ShoreFin Report 2014

Summary

This report details the Cardigan Bay Marine Wildlife Centre’s ShoreFin project, the first land-based bottlenose dolphin photo-identification project in New Quay, Ceredigion. This field season our primary aim was to develop our methodology for establishing this as an ongoing research project. By documenting the individual animals that visit the New Quay bay area we aim to acquire a greater understanding of the bottlenose dolphin population residing in Cardigan Bay and plan to continue the project into the future. We anticipate that the data we have already collected as part of this project will contribute towards answering further questions regarding bottlenose dolphin site usage, behaviours, provide additional information on the range of the local population as well as the potential effects of human activities on their behaviour.
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Introduction

The Cardigan Bay Marine Wildlife Centre (CBMWC) is a non-profit organisation whose seasonal daily operations are carried out by volunteers. CBMWC operates a visitor centre for the public, an education centre for school and community groups, as well as conducting marine mammal research through boat and land based surveys. CBMWC’s marine mammal data is collected on boat surveys in collaboration with a local eco-tourism business, Dolphin Survey Boat Trips (DSBT) whom operate out of New Quay. CBMWC also collects data on inshore marine megafauna sightings from surveys conducted from land-based vantage points; all these non-invasive surveys are conducted by trained volunteers. Photo-identification (photo-ID) of the local bottlenose dolphin population has historically been conducted either opportunistically or under licence (issued by Natural Resources Wales, formally Countryside Council for Wales) when required. However, a limited amount of photo-id data has been collected on the bottlenose dolphins that visit the New Quay bay area due to technological restrictions as well as boat surveys advocating and following local codes of conduct and strict licensing protocols. Due to these restrictions limited data has been collected for New Quay bay which is historically known as a hotspot area for bottlenose dolphins. This is the reason why the ShoreFin project was initiated. This season the ShoreFin project has developed a means for photo-ID to be carried out from land in a completely non-intrusive manner. Our goals were to extend our photo-ID dataset further and provide greater understanding of how dolphins are using the New Quay bay area. The future continuation of ShoreFin will hopefully provide valuable data to be used by researchers and policymakers.

Photo-ID of dolphins has been used as a primary means of identifying individuals and monitoring population dynamics (i.e. size, social structure, population composition) of marine mammals across the globe since the late 1970s (Würsig & Würsig 1977). The method involves photographing specific body parts, depending on species, that have particular physical characteristics that are unique to every individual (Würsig & Jefferson 1990), like fingerprints in humans. Following the mark-release-recapture model for population sampling, individual dolphins are identified by permanent and semi-permanent marks on their dorsal fins and by comparing these nicks and notches, scarring from teeth rakes and pigmentation patterns on each dorsal fin photographed (Würsig & Jefferson 1990). Images collected over time, sometimes years, on multiple occasions can be matched throughout years using the same identifiable marks. Each time a dolphin with identical markings is seen, it is identified as the same individual. Photo-ID is one of the least invasive methods of identification, as you never have to physically come in contact with the animals in order to identify them. Since its inception, photo-ID methods have become more sophisticated (i.e. moving from film to digital) as well as more methodical and standardised (Rosel et al. 2011). As the methods develop, they are increasingly being used for population abundance estimates, and monitoring of population composition and social structure.
Traditionally, photo-ID is carried out from a boat-based platform, either during transect surveys or in some cases more opportunistic survey efforts (Würsig & Jefferson 1990). Given the mobility of boats, researchers are able to encounter dolphins throughout their range, rather than in a single, particular area. The manoeuvrability of boats also enables the researchers to be placed in the optimum position to obtain the clearest photographs, to ensure a good angle and the best lighting for the photos, which all aid in identification process.

Cardigan Bay Marine Wildlife Centre has been photographing dolphins for ID purposes since 2005. In the past, photo-ID in New Quay bay has been conducted opportunistically during boat surveys, limited by local codes of conduct and licence protocols. This year, with the development of the ShoreFin project, CBMWC has a full season of dedicated photo-ID data to add to our database. As the only dedicated land-based photo-ID project for bottlenose dolphins, ShoreFin has developed their own protocols and procedures to deal with the particularities of land-based photo-ID in this area. As the project continues in subsequent years, new methodologies pertaining directly to land-based platforms will be developed with hopes of becoming standards for the field. Standardising methodology provides data useful for researchers and policy makers in the future.

