Dolphin Watch:

Bottlenose Dolphins and Boat Traffic

on the Ceredigion Coast, West Wales

2017

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Contents

Introduction

In 1994, when the Dolphin Watch study first began, the aim was to obtain further information on the relationship between cetacean site use and boat traffic; this data would then help to guide future management of the then recently designated voluntary Marine Heritage Coast (MHC). Dolphin Watch was established in response to a community led initiative which raised concerns that perceived increases in powered craft activity may have potential adverse effects on the local bottlenose dolphin population. The project was designed with the aim of encouraging local people to participate in monitoring the dolphins, to both build support for the MHC and to raise public awareness of the issue of boat disturbance.

In 1996 an area in the south of Cardigan Bay was put forward as a candidate Special Area of Conservation (cSAC) under the EU Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, 1992) because of its importance for the bottlenose dolphin population in Cardigan Bay.

In 2004 the Cardigan Bay Special Area of Conservation (SAC) was officially designated as an SAC. Stretching from Ceibwr Bay in Pembrokeshire to Aberarth in Ceredigion and extending almost 20km from the coast, Cardigan Bay Special Area of Conservation (SAC) protects the wildlife found in around 1000km^2 of sea. Cardigan Bay SAC forms part of a network of protected sites known as the Natura 2000 (N2K) network.

Dolphin Watch has now completed twenty four years of data collection. This is our tenth Dolphin Watch survey report (Pierpoint and Allan 2000, 2001; 2002; 2004; 2006; Allan et al 2010; Sampson et al 2015, Perry 2016, Heath and Vaughan 2019). A peer reviewed paper has also been published Pierpoint, C., Allan, L., Arnold, H., Evans, P., Perry S., Wilberforce, L and Baxter, J. (2009*)* Monitoring important coastal sites for bottlenose dolphin in Cardigan Bay, *Journal of the Marine Biological Association of the United Kingdom*. 89 (5): 1033-1043).

The key aims of the project are:

- To monitor the presence of bottlenose dolphins to improve our understanding of bottlenose dolphin site usage and to monitor trends in dolphin occurrence
- To monitor levels of boat traffic to aid coastal zone management and to assess the effectiveness of the local codes of conduct
- To Investigate interactions between bottlenose dolphins and boats
- To increase public awareness and appreciation of the marine wildlife in Cardigan Bay

Method

Bottlenose dolphin monitoring was completed at six study sites in Cardigan Bay, West Wales. The data was collected by a team of volunteers, some of whom had already taken part in the project in previous years, but also working alongside volunteers new to the project. The study sites were located at Mwnt, Aberporth, Llangrannog, New Quay Bird's Rock, New Quay Harbour and Aberystwyth.
Records from New Quay Harbour were collected and contributed to the database by the Wildlife Trust of South and West Wales Living Seas' staff and volunteers from the Cardigan Bay Marine Wildlife Centre (CBMWC).

This year's report covers field data collected from 1st March to 31st October 2017, as in the 2016 Dolphin Watch report. The data from March to October was analysed in order to include the full length of the field season covered by volunteers at many of the sites, and to ensure that sufficient data collected in suitable conditions (visibility at least 2 km, sea state 3 or less) was available for analysis.

Site use by bottlenose dolphins

Watches of two hours each were scheduled with set start times of 09:00, 11:00, 13:00, 15:00, 17:00 and 19:00. At New Quay Harbour, The Wildlife Trust of South and West Wales Living Seas' staff and volunteers from the Cardigan Bay Marine Wildlife Centre carried out additional watches throughout the field season at 07:00.
The two hour watches were divided into eight 15 minute intervals. At the beginning of each interval the start time and information on sighting conditions (general weather and visibility, wind direction and sea state) were recorded on a data sheet. This information was later used to extract a subset of observations made in good conditions (visibility at least 2 km, sea state 3 or less) for which sighting rates of bottlenose dolphins were calculated and comparisons made between study sites.

Dolphin Watch volunteers received training at the start of the season to address any misconceptions and to update survey skills and data collection methodology. Volunteers were provided with a range of keys, guidance notes and a comprehensive photographic guide detailing cetacean behaviours that may be observed.

When marine mammals were present at the site their locations were marked on a map. Locations were estimated by eye within a grid of guidelines to landmarks. A group of bottlenose dolphins was considered to be animals in close proximity (within about ten body lengths of another animal) and behaving in a similar manner. Abbreviated codes were written against each individual animal or group location giving species name, group size, number of calves and behaviour at the beginning of the fifteen minute interval or when first seen.

From these systematic counts sighting rates for bottlenose dolphins were derived. Two indices were used to make comparisons between sites and with previous field seasons. These indices were:

a) The proportion of two hour watches in which dolphins were recorded

b) The average count of dolphins in a fifteen minute interval per two hour observation period.

For those watches in which dolphins were recorded at least once, three further indices were calculated:

c) Group size: as a measure of the average group size or number of dolphins aggregated at each site, the mean of the highest count recorded in each watch was used. The total number of dolphins seen in each two hours was not estimated, as we cannot determine this from the data collected. The aim of the study is not to identify individual animals; therefore we are unable to establish whether the same animal/s moved through the site more than once in a watch.

d) Occurrence of young bottlenose dolphins (juveniles or calves): bottlenose dolphins were recorded as calves if they were distinctly paler than the accompanying adult and approximately two-thirds of the adult length or less. Foetal folds may also still be visible.

e) Site occupancy: to examine the amount of time that dolphins tended to occupy sites, the average number of fifteen minute intervals with bottlenose dolphins present per watch was calculated for watches in which dolphins were recorded at least once.

Encounters between bottlenose dolphins and boats

Additional information was recorded on the data sheet when a vessel/s came within 300 metres of a group of bottlenose dolphins. This was classed as a 'boat encounter'.

Only the first boat encounter in each fifteen minute interval was recorded. This reduced the likelihood of bias towards particular types of boat that observers may have considered to have a greater impact on dolphin behaviour.

For each 'boat encounter' the observer recorded the type of boat that was closest to a dolphin/group; the total number of vessels within a 300 metre radius of an individual dolphin/group, compliance/non-compliance with the Ceredigion Water Users Marine Code of Conduct and all the dolphin behaviours that were observed.

Boat operators were considered to have complied with the code of conduct if they either passed the animals at 'no-wake' speed and with no erratic alterations of course (code Y1) or slowed down gradually and stopped (Y2). Four codes were used when operators did not comply and these were either because they were travelling too fast within 300 metres of dolphins (N1); they followed an erratic course to approach, avoid or follow dolphins (N2); they attempted to touch, feed or swim with dolphins (N3), or they were clearly exceeding 8 knots within a buoyed, low speed zone at New Quay (N4). A code (R) was used when the boat involved was a vessel permitted under licence from Natural Resources Wales to approach bottlenose dolphins for research purposes. These vessels carry a flag that they must fly when they are invoking their licence.

We then examined whether compliance or non-compliance with the Ceredigion Marine Codes of Conduct affected the dolphins' behaviour and how the dolphins responded to encounters with boats. Observers recorded dolphin behaviour for each fifteen minute interval throughout the two hour observation period and the dolphins' behavioural responses during encounters.

Results

Observer effort

During 2017 a total of 1258 observation periods (watches) were carried out between March and October (Table 1). Since the first season's field work in 1994 a total of 13,888 watches have been completed.

