study. A total of 146 photographic surveys were conducted between January 1984 and December 1989. Dolphin schools were encountered on 79% of all surveys, and 2,869 individuals were observed in 145 separate schools. Three-hundred seventy-three dolphins were individually identified. All schools were sighted within 1 km of shore, and more than two thirds of the schools were encountered in the southern half of the 32-km long study area. School site (mean = 19.8, SD = 18.40) and the number of dolphins encountered per survey (mean = 26.8, SD = 22.30) were highly variable. Low resighting rates of known individuals provided little evidence for longterm site fidelity. When our six-year photoidentification database was combined with previous data, 404 dolphins were identified in the study area from September 1981 to December 1989. Jolly-Seber population estimates during the 1984-1989 study period varied between 234 and 285. The combination of regular dolphin occurrence, low site fidelity by known individuals, and the continuous increase in the rate at which new dolphins were identified indicates that numerous different individuals were visiting the study area across and within years. The open California coastline differs in habitat structure and prey distribution from more protected study areas where bottlenose dolphins display site fidelity. These habitat differences may help to explain the observed intraspecific behavioral variability of this species.

Defran, R. H., Weller, D. W., Kelly, D. L., & Espinosa, M. A. (1999). Range Characteristics of Pacific Coast Bottlenose Dolphins (*Tursiops Truncatus*) in the Southern California Bight. *Marine Mammal Science*, 15(2), 381-393 <https://doi.org/10.1111/j.1748-7692.1999.tb00808.x>

Boat-based photoidentification surveys of bottlenose dolphins (*Tursiops truncatus*) were conducted from 1982 to 1989 in three discrete coastal study areas within the Southern California Bight: (1) Santa Barbara, California; (2) Orange County, California; (3) Ensenada, Baja California, Mexico. A total of 207 recognizable dolphins were identified in these three "secondary" study areas. These individuals were compared to 404 dolphins identified from 1981 to 1989 in our "primary" study area, San Diego, California, to examine the coastal movement patterns of bottlenose dolphins within the Southern California Bight. A high proportion of dolphins photographed in Santa Barbara (88%), Orange County (92%), and Ensenada (88%) were also photographed in San Diego. Fifty-eight percent (n = 120) of these 207 dolphins exhibited back-and-forth movements between study areas, with no evidence of site fidelity to any particular region. Minimum range estimates were 50 and 470 km. Minimum travel-speed estimates were 11-47 km/d, and all dolphin schools sighted during the study were within 1 km of the shore. These data suggest that bottlenose dolphins within the Southern California Bight are highly mobile within a relatively narrow coastal zone. Home-range dimensions and movement patterns for many vertebrate species are influenced, in part, by variation in food resources. The unique range characteristics documented during this study may reflect the highly dynamic nature of this coastal ecosystem and the associated patchy distribution of food resources available to these bottlenose dolphins.



Marten, K., & Psarakos, S. (1999). Long-Term Site Fidelity and Possible Long-Term Associations of Wild Spinner Dolphins (*Stenella Longirostris*) Seen Off Oahu, Hawaii. *Marine Mammal Science*, 15(4), 1329-1336 <https://doi.org/10.1111/j.1748-7692.1999.tb00894.x>

Wild spinner dolphins (*Stenella longirostris*) have been studied in the Hawaiian Islands since the 1970s. The main focus of these studies has been the Big Island of Hawaii (Norris and Doherty 1980; Norris et al. 1985, 1994; Ostman 1994; Driscoll 1995), with some study on the islands of Lanai (Ostman and Driscoll, unpublished data; Forestell, unpublished data). Shallenberger (1991) provided survey information for this and other cetacean species throughout the Hawaiian islands. Data (unpublished) have also been collected on distribution, movements, and behavior along the west and south shores of Oahu.\* This report describes identifications and possible long-term associations of spinner dolphins sighted in 1978-1979 and again in 1995-1998 at a resting area along the northwest coast of Oahu.

Simões-Lopes, P. C., & Fabian, M. E. (1999). Residence Patterns and Site Fidelity in Bottlenose Dolphins, *Tursiops Truncatus* (Montagu) (Cetacea, Delphinidae) Off Southern Brazil. *Revista Brasileira De Zoologia*, 16, 1017-1024 Retrieved from [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0101-81751999000400012&nrm=iso](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0101-81751999000400012&nrm=iso)

Residence patterns, habitat use, range, and some population estimate of the coastal bottlenose dolphin, *Tursiops truncatus* (Montagu, 1821), were documented in two coastal sites in southern Brazil: Laguna (Santa Catarina) (28°30'S; 48°55'W), and Imbe/Tramandai (Rio Grande do Sul) (29°58'S; 50°07'W). Regular observations were carried out at the Laguna system for 27 months (August 1989 to December 1991). The dolphins were photo-identified using natural permanent marks. Over 4,500 photographs were taken from shore grounds 6 to 14 meters away. Up to 51 dolphins have used the estuaries of Laguna's canal and Imarui-Santo Antonio's lagoon system in 1991. A stable group of nine animals has inhabited the Imbe/Tramandai area for over 13 years. Both sites were considered distinctive geographical communities, with 5.7% interchange within their individuals. In Laguna 88.5% of the individuals were resident and the rest were nonresident. Four cases of movement along the coastline were followed and females were more resident than males.