New Quay Bay (52° 13’N, 004° 21’W) offers a unique location for dolphins in the Cardigan Bay area. Llanina reef, acts as shelter for a variety of fish species, also acts as a prime feeding ground for dolphins. The fish factory, which mainly processes common whelks (Buccinum undatum), disposes of their waste directly into the New Quay waters; these discards attract small fish which in turn attract larger schooling fish, potentially providing the dolphins with an easy and convenient foraging area (Denton 2012). As you move closer to shore, the harbour wall in New Quay buffers the prevailing wind’s effect, offering quiet, shallow waters for cows and calves to spend time in. On the other hand, it offers a number of challenges to the dolphins. New Quay is a popular tourist destination, attracting the majority of tourists during the summer holidays (STEAM Report 2010). This leads to an increase in boat traffic in and around the New Quay waters (Pierpoint et al. 2009). Personal watercrafts, commercial fishing vessels and companies running boat trips add additional challenges to the dolphins who visit the area during the summer season. An increase in the local human population also means an increase in pollution, through littering and general urban runoff into the bay and the surrounding waters.

Bottlenose dolphins (Tursiops truncatus) are a cosmopolitan cetacean species, found in temperate and subtropical waters around the world (Klinowska. 1991). They are both a coastal and offshore species, although the populations around Britain are primarily coastal populations (Evans 1992). Discrete populations of dolphins can range between 35 –1,500 individuals, although inshore groupings usually range between 2-15 (Shane et al. 1986). The average lifespan is between 40-50 years (Grellier et al. 1995), although females are known to live longer (Thompson & Wilson 1994). Within a population, groupings of individuals often change often, following a ‘fission-fusion’ pattern of association (Wells et al. 1987). Mothers and calf pairings are the strongest, and one of the few multi-year bonds made in a population, with calves staying with their mothers for 3-6 years before associating primarily
with other juveniles (Wells et al. 1987). Males are also known to form small groupings, known as male alliances, of 2-3, and can maintain these bonds for years (Barnes 2011).

In Cardigan Bay, bottlenose dolphin prey sources include, but are not limited to, mullet, salmonids and mackerel (pers. obs.). Bottlenose dolphins display daily routine behaviours, usually including foraging, socialising and travelling between locations. Prey abundance has a major effect on habitat selection for bottlenose dolphins, but abiotic factors such as tides, temperature or salinity can also have direct or indirect effects (Wells & Scott 2002). Cardigan Bay dolphins have shown a preference for slack water, preferring to travel when tidal flow is slow (Gregory & Rowden 2001), behaviour which is possibly related to energy conservation.

![Map of Cardigan Bay SAC](https://www.cardiganbaysac.org)

Figure 1. Location of the Cardigan Bay SAC

The bottlenose dolphin population of Cardigan Bay is one of two populations in the UK (the second in Moray Firth, Scotland; Baines & Evans 2012). The population includes both resident and transient individuals (Grellier et al. 1995), which use the bay for all life history stages. The bay, with its particular biological (e.g. reefs) and physical factors (e.g. temperature, depth, tide strength), offers a prime area for dolphin survival (Cardigan Bay Special Area of Conservation (SAC) Management Scheme). The population is considered an ‘open’ population (Grellier et al. 1995, Evans et al. 2000), whose size and composition is affected not only by births and deaths, but also by immigration and emigration. The Cardigan Bay population is estimated to have 150-350 individuals (Evans et al. 2000), though recent photo-ID efforts place the population around 250 individuals (Feingold & Evans 2014). The CBMWC photo-ID database has identified 213 well marked individuals since 2005; because of the important role the bay plays for these dolphins, the Cardigan Bay Special Area Conservation (SAC) has been designated to conserve and protect the semi-
resident population (Cardigan Bay Special Area of Conservation (SAC) Management Scheme). The SAC was initially created with limited knowledge on the biology and life histories of the Cardigan Bay dolphin population, with the understanding it would allow for research opportunities. CBMWC has been involved in researching the local population since 1996. The research has helped to develop important guidelines and restrictions within the SAC, to ensure a future for the dolphin population. The research conducted and the information gathered continues to support the requirement to protect and conserve the Bay, as dolphins use the Bay for all important life history stages (i.e. feeding and mating). Continued research is imperative to aid understanding of how dolphins use the Bay both as a whole as well as fine scale habitat usage, allowing policy makers to tailor the SAC management plans to ensure protection of this species. Additional research will allow provide information for the conservation of the animals themselves, but also hopefully limit any inconveniences, on a socio-economic level, a broad-ranged SAC might afford.

Methods

In preparation for the season, a course on photographing coastal species (Documenting Coastal Species Through a Lens) was run by the School of Education and Lifelong Learning (SELL), Aberystwyth University. Training on use of the photographic equipment and how best to approach photographing dolphins were provided. In addition, background knowledge and advice from CBMWC’s science officer Sarah Perry aided in setting up the data collection and systems for the project. Throughout the day volunteers from CBMWC undertook marine mammal surveys from New Quay harbour wall as part of the Ceredigion County Council’s Dolphin Watch Project, assistance from CBMWC volunteers conducting these surveys were vital to the success of this project.