When the project began observations were carried out at three sites; Aberporth, New Quay Bird's Rock and Ynys Lochtyn. Watches at Ynys Lochtyn have not taken place in recent years; however during 2017 some watches were completed at Ynys Lochtyn by the Cardigan Bay Special Area of Conservation officer. Mwnt has also been included since 1998; New Quay Harbour and Aberystwyth were added to the site list in 2004. The New Quay Harbour data is contributed to the database by The Wildlife Trust of South and West Wales. This data is collected by Living Seas' staff and volunteers based at the Cardigan Bay Marine Wildlife Centre, following the same survey protocols but surveys are conducted over the full calendar year.

Table 1: Observation period (watch) totals in the period 1st March – 31st October 2017

	All sites	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
No of watches	1258	34	14	6	71	1108	25
Hours of effort	2516	68	28	12	142	2216	50

Survey conditions

Between 1st March and the 31st October 2017, 1105 watches, 2210 hours of effort were completed in good conditions for observing marine mammals (Table 2). Watches conducted when conditions were not suitable were removed from the dataset. Only watches where data was available for the full two hour survey (eight successive fifteen minute intervals) conducted in Beaufort sea state 3 or less and where visibility was greater than 2 km were used for further analysis (Figures 1 & 2).

Table 2: Number of watches conducted in good conditions (used for further analysis)

	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
Number of watches in good conditions	33	13	6	65	963	25
Hours of effort in good conditions	66	26	12	130	1926	50

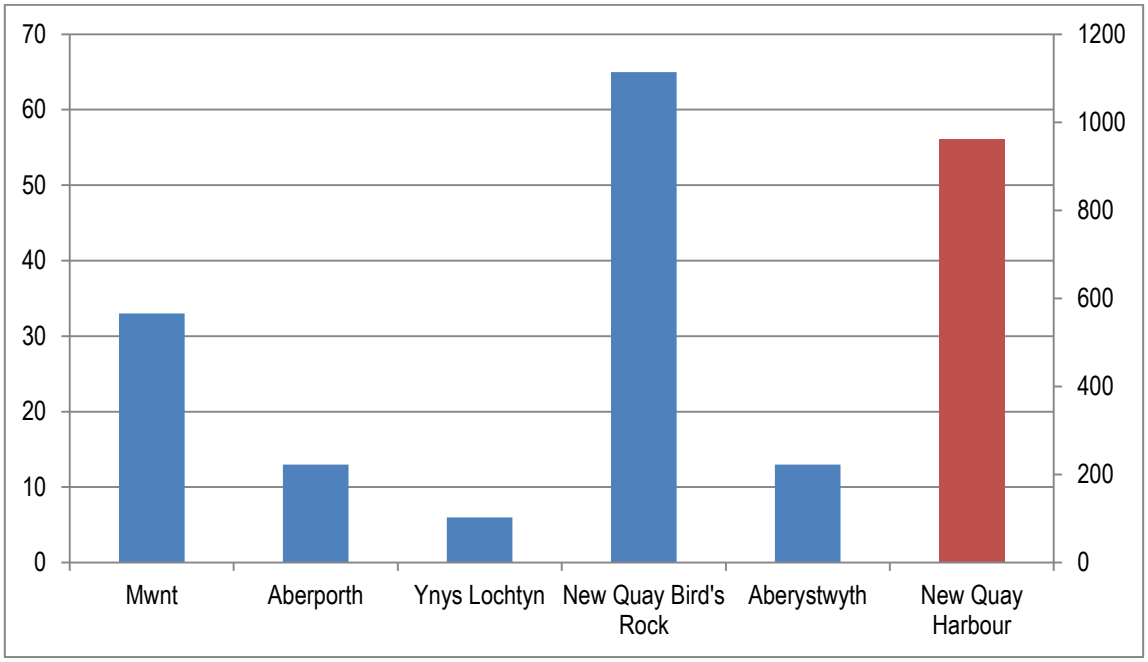


Figure 1: Number of watches conducted in good weather at Dolphin Watch monitoring sites
N.B. New Quay Harbour watches are conducted every day throughout the season from 7am to 7pm by Living Seas' staff and volunteers based at the CBMWC. Therefore the number of watches at this site is much higher at 963.

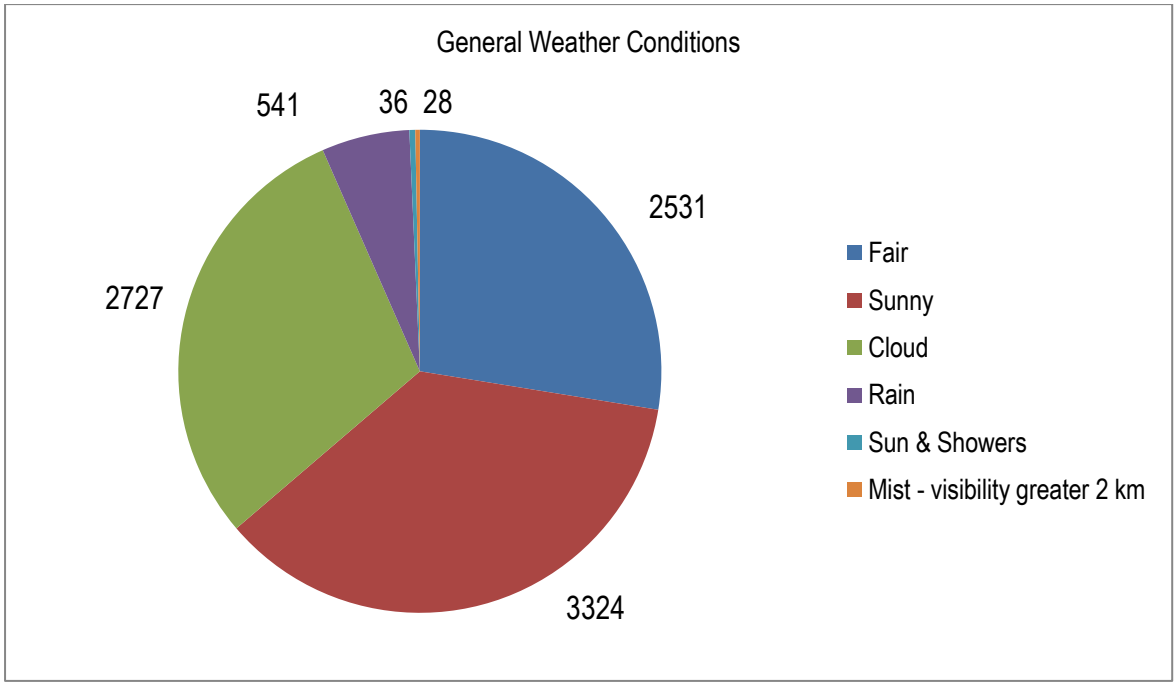


Figure 2: Weather conditions (number of intervals)

The median sea state recorded across all sites was sea state 2 (wavelets; glassy crests do not break). The median sea state for individual sites was also sea state 2 with the exception of Aberystwyth where the median sea state was 1 (calm, rippled surface).

The wind directions that were the most frequently recorded were south-westerly, westerly, north-westerly and southerly over all sites (Table 3 & Figure 3).