Wood, C. J. (1998). Movement of Bottlenose Dolphins around the South-West Coast of Britain. *Journal of Zoology*, 246, 155-163 <https://doi.org/10.1017/s0952836998010048>

After an absence of two decades a group of bottlenose dolphins, *Tursiops truncatus*, became resident in the coastal waters of Cornwall, U.K. in 1991. Using a combination of field techniques and information from the general public, the movements of this group were monitored. The dolphins demonstrated a seasonal residency pattern, spending the winter in southern Cornwall and moving further north-eastward during spring and summer. Residency was flexible with a number of individual dolphins using the region intermittently. The dolphins occupied a linear range of coast of 650 km. Within this range they repeatedly made long-distance journeys. Mean swimming speed was documented at 7.9 km.h<sup>-1</sup>, with the dolphins travelling the coast at a mean of 3.6 km.h<sup>-1</sup>. The longest journey recorded covered 1076 km and took 20 days. In one confirmed case the dolphins left the south-west of England and were resighted in Wales. Such wide ranging movements have important implications for the conservation of bottlenose dolphins in U.K. waters.

Whitehead, H., Gowans, S., Faucher, A., & Mccarrey, S. W. (1997). Population Analysis of Northern Bottlenose Whales in the Gully, Nova Scotia. *Marine Mammal Science*, 13(2), 173-185  
<https://doi.org/10.1111/j.1748-7692.1997.tb00625.x>

Northern bottlenose whales (*Hyperoodon ampullatus*) are consistently found through the year in the Gully, a prominent submarine canyon on the edge of the Scotian Shelf. Individuals were photographically identified during field studies between 1988 and 1995. About 70% of the population is identifiable, and 29% have markings which persist reliably over periods of years. A mark-recapture analysis of photographic individual identifications collected between 1988 and 1995 indicates that the population using the Gully numbers about 230 animals (approximate 95% confidence interval 160-360). The rate of mortality plus emigration plus mark change (in animals with reliable long-term marks) is about 12% per year, although this estimate has wide and uncertain confidence limits. Members of the Gully population, which includes calves and mature males, are shorter than animals caught off Labrador. The small size of the Gully population and its persistent use of a very small, bathy-metrically unique ocean area make it vulnerable to human disturbance.

Williams, J. A., Dawson, S. M., & Slooten, E. (1993). The Abundance and Distribution of Bottle-Nosed Dolphins (*Tursiops-Truncatus*) in Doubtful Sound, New-Zealand. *Canadian Journal of Zoology*, 71(10), 2080-2088 <https://doi.org/10.1139/z93-293>

Photographic identification and standardized zigzag surveys were used to study the distribution and abundance of bottlenose dolphins in Doubtful Sound, New Zealand. Forty individuals were identified from nicks and markings on their dorsal fins. Chapman's and Bailey's modifications to the Lincoln - Petersen estimate and the computer program CAPTURE were used to estimate the number of marked individuals in the population, which ranged from 30 to 40 animals for three survey periods (two summers and a winter). The proportion of identifiable individuals in the population was assessed empirically as 65.5%. These data resulted in a total population estimate of approximately 58 individuals. The majority of the dolphins in the catalogue were found in each survey period, indicating their residency in the fiord. Movements of dolphins around the sound were not predictable, but there were areas in which dolphins were more likely to be found and other areas in which dolphins were never seen. However, there were no obvious seasonal or daily movement patterns.

Ballance, L. T. (1992). Habitat Use Patterns and Ranges of the Bottle-Nosed-Dolphin in the Gulf of California, Mexico. *Marine Mammal Science*, 8(3), 262-274 <https://doi.org/10.1111/j.1748-7692.1992.tb00408.x>

I studied behavior and range patterns of individual bottlenose dolphins during 1984 in the mid-eastern Gulf of California, Mexico. Dolphin sighting rate was significantly higher in areas close to estuary mouths, 0.306 sightings per hour compared with 0.155 sightings per hour in areas distant from estuary mouths. Dolphins used these estuarine areas to feed; 61% of all behavior observed near estuaries was feeding as compared with 23% elsewhere. Traveling comprised 61% of all behavior observed in areas distant from estuary mouths. Estuaries are sites of large concentrations of nutrients which support great numbers of filter-feeding zooplankton and fish. Bottlenose dolphins may specialize on estuarine prey, or they may feed in estuarine areas simply because of the abundance of potential prey that these systems support. In either case, data on relative numbers, distribution patterns, behavior and diet indicate that this is a general trend in habitat use for many coastal populations of this species in the Pacific and

Atlantic. Ranges of a few individuals spanned a minimum of 65 km of coastline, and animals were not permanent residents of a monitored bay. In contrast, dolphins off the coast of Sarasota, Florida, have been reported to be year-round residents with smaller ranges. This difference in degree of site fidelity may be related to habitat differences. The west coast of Florida is dotted with numerous and large estuarine systems which may host permanent prey populations and support resident groups of dolphins. The Gulf of California coastline contains few estuaries; most are small and perhaps support prey resources which are ephemeral, requiring dolphins to range over larger distances in search of food.