From 14 April 2014 to 30 September 2014, volunteers from CBMWC carrying out land surveys from New Quay harbour wall would radio ShoreFin officers when dolphins were in the bay, particularly close to the harbour wall or the fish factory. Photographs were taken with a Canon 550D DSLR camera (Canon UK Ltd., Woodhatch, UK) and a Sigma 50-500mm lens (Sigma Imaging (UK) Ltd., Welwyn Garden City, UK). The lens has significant enough zoom to capture photographs of dolphins in the area from our land based vantage points, with a range of almost up to a kilometre. During an encounter (a sighting of dolphins where photos were taken) photos of both right and left sides of dorsal fins were priority, however attempts were made to obtain photographs of individual’s heads, dorsal, ventral (underneath) areas or flukes. A recent workshop report on photo-ID methods (Rosel et al. 2011) discusses the important parameters for quality identification photos: Focus, contrast, angle, proportion of fin visible and proportion of frame filled by fin. From a boat-based platform, photographers have the ability to manoeuvre themselves into position around individuals to maximize the quality of their photos. Photographers from a land-based platform do not have this freedom, and have to rely on the behaviour of the dolphins for quality photos, but also must occasionally work with poorer quality photos than what would be acceptable for projects surveying from boats. Contrast and angle were difficult to control for, and were mostly dependent on the time of day, weather conditions and the animal’s position in relation to the photographer. Proportion of frame filled by fin was somewhat dependent on the distance between the
dolphin and the photographer, though the majority of photos were taken only of individuals within an acceptable range of the camera.

Notes were taken immediately following an encounter, detailing the time of the encounter, location of the photographer and the weather conditions (cloud cover, sea state, visibility, wind and general weather, tides). Subjective notes on group size and composition, behaviour and general locations (by zones) were written by the photographer. The number of photographs taken and kept were also recorded. All photographs with dolphins in the frame were kept for processing; photos without dolphins (i.e. water shots) were deleted immediately. All data were recorded and stored on excel spreadsheets.

Photographs were renamed and cropped using ACDSee Pro 3.0 (ACD Systems, British Columbia, Canada), then graded based on quality (See Appendix D). Only photographs of Grade 3 quality were used for identifying individuals in the encounter. Individuals were sorted based on permanent markings (notches, nicks) and non-permanent markings (i.e. rake marks). Once initial sorting was complete, attempts were made to match individuals in encounters to others photographed during the present season, as well as to individuals in the existing CBMWC photo-id database. Matches made to existing, catalogued dolphins were checked by a second matcher, and then confirmed by the CBMWC science officer.

Encounter data were sorted and analysed using Microsoft Office Excel. The success rate of the project was determined in two ways: the proportion of sightings photographed and the proportion of dolphin groups photographed. This was then compared to the number of sightings photographed from boat based photo-ID encounters. This provided the difference between dedicated photo-ID and opportunistic photo-ID success.

Photographs of each identified individual were analysed and labelled as either adult, juvenile or calf. These was assessed based on the dolphin’s size and colouring. The proportion of dolphins at each life stage were calculated to give the number of adults, juveniles and calves encountered per month of the season.

The frequency of encounters were totalled for each mother and calf pairing identified this season. Encounters were displayed for each month of the season (April to September) allowing us to obtain information on the usage of New Quay bay by mothers and calves over the field season.

Individual encounter data for four dolphins photographed regularly in New Quay over the season were totalled for each month giving a frequency of encounters over the entire season.

Maps of all encounters were made using locations taken during Dolphin Watch dolphin sightings. Encounters of individuals in case studies were separated out of these initial encounters. Maps were created with ArcGIS (Esri, CA, USA).

Numbers of dolphins in New Quay Bay each month were determined by dividing the number of distinctive (i.e. identifiable) dolphins by a distinctiveness ratio (the number of distinct dolphins in an encounter divided by the total number in an encounter; Balmer et al. 2008). The cumulative total of new individuals in the Bay each month were also determined.
Thirteen behaviour types, based on categories used by the Dolphin Watch project were combined into three categories: Foraging, travelling or social/other behaviours (Table 1). To ascertain which behaviours dolphins were exhibiting whilst in New Quay bay the proportion of times each behaviour category was observed were calculated and tested for significance using a chi-squared test.