Table 3: Prevailing wind during watches

	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
Wind direction	W	S	SW	SW	SW	SW

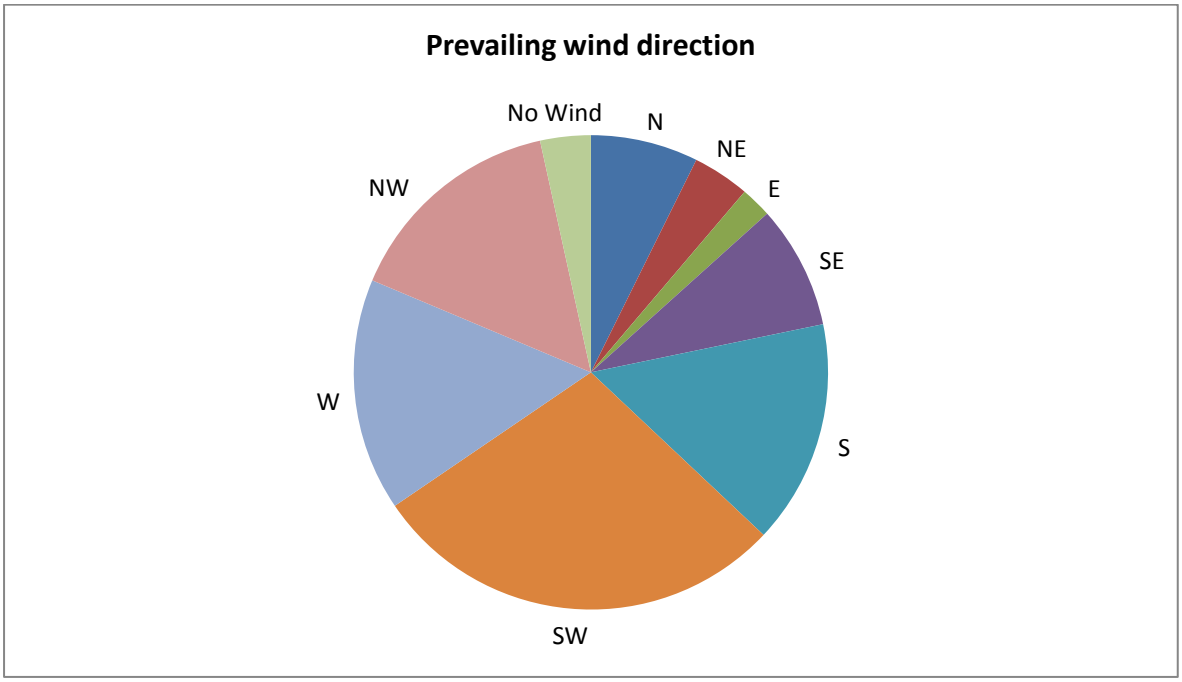


Figure 3: Prevailing wind – frequency of wind direction recorded during all surveys 2017

Sightings rates

Sightings rates for bottlenose dolphins were calculated from 1105 watches. These were watches with eight intervals recorded in good conditions (sea state 3 or less and visibility >2km) between the beginning of March and the end of October 2017.

Table 4: Percentage of two hour watches at each site with dolphin sightings

Year	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
2017	52%	23%	83%	54%	73%	16%

Ynys Lochtyn had the highest sightings rating of all the sites, however only six watches in total were completed at this site. Sightings rates for New Quay Harbour had previously been dropping year on year since 2013; however the 2017 sightings rate of 73% is significantly higher than the 2016 figure of 58%. The sightings rate at Mwnt has decreased from 77% in 2016 to 52% in 2017. Aberporth has remained constant at 23%. New Quay Bird's Rock shows only a small fluctuation from the 2016 figure of 49% to 54% in 2017. The sightings rate in Aberystwyth has decreased significantly from 50% sightings rate in 2016 to just 16% in 2017 where a total of twenty five watches took place (Table 4 & Figure 4).
(Figures for 2016 were taken from Heath, M and Vaughan, A (2019) '*Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2016*'.)

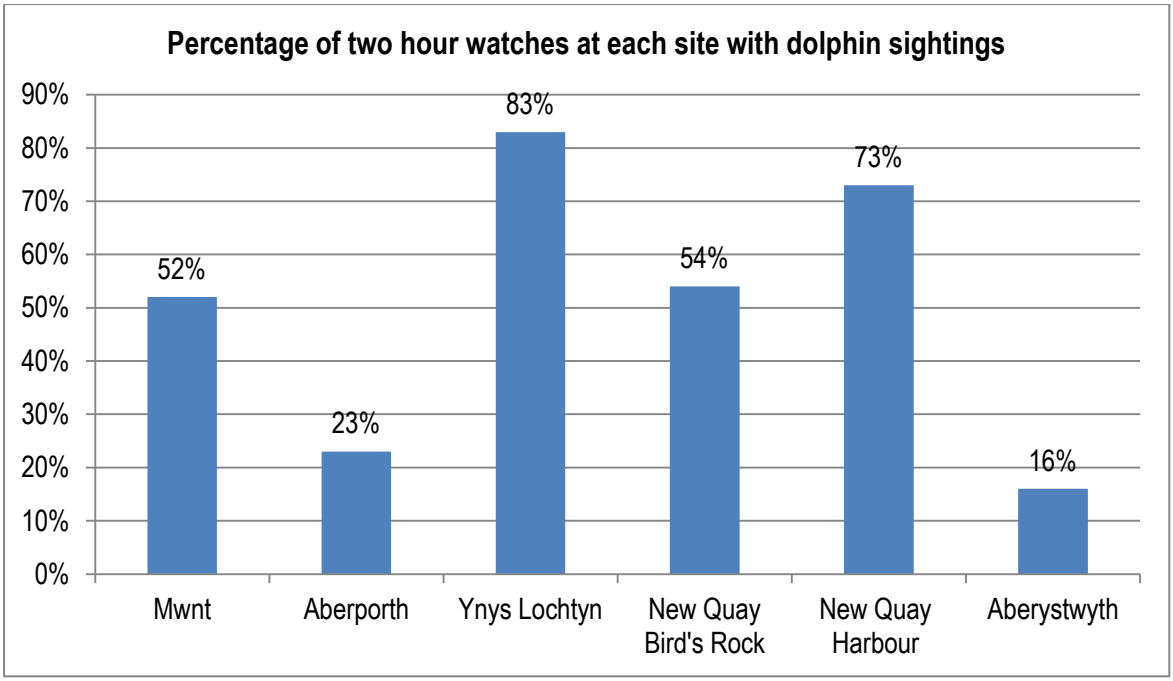


Figure 4: Sightings rates - percentage of two hour watches in which dolphins were recorded

Table 5: Mean average number of dolphins observed in a fifteen minute interval where dolphins were sighted

Year	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
2017	3.1	2.0	3.7	3	2.4	2.8
2016	3.2	1.75	No watches	3.4	3.14	1.9
2013-15	3.5	1.75		3.12	3.1	1.9

Watches at Ynys Lochtyn, Mwnt and New Quay Bird's Rock recorded the highest average number of dolphins (Table 5 & Figure 5). At Mwnt the average number of dolphins has been decreasing slightly. The mean average number of dolphins observed in a fifteen minute interval where dolphins were sighted has also decreased at New Quay Harbour from 3.1 in 2013-16 to 2.4 in 2017.
(Figures for the period 2013-15 were taken from Perry, S (2016) '*Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2013-2015'*. Figures for 2016 are taken from Heath, M and Vaughan, A (2019) *'Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2016'*.)