<table>
<thead>
<tr>
<th>Original Behaviour category</th>
<th>New Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3  S4</td>
<td>Foraging</td>
</tr>
<tr>
<td>T2</td>
<td></td>
</tr>
<tr>
<td>T1  T3</td>
<td>Travelling</td>
</tr>
<tr>
<td>S1  B</td>
<td></td>
</tr>
<tr>
<td>S2  L</td>
<td>Social/ Other</td>
</tr>
<tr>
<td>S5  TS</td>
<td></td>
</tr>
<tr>
<td>S6  GF</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. The 13 types of behaviour as described by Dolphin Watch categorized into 3 categories. S3 = long diving, foraging at depth; T2 = travelling, surfacing at irregular intervals; S4 = chasing prey at surface; T1 = travelling, surfacing regularly; T3 = travelling rapidly with forward leaps; S1 = lying motionless at surface; S2 = slow circling, milling; S5 = playing with objects; S6 = fast circling with splashes or tail slaps; B = bow riding; L = leaping; TS = tail slaps; GF = tight grouping.

Results

Photo-ID Effort

A total of 23 hours and 35 minutes were spent photographing dolphins from land based vantage points, resulting in 214 encounters in which photographs of high enough quality to identify individuals were captured. We successfully photographed 25% of Dolphin Watch sightings from land and 36% of the dolphin groups that visited New Quay Bay. Only 15% of dolphin sightings by boat were photographed opportunistically.

Photo-ID results

Fifty-nine individual animals were identified by the ShoreFin project: 33 were matched to animals already identified in CBMWC’s existing bottlenose dolphin photo-identification catalogue, 26 were added to the catalogue and therefore classed as new individuals (Appendix C). As part of the ShoreFin project, an average of 25 (± 2.42 SE (n=59)) individual dolphins were identified each month, out of an estimated average of 30 (±3.24 SE (n=747)) dolphins that were sighted in New Quay Bay each month with a mean distinctiveness rate of
0.83 (±0.03 SE) (Figure 2). Re-encounters of individuals averaged 8.5 (±1.67 SE) times during the season, although most commonly individuals were only photographed once (min=1, max= 58).

The discovery curve of cumulative individual dolphins seen throughout the season shows a decline in the number of new individuals photographed as the season progresses, resulting in no new individuals photographed in September (Figure 3).

Figure 4 shows the location of all dolphin groups in New Quay bay during the season, as well as those present during an encounter. This includes those that are beyond the range of our camera equipment and therefore too far away to obtain useable photographs. For example, the majority of dolphin groups concentrated in zone three were not photographed successfully, even when they were present at the time of an encounter, as this zone is beyond the range of the camera.
The majority of encounters were photographed close to the harbour wall or inshore by New Quay headland (Figure 4), as shown by the concentration of encounters in those areas.

Figure 4. Map of all dolphin groups in New Quay Bay as recorded by Dolphin Watch and all dolphin groups in New Quay Bay during photo-ID encounters.

Dolphins were seen engaging in foraging behaviours (49%) significantly more often than other behaviour categories ($\chi^2$ d.f. = 12, $P < 0.001$; Figure 5).

Figure 5. Proportion of behaviour categories recorded during encounters.
Adults, juveniles and calves

Photographing individuals we encountered through ShoreFin allowed us to identify the life stage of individuals and therefore information on the structure of a proportion of the population of dolphins using New Quay Bay.

![Circle chart showing 56% adults, 32% juveniles, and 12% calves.]

**Figure 6. Percentage of adult, juvenile and bottlenose dolphin calves identified by ShoreFin from land.**

As seen in Figure 6, by analysing the photographs of the dolphins we were able to ascertain that the majority of individuals photographed that visited the bay were adults. A total of 33 adults (56%) were identified in the New Quay bay area over the season. Adults were easier to identify as they tended to have more distinctive fins and markings. Juveniles are paler in colour and tended to have ‘cleaner’ fins with fewer permanent markings. We identified 19 juveniles (32%) over the season. Seven calves were identified (12%) in the New Quay bay area, these were much smaller in size with paler colouring and foetal folds still visible. Calves were identified under the assumption that they were offspring of an associated female, whilst some became more identifiable as individuals from superficial scarring gained over the season.

![Bar chart showing number of dolphin encounters by month for adults, juveniles, and calves.]

**Figure 7. Number of bottlenose dolphin adult, juvenile and calf encounters over the season.**

Adults were the most regularly identified individuals with particularly high frequencies in June, July and August. Calves were increasingly present throughout the season with most encounters in August. Juvenile presence remained fairly low throughout the season.
Mothers and Calves

All photos © CBMWC
One of the most prominent and interesting observations of the ShoreFin project were the number of mother and calf pairings that were photographed using the area and how regularly we saw them. Over the season there were a number of mothers and their calves that would, at times, be present on an almost daily basis. The high use of the bay throughout the season suggests that it is a favoured area for mothers and their young. Between April and September we have witnessed seven mother and calf pairings that have used the bay regularly including one newborn calf born between July and August. The mother (014) was photographed in the bay in late May, she was then photographed again in mid-August with a calf (699). This pair was seen frequently together over the coming months foraging and travelling across the bay.