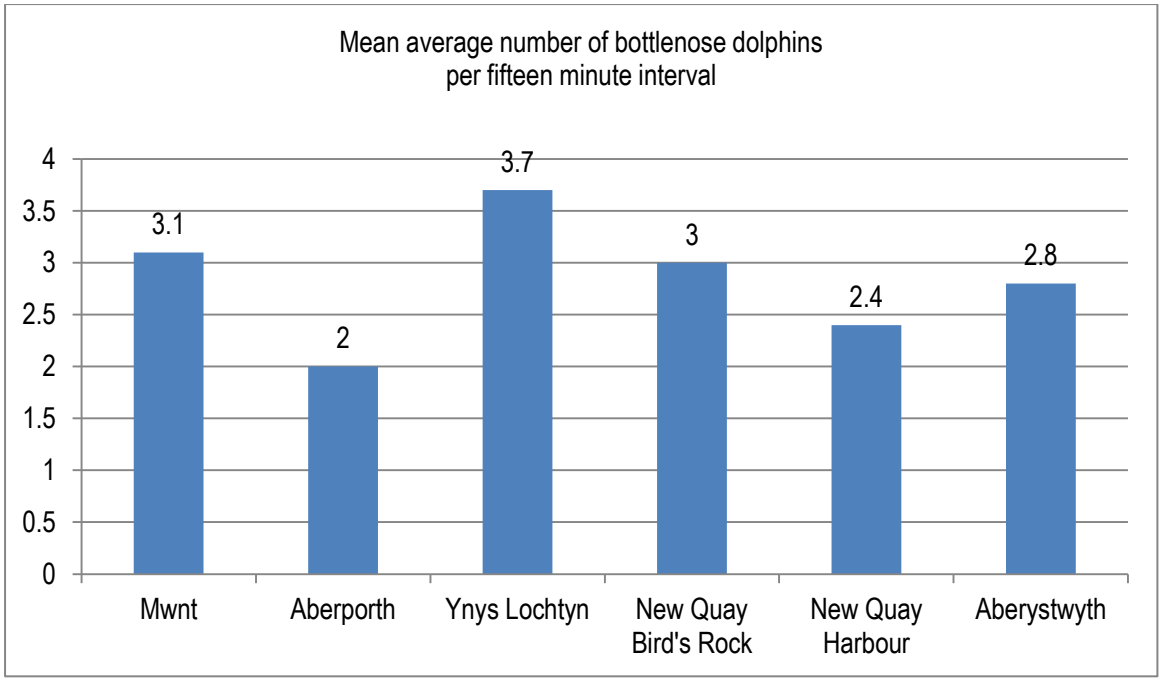


Figure 5: Mean average number of dolphins observed in a fifteen minute interval where dolphins were sighted

Group size

The mean average of the highest group size of dolphins recorded per interval in each two hour watch when sightings occurred was used as a measure of group size (Table 6 & Figure 6). Group size has decreased at Mwnt over the last four monitoring seasons from 4.3 in 2014 and 3.8 in 2015 to 3.65 in 2016 and 3.1 in 2017. The group size in New Quay Harbour and Bird's Rock has decreased slightly in 2017. Group size at Aberporth and Aberystwyth have been variable over the last four years, however at these sites far fewer watches have taken place (less than 25 during the season).
(Figures for the period 2013-15 were taken from Perry, S (2016) '*Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2013-2015'*. Figures for 2016 are taken from Heath, M and Vaughan, A (2019) *'Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2016'*.)

Table 6: Mean average of the highest group size of bottlenose dolphins recorded in each two hour watch

Year	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
2017	3.29	2*	4.6	3.51	3.7	2.75*
2016	3.65	1.67*	No watches	4.15	4.03	2.4

** Fewer than 5 watches recorded with sightings*

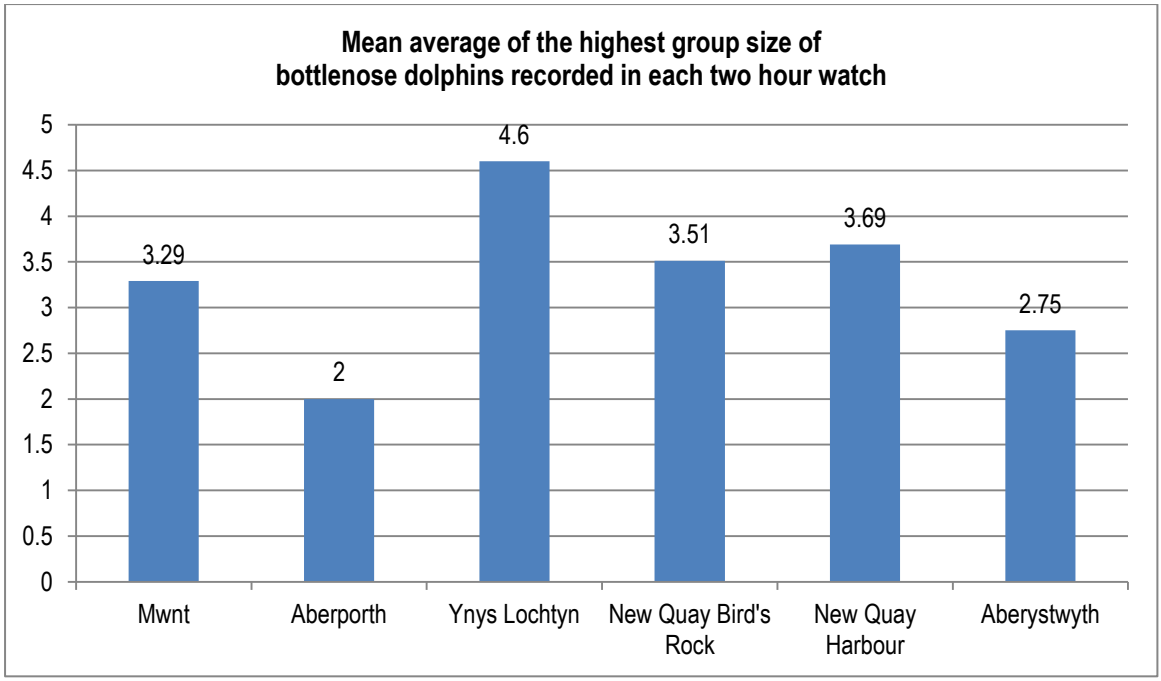


Figure 6: Mean average of the highest group size of bottlenose dolphins recorded in each two hour watch

Maximum recorded group size at each site

The maximum dolphin group size observed at each site was also recorded (Table 7 & Figure 7). The largest group sizes were observed at New Quay Harbour (12 animals) Ynys Lochtyn (9 animals) New Quay Bird's Rock (8 animals) and Mwnt (7 animals). The Mwnt, New Quay Bird's Rock and New Quay Harbour sites show consistently larger groups of animals in all years since group size was first included in the 2008 report. 2017 is the first year in a number of years that monitoring has been conducted at the Ynys Lochtyn site.