Amongst the mother and calf pairings, the most regularly encountered dolphins are shown in Figure 8. Figure 8 shows the number of photographic encounters in the New Quay bay area over the season of three mother and calf pairings. Connie (004) and calf (673), Nick (015) and calf (220) and our newly named Jacky (376) and calf (657). Their presence has varied over the season but were most frequently sighted during the height of summer (June-August). The pairings would frequently be seen alone and occasionally as part of larger groups. Social behaviours of calves includes interacting with seaweed, rolling on the surface, body slapping and leaping. Mothers particularly dolphin 376 and 004 would forage with their calves in very shallow waters off the harbour, travelling through the boat moorings to reach waters off Penpolion (the old harbour wall). The number of visits to New Quay and the repeated behaviour indicates that these mothers favour the shallow waters of New Quay as an area where their calves are safe to be social and to learn to forage. The area may provide a nursery ground for their young, offering protection that places offshore cannot. Further research into behaviours of individuals in the area will hopefully provide additional evidence in support of this theory.

**Figure 8.** Encounter frequencies of three mother and calf pairs in New Quay Bay
Prey Species

Figure 9. Prey species A- Mackerel; B- Gadoid sp.; C- Salmonid sp.; D- Salmonid sp.; E- Mullet; F- Mullet; G- Salmonid sp.
Bottlenose dolphins have a diverse diet and will feed on a variety of fish species. With the help of experts at Natural Resources Wales (NRW), we were able to identify some of the prey species that the bottlenose dolphins were feeding on in the New Quay bay area. A additional aspect of this land-based photo-ID is that we were able to photograph dolphins chasing and catching prey. This gives a much more ‘real time’ look into the diet of a dolphin. Most commonly diet analysis is conducted on stomach content examination in stranded individuals. By photographing dolphins foraging in the area, we have managed to capture some of the fish species that the dolphins have been feeding on over the season providing us with information on the species of prey available in the area. Figure 9 provides a selection of some of the photographs of dolphin prey species that we have been able to capture. The species identified include:

- **Mackerel** – Reaches up to 40cm in length and have characteristic vertical stripes along the back. These fish live in pelagic shoals coming inshore through the summer and autumn.
- **Gadoid sp.** – a benthopelagic species, cod live mainly on soft substrates from shallow waters to 600m. They can reach 1 metre in length and are an apex predator in some marine food chains.
- **Salmonid sp.** – Includes the salmon and sea trout, these fish spawn in freshwater but spend the majority of their lives in coastal waters and the open sea, returning only to rivers for reproduction. They can reach over 1 metre in length.
- **Mullet** – a shoaling fish found in coastal waters. They can reach 75cm in length.

The topographical features of New Quay appear to make this an ideal habitat for these coastal dwelling species. The shallow waters of the harbour, soft substrate and the sheltered Llanina reef provide them with the feeding/breeding grounds they require and in turn, this has provided the bottlenose dolphins with an ideal feeding ground. During the season, ShoreFin regularly witnessed foraging behaviour from a number of dolphins and witnessed some extraordinary predatory chase behaviours, with a number of dolphins chasing fish in the very shallow waters of the harbour during low tides. The behaviours witnessed and the variety of fish species present suggests New Quay is a favoured feeding ground for dolphins from the Cardigan Bay population.
Case Study 1

CBMWC CATALOGUE NAME: 036-05W5
Nickname: None
Gender: Probable Male
Number of encounters this season: 37

Figure 10. Map displaying the photographic encounters of dolphin 036 over the field season.
This individual has been a regular to the shores of New Quay since the beginning of the ShoreFin project and has been photographed a total of 37 times throughout the season (Figure 10). Dolphin 036 is easily distinguished by the two notches found on the dorsal fin as well as the scarring across the top of both left and right sides. First photographed in April with encounters steadily increasing to a peak (14) in July alone. Encounters with 036 then decreased with no photo-id encounters of the individual in September (Figure 11). 036 was frequently seen close to the harbour wall in New Quay (Figure 10). Most photographic encounters occurred in zone 5 (Figure 10) which was an optimal location for taking the highest grade of photos however, due to the distinctiveness of 036’s dorsal fin, we have been able to photograph and identify the individual at much further distances in zones 1 and 3.

036 was quite frequently sighted with other adults in groups travelling through New Quay but also seen alone. The probable male displayed a variety of behaviours but was most commonly foraging or travelling. On a few occurrences behaviours such as leaping and body slapping were witnessed, along with other individuals including 007. During the 2014 season, 036 was identified, from a boat-based photo-ID encounter, as a dolphin involved in an attack on a harbour porpoise. Overall this individual has shown a great presence in New Quay and exhibited a number of different behaviours. Through the use of photo-ID we have managed to gain a better understanding of particular characteristics of dolphin 036.

Figure 11. Number of encounters with dolphin 036 over the field season

© CBMWC
Case Study 2

CBMWC CATALOGUE NAME: 007-05W3
Nickname: 007
Gender: Probable Male
Number of encounters this season: 65

Figure 12. Map displaying the photographic encounters of dolphin 007 over the field season
Easily identified by the three distinctive nicks on the dorsal fin, this probable male is one of the most commonly photographed dolphins encountered this season. He has been photographed a total of 56 times by the ShoreFin project alone and has been photographed at least twice a month over the entire season. 007 became such a frequent visitor over the summer he was photographed 21 times in July alone (Figure 13). 007 was regularly encountered very close in to the harbour wall, being photographed close into the bay in zones 5 & 6 (Figure 12). His distinctive fin has also allowed him to be photographed at further distances in zone 3 and has also been captured regularly from the headland by the fish factory foraging. His presence has almost been predictable with him showing up regularly to forage off the end of the harbour wall many mornings. He was mostly photographed as a single animal and came across as quite a solitary individual throughout the project, venturing into New Quay to forage for what could be hours. However, his behaviour changed when in a group travelling and was photographed leaping and socialising with others off the headland. 007, like 036 was identified as a dolphin involved in an attack on a harbour porpoise further down the coast during a boat-based photo-ID survey.
Case Study 3

CBMWC CATALOGUE NAME: 015-05W3
Nickname: Nick
Gender: Female
Number of encounters this season: 47

Figure 14. Map displaying the photographic encounters of dolphin 015 over the field season
Nick, dolphin 015 is identified by the three distinctive nicks on her dorsal fin. She is a mother to dolphin 220 who has also been present in New Quay regularly over the season. 220 is one of the older calves documented this year and will forage independently from its mother. Nick has been photographed 47 times by ShoreFin this season, she was in the area most often through June to August, with 21 encounters in July alone. After July, she was sighted less often and was only photographed once in September (Figure 15). Nick has been photographed frequently feeding and foraging around the harbour wall with her calf and was quite often travelling into New Quay in larger groups of 5-6 individuals. As seen in Figure 14, she was present most often around the end of the harbour wall in zone 5 & 6 but has also been photographed from the headland foraging regularly in zone 2 (Figure 14). Figure 14 shows Nick to have been sighted at the three feeding hotspots in the bay, her high presence during the month of July suggests prey species were in abundance, resulting in her regular return to the area to forage. Amongst her feeding behaviours in the area, Nick was also associated to an event over the summer where a porpoise tried to strand itself due to what looked to have been distress caused by bottlenose dolphins in zone 5.
Case Study 4

CBMWC CATALOGUE NAME: 376-11 & 657-13
Nickname: Jacky and calf
Gender: Female and unknown
Number of encounters this season: 83

Figure 16. Map displaying the photographic encounters of dolphins 376 & 657 over the field season.
Jacky and her calf were ShoreFin’s most commonly encountered dolphins this season. Photographed 87 times, this mother and calf pairing were present from April to October. Jacky, dolphin 376, is identified by the scarring and tooth-rake marks found both on the left and right side of her dorsal fin. Her calf has been identified over the season mainly from tooth-rake marks and scarring gained over the season. Mother and calf were photographed most frequently, 17 times, during June (Figure 17). This pair were frequently photographed close in to the harbour wall and were regularly photographed very close in the bay in zone 6 (Figure 16). The mother and calf pairing were the only two most regularly foraging in zone 6, others would not venture so far inshore as these two did (Figure 16). They were, on occasions, found foraging in the public swimming area off the beach. They were also frequently photographed travelling between the cardinal buoy in zone 3 to the harbour wall and out towards the headland in zone 2 (Figure 16). The two individuals were seen foraging regularly by the end of the harbour wall and also much further into the bay in shallow waters where Jacky has been photographed catching large salmon amongst other prey species. Throughout the project the calf has been observed, appearing to become more independent, venturing further from its mother, foraging by itself, socialising with others or being independent. The project has provided us with the opportunity to gain a more in-depth insight into mother and calf interactions and behaviours, observing changes over time that boat-based surveys may not be able to document so well.
Discussion

Summary of Results

The Cardigan Bay population is estimated to have 213-250 well marked individuals. The 59 individuals identified by the ShoreFin project suggest that approximately 24-28% of the population use New Quay bay at some point during the year (April to October).