Table 7: Maximum recorded group size at each site

Year	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
2017	7	3	9	8	12	3

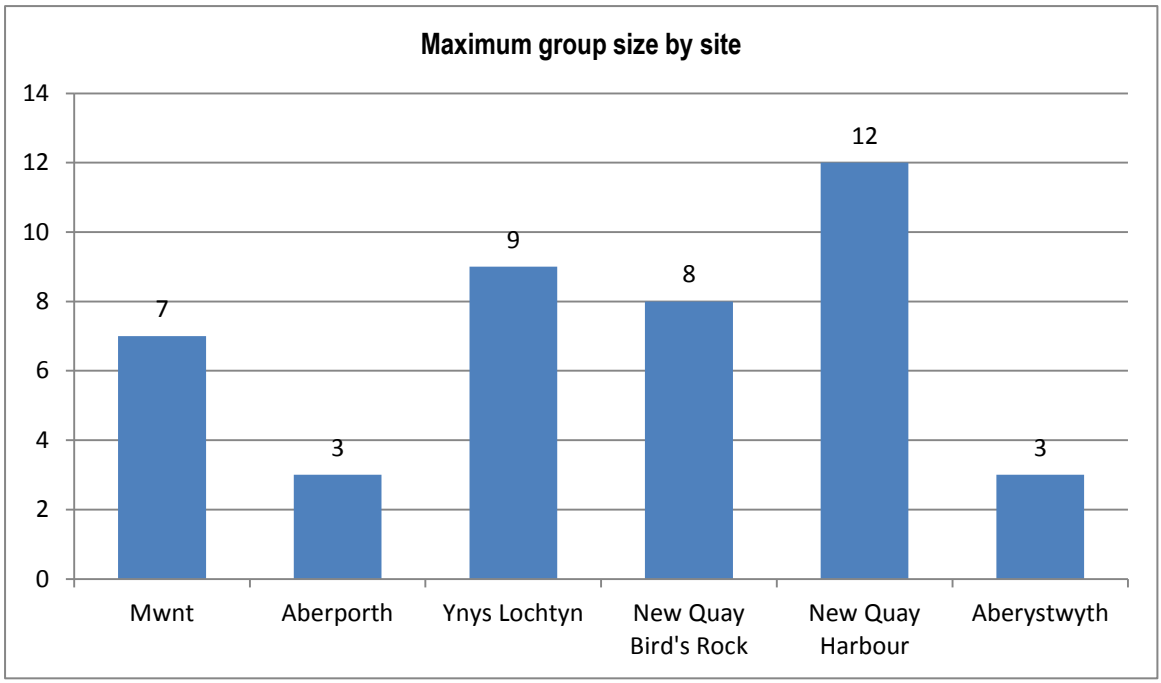


Figure 7: Maximum group size of bottlenose dolphins by site

Sightings of young bottlenose dolphins

Young dolphins were sighted at Mwnt in more than 53% of the watches during 2017; the highest percentage for any site and an increase from previous years. New Quay Harbour had a similarly high percentage, at 50% of watches with young dolphins present, consistent with previous years. No young dolphins were recorded at Aberporth or Aberystwyth in 2017. However at these sites relatively few watches take place therefore this data needs to be interpreted with caution. At Ynys Lochtyn 40% of watches were recorded where dolphins were present with young animals (Table 8).

The number of young bottlenose dolphins recorded at New Quay Bird's Rock has fluctuated widely in recent years and was down to 23% in 2017, a slight drop from the 24% recorded in 2016, but a significant drop from the 2011, 2012 and 2015 totals of 48.8%, 34.5% and 37.1% respectively (Figure 8).

(Figures for the period 2010 – 2012 were taken from Sampson, B., Green, M. and Kelsall, J (2014) *'Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2010-2012'*.
Figures for the period 2013-15 were taken from Perry, S (2016) '*Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2013-2015'*.
Figures for 2016 are taken from Heath, M and Vaughan, A (2019) *'Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2016'*.)

Table 8: Young dolphin sightings (percentage of watches when dolphins present with young animals)

Year	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
2017	53%	0%	40%	23%	50%	0%
2016	41%	33%	No watches took place	24%	50%	0%

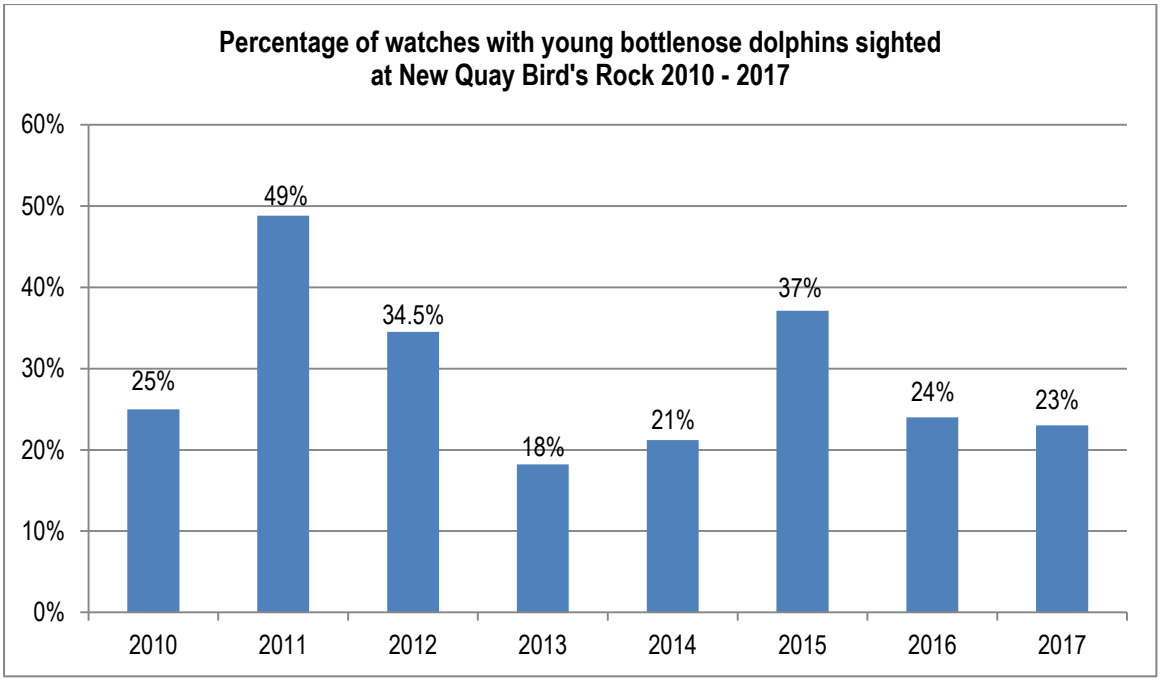


Figure 8: Percentage of watches with young bottlenose dolphins sighted at New Quay Bird's Rock 2010-2017

Site occupancy

Site occupancy is defined as the amount of time that bottlenose dolphins were present at each site. It is measured as the mean average number of fifteen minute intervals that dolphins were recorded per two hour watch.

New Quay Harbour had the highest occupancy rates, with dolphins present for more than four intervals out of eight (one hour) on average (Table 9). Site occupancy rates for all sites were consistent with previous years.

Table 9: Site occupancy (mean number of fifteen minute intervals per watch when dolphins were present)

Year	Mwnt	Aberporth	Ynys Lochtyn	New Quay Bird's Rock	New Quay Harbour	Aberystwyth
2017	3.4	1	6	3.8	5.3	2.8

Direction of travel by bottlenose dolphins

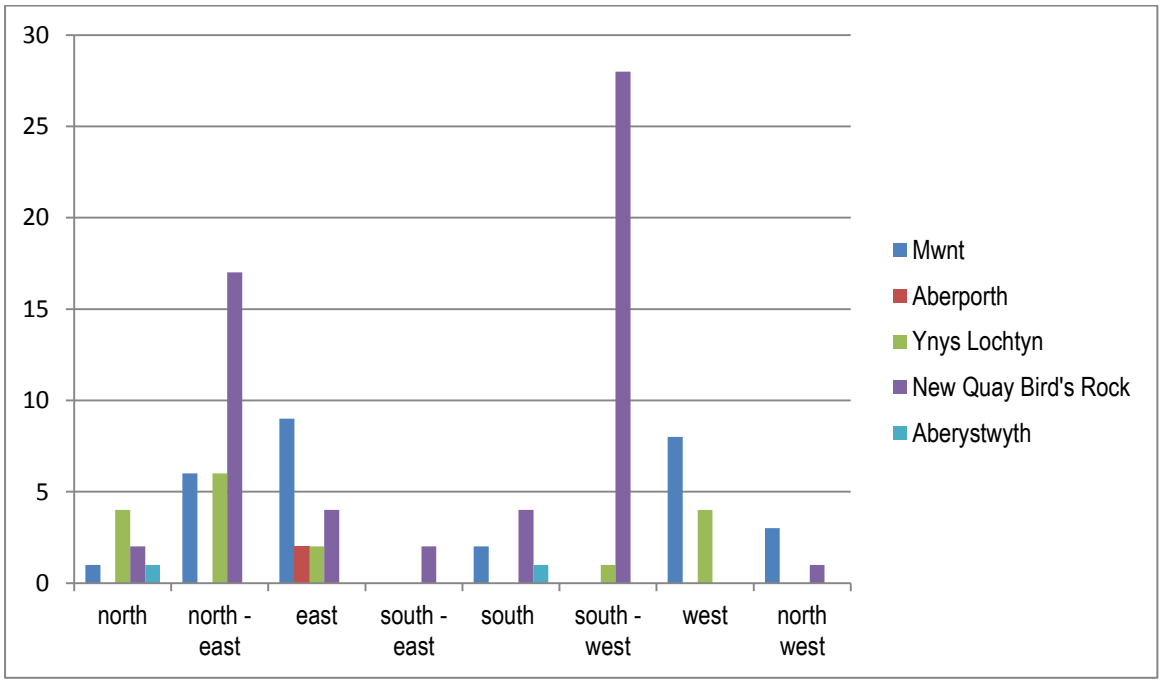


Figure 9: Direction of travel by bottlenose dolphins, excluding New Quay Harbour

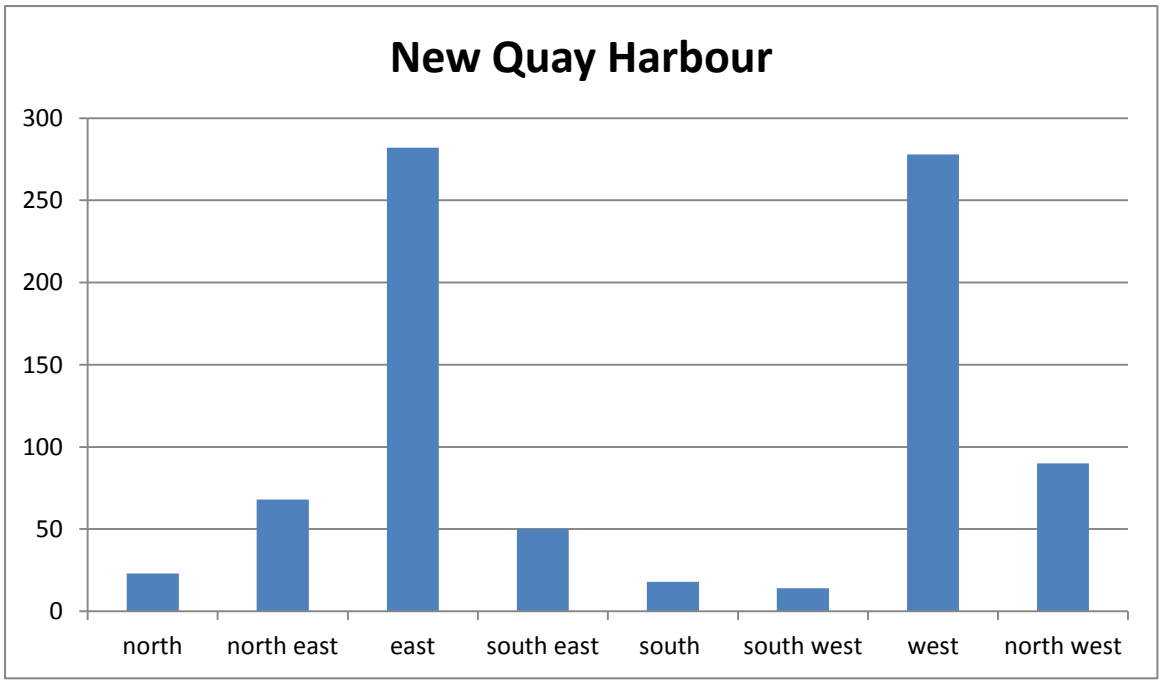


Figure 10: Direction of travel of bottlenose dolphins in New Quay Harbour

Figures 9 and 10 above show that the most frequently recorded direction of travel for bottlenose dolphins is movement up and down the Ceredigion coast; travel directly out to sea is much less frequently recorded at all sites.

Levels of boat traffic by site

Boat traffic was monitored by tally counts of vessels over each two hour observation period. New Quay Harbour was the busiest site for boat traffic, followed by Bird's Rock and then Aberystwyth and Aberporth; with the lowest boat counts at Mwnt and Ynys Lochtyn (Table 10 & Figure 11).

Table 10: Mean boat counts per two hour watch 2017

	Mwnt	Aberporth	Ynys Lochtyn	New Quay Birds Rock	New Quay Harbour	Aberystwyth
2017	1.6	6	1.7	7	20.3	6.2