As part of Dolphin Watch, dolphin groups in the bay were recorded every 15 minutes as new sightings. This season we hadn’t developed a means of differentiating between new and existing dolphin groups in the bay, therefore the sightings and dolphin group numbers are much higher than the actual number of individual dolphin groups. However, based on these numbers, the ShoreFin project successfully photographed 36% of the dolphin groups recorded in New Quay bay. The New Quay bay survey area is a large area, 4.9 km² (Pierpoint et al. 2009); a high number of the groups of dolphins recorded in the bay were located around the north cardinal marker or offshore, which is just beyond the range of our camera equipment to obtain photographs suitable for photo-identification purposes.

The initial reason for implementing a dedicated land based photo-ID project was to enable us to obtain photo-ID images of the dolphins that visit the New Quay bay area. New Quay bay is a hotspot area for bottlenose dolphins however, we are restricted in our ability to obtain photo-identification images from our boat surveys in this area due to its popularity with tourists, other charter boat operations, our support of the local codes of conduct and protocols associated with our photo-identification licence. As expected a greater number of dolphin groups were photographed by the ShoreFin project than were obtained opportunistically (i.e. when the dolphins approached the boat) during boat surveys. This helps validate the methods used and highlights the efforts undertaken as part of this project; as well as recognising the future opportunities available as part of this project and thus supports its continuation as a long-term monitoring project.

Dolphins allocated a high percentage of their time in New Quay Bay to foraging and potentially feeding, supporting claims that New Quay Bay is an important location for dolphins, rather than simply a migration corridor along the Welsh coast. In addition, dolphins spent a proportionate amount of time socialising in the bay, marking it as important for a variety of life history stages.

We have photographic evidence of dolphins feeding in the New Quay bay area. The prey species identified with help from Natural Resources Wales (NRW) and the ShoreFin project data provides us with an opportunity to explore Cardigan Bay dolphin dietary information in a non-invasive way and will fill a noticeable data gap in relation to dolphin diet. The varied species identified included salmon, mullet, cod, mackerel and sewin (sea trout). We have plans to expand on this research and data collection in the future.

Some of the most interesting aspects of the project were the ability to study individual animals in detail. Frequent visitors to the area such as dolphins 007 and 036 have been observed exhibiting a variety of behaviours over the season and it provides the opportunity to study these animals behavioural characteristics and life histories. Research into dolphin
behaviours should be undertaken as a project run in parallel to ShoreFin and would provide a more in-depth look at the behaviours and site usage of particular individuals that are using New Quay.

ShoreFin provided further evidence of the frequent use of New Quay bay by mothers and calves. The documented use of the area by seven mothers and calf pairings this season has provided an ideal opportunity to observe the mother and calf relationship. The area is believed to be favoured by these mothers for its sheltered shallow waters.

**Plans for the Future**

This season field notes were created after photo encounters in the field were completed. This may have led to the loss of some detail of the encounters, particularly for those that lasted for longer periods of time when there were a high number of dolphins or they were exhibiting interesting behaviours worth photographing. The use of bespoke encounter forms, to be taken into the field and filled in on site will allow photographers to write notes as they go and therefore maintain a more detailed account of the ShoreFin encounter. These encounter forms will include survey site maps to accurately record locations of encounters, separately from the regular Dolphin Watch sightings as part of CBMWC’s land-based surveys. This will provide us with more precise information on the range of the camera and the project abilities.

The data taken on the number of dolphin groups in New Quay Bay by the Dolphin Watch program is not an accurate accounting of distinct or new dolphin groups in the Bay at any given time, they recount sightings of dolphins every 15 minutes. New methodology for keeping an accurate count of dolphins in the bay during the season will allow us a more accurate measure of successful photography encounters.

A catalogue of individuals photographed as part of the ShoreFin project means as the project progresses we should gain a more comprehensive idea of population numbers and composition using New Quay bay.

The presence of CBMWC researchers photographing dolphins was of clear interest to visitors and locals this season. The general public were keen to ask questions about individual dolphins, the identifying process and the background of the project and to find out more about the dolphin population in Cardigan Bay. The ShoreFin project helped raise awareness of the CBMWC and the variety of work we carry out in the local area; we hope to increase the awareness of our work through this project in the future. Further development of the use of social media sites such as Facebook and Twitter, provide an ideal opportunity and way of keeping the public updated on the progress of the project, information on new mothers and calves, the presence of familiar fins (regularly photographed individuals) in the bay will all keep the public engaged and interested in the local wildlife and help to promote conservation efforts. CBMWC has an existing dolphin adoption program in place, and the ShoreFin Project has helped to maintain an updated account of the presence of the adoptable dolphins in the bay.
Concluding Statements

The designation and monitoring of marine protected areas (MPAs) rely on up to date, accurate, scientific information. This project emphasises the importance of the New Quay bay area to bottlenose dolphins and provides evidence for the need to continue local conservation efforts. Its important that we further our knowledge and understanding of the Cardigan Bay population of bottlenose dolphins, their relationship with and use of the marine ecosystem which they inhabit.

Acknowledgements

We would like to thank the staff, the volunteers and work experience students of Cardigan Bay Marine Wildlife Centre (in no particular order):
Laura Mears (staff), Heather Payton, Sue Davies, Barry Davies, Sue Evitts, Lindsay Probert, Sarah Williams, Gary Hartley, Neil Buckland, Sam Morys, Sam Ryan, Zoe Temple, Ffion Lloyd, Daisy Hunt, Mollie Cook, Gill Oram, Anne Bateman, Ben Schoonman, Kate Blake, Abigail Mabey, Alexander Bolland, Chris Lickley, Josephine Potter, Lea Klein, Megan Rush, Rebecca Lyal, Hannah Meulman, Sarah Thomas, Ashleigh O’Conner, Molly Rivers, Katherine Jones, Sophie Farenden, Sarah Purdon, Will Hutchinson, Emma Robson, Cheryl McAndrew, Olivia Lovegrove, Samantha Kerr, Abigail Melville, Fiona Riley, Angus Paget, Gerri Murphy, Gemma Haggar, Oliver Sowler, Natasha Massey, Dylan Langley.

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Thank you also to Natural Resources Wales for providing assistance with prey species analysis and to Simon Tune for providing advice with purchasing and using the camera equipment.

Funding for equipment and training for this project was provided by Environment Wales and Natural Resources Wales.
References


Appendices

Appendix A – Encounter form for 2015 Season

SHOREFIN LAND ENCOUNTER FORM

Date ____________________ Location ____________________ HW H Other ____________________

Start Time ____________________ End Time ____________________

Cloud Cover (0-8) ____________________ Sea State (0-9) ____________________

Visibility (km) (<5, 5-7, 7-10, >10) ____________________ Wind (mph) ____________________

General weather ____________________

High Tide ____________________ Low Tide ____________________

Behaviours

☐ Resting ☐ Milling ☐ Long Dives ☐ Travel, regular surfacing

☐ Travel, long dives ☐ Feeding ☐ Playing (w/ seaweed, jellyfish, etc.) ☐ Leaping

☐ Socializing ☐ Fast Travel ☐ Bow-riding ☐ Tight Group ☐ Tail Slap

Notes ____________________

Total No Animals ___________ Adults ___________ Juvenile ___________ Calf ___________ New-born ___________

Total No photographed ___________ Adults ___________ Juvenile ___________ Calf ___________ New-born ___________

Photo No. Start ___________ Photo No. End ___________

Encounter Locations

[Diagram of location areas]
Appendix B – Protocol for Dolphin Watch program

Dolphin Watch Project – CBMWC Land based data collection in New Quay bay
Data collection methodology

These surveys were primarily designed to monitor bottlenose dolphin site usage and investigate potential anthropogenic impacts on dolphins, including boating activity at each site. Training sessions were conducted by Sarah Perry (CBMWC Science officer) for all new volunteer researchers taking part in these surveys and additional support and feedback were provided in the field by more experienced observers.

The method used was to scan each area with a combination of the naked eye and low powered binoculars for 2 hour observation periods. Each 2 hour watch was divided into eight successive 15 minute intervals. Environmental information including sea state which was recorded using the Beaufort scale, visibility, general weather conditions and wind direction were recorded at the start of each 15 minute interval. A simple map of the survey area was used to record the location, size and activity of each marine mammal sighting at the beginning of each 15 minute interval or when the animal was first seen. Position estimation on the map was aided by map guidelines, including known distances to prominent coastal features and to marker buoys. Groups of animals were defined as animals in close proximity, within ten body lengths. For cetaceans the number of calves present was recorded: calves were defined as juvenile animals less than or approximately 2/3 adult length, closely accompanied by an adult. An activity code is then allocated to each group that best summarised the animals’ behaviour observed.

Further detailed information on methods for these surveys can be found in Pierpoint et al (2009).
## Appendix C – Bottlenose dolphins identified by Shorefin 2014

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Appendix D - Grading Criteria for Photographs

1. Is the picture in focus?
   - Yes → Grade 1
   - No → No

2. Is fin height at least 1 cm?
   - Yes → Grade 2
   - No → No

3. Is entire fin in frame?
   - Yes → Grade 3.1
   - No → No

4. Is fin perpendicular?
   - Yes → Grade 3.2
   - No → No

5. Dull light?
   - Yes → Grade 3.3
   - No → No

6. Backlit/Silhouette?
   - Yes → Grade 4
   - No → No

7. Bright light, clear image?
   - Yes → Grade 5
   - No → No