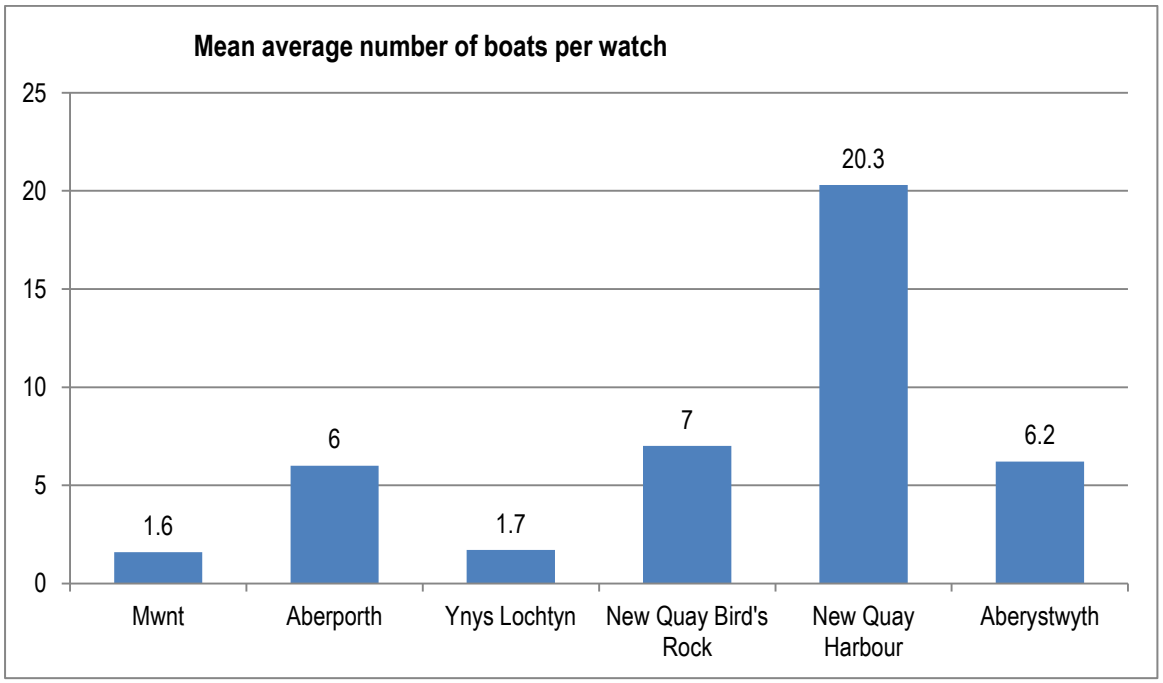


Figure 11: Mean average boat counts per two hour watch for each site

The most frequently recorded boat types in New Quay Harbour in 2017 were visitor passenger boats, with 5,279 recorded during the season in 2017. The next highest category were canoes, kayaks and paddleboards at 5,123; which have overtaken motorboats for the first time as the second most frequently recorded type of water craft. These were followed by motor boats at 3769, speed boats/RIB at 2190, and sail boats at 2224.

At New Quay Bird's Rock visitor passenger boats were again the most frequent, with 230 visitor passenger boats recorded. The next most frequently recorded type of vessel at this site were motor boats, with 59 recorded; therefore the number of visitor passenger boats at Bird's Rock is significantly higher than any other type of vessel.

At Mwnt and Ynys Lochtyn, visitor passenger boats were the most frequently recorded boat type in 2017. At Aberystwyth, motor boats were the most frequently recorded vessel type.

At the Aberporth site, the number of canoes, kayaks and SUPs recorded is significantly higher than other types of vessel. The number was also high given the small number of watches that took place here. Over the thirteen watches (twenty six hours) that took place at Aberporth in 2017, 56 canoes were recorded, a further increase on the 40 canoes/kayaks/SUPs recorded over the thirteen watches in 2016 (Table 11 & 12).

Table 11: Total count of different types of boat on each site in good weather watches

Site	motor boat	speed boat (RIB)	sail boat	commercial fishing boat	visitor passenger boat	canoe/ kayak/ SUP	jet-ski	research boat
Mwnt	10	2	7	14	16	3	0	0
Aberporth	9	8	4	1	0	56	0	0
Ynys Lochtyn	1	1	0	2	4	0	0	0
New Quay Bird's Rock	59	53	34	34	230	4	0	0
New Quay Harbour	3769	2190	2224	972	5279	5123	14	3
Aberystwyth	39	0	6	15	0	9	0	1

Table 12: Mean average counts of different boat types for each site by two hour watch

Site	motor boat	speed boat (RIB)	sail boat	commercial fishing boat	visitor passenger boat	canoe/ kayak/ SUP	jet-ski	research boat
Mwnt	0.3	0.1	0.2	0.4	0.5	0.1	0.0	0.0
Aberporth	0.7	0.6	0.3	0.1	0.0	4.3	0.0	0.0
Ynys Lochtyn	0.2	0.2	0.0	0.3	0.7	0.0	0.0	0.0
New Quay Bird's Rock	0.9	0.8	0.5	0.5	3.5	0.7	0.0	0.0
New Quay Harbour	3.9	2.2	2.3	1.0	5.5	5.3	0.0	0.0
Aberystwyth	2.1	0.5	0.3	1.8	0.0	1.4	0.0	0.0

New Quay Harbour

Due to the high volume of boats in the New Quay Harbour area, a factor unique to this site; boat counts per watch time and dolphin occupancy per watch time were also investigated to examine whether there is a correlation between the number of boats and site use by bottlenose dolphins.

The watch between the hours of 1300 – 1500 has the greatest average number of boats per watch at 25.4 and the smallest percentage of bottlenose dolphin sightings per watch at 65%.
The greatest percentage of sightings occurred in the mornings up to 1100 hours and also in the late afternoon and early evening after 1700 hours, both periods when the boat traffic is quietest (Figures 12 & 13).

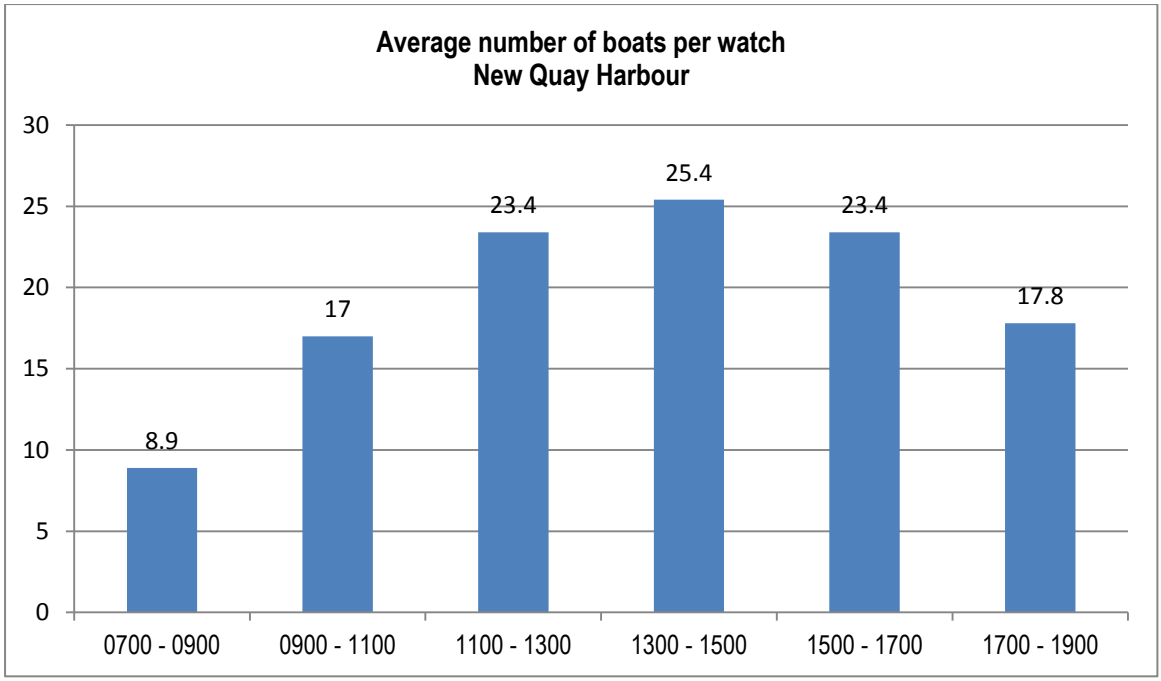


Figure 12: Average number of boats recorded by time of watch at New Quay Harbour

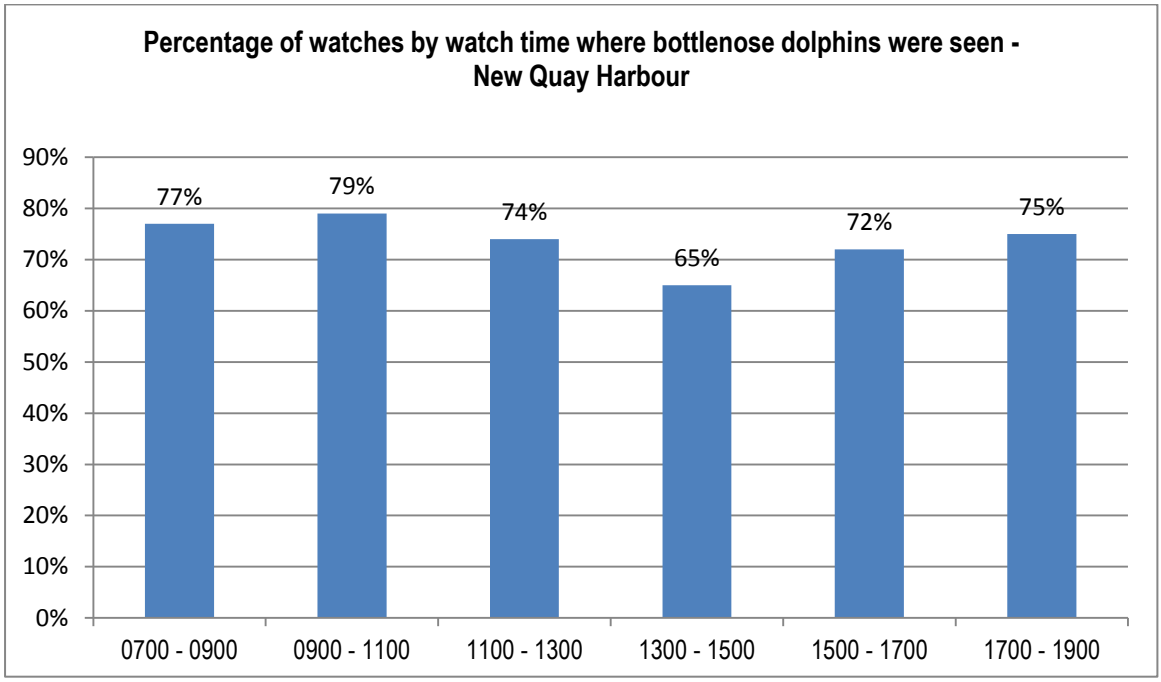


Figure 13: Percentage of watches by time of day where dolphins were seen at New Quay Harbour

Encounters between dolphins and boats

The protocol followed during a Dolphin Watch survey defines a boat encounter as occurring when a vessel travels within 300m of an individual dolphin or a group of dolphins. A total of 1781 encounters between bottlenose dolphins and boats were recorded in 2017. The highest observed encounter rates were at New Quay Harbour; New Quay Bird's Rock had the second highest encounter rate. Encounters with visitor passenger boats were most frequently recorded across the survey sites.

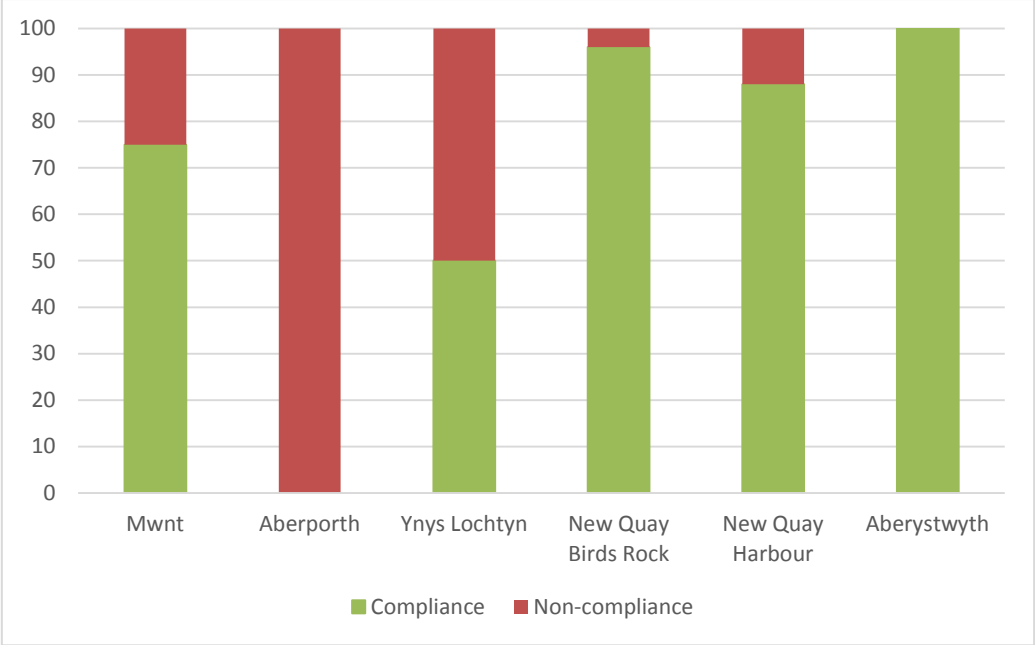
Compliance with the Ceredigion marine codes of conduct by boat users during encounters with dolphins

There were 1781 encounters recorded between boats and dolphins during the 2017 survey period. In 1572 encounters (88% of the total) the observer recorded that the boat user followed the relevant code of conduct; these codes of conduct are the guidelines for recreational boat users and for commercial passenger boats. There were 211 incidents (12% of encounters) in which boat users did not follow the appropriate code of conduct (Table 13).

The rate of compliance with the Ceredigion Marine Codes varied by location: Aberystwyth, Aberporth and Ynys Lochtyn all recorded less than five boat encounters; therefore this data cannot provide an accurate or fair indication of compliance at these sites. At the three remaining sites boat users in the New Quay Bird's Rock area had the highest rate of compliance at 96%, followed by New Quay Harbour at 88% and Mwnt at 75% (Figure 14).

Table 13: Percentage of compliance/non-compliance with the Ceredigion Marine Code of Conduct during dolphin encounters

Site	Total number of boat encounters	Number of boat encounters following the code of conduct	Percentage compliance with code of conduct	Number of boat encounters not following the code of conduct	Percentage non-compliance with code of conduct
Mwnt	8	6	75%	2	25%
Aberporth	1	0	0%	1	100%
Ynys Lochtyn	2	1	50%	1	50%
New Quay Bird's Rock	68	65	96%	3	4%
New Quay Harbour	1700	1498	88%	202	12%
Aberystwyth	2	2	100%	0	0%
All sites	1779	1572	88%	209	12%



N.B. Aberporth, Ynys Lochtyn and Aberystwyth recorded less than 5 encounters in 2017.

Figure 14: Percentage of compliance/non-compliance with the Ceredigion Marine Codes of Conduct during dolphin encounters (as a percentage of all recorded encounters per site)

Proportions of different types of non-compliance with the codes of conduct

The majority of cases of non-compliance with the codes of conduct involved water users travelling too fast within 300 metres of a group of dolphins (56%) or manoeuvring erratically to either approach or follow the dolphins (43%) (Table 14).

Table 14: Relative proportions of types of boat non-compliance with the codes of conduct

Boat activity (when not complying with codes of conduct)	**Number of encounters**	**Percentage of non-compliance**
N1: Too fast, wake speed within 300m of dolphins	117	56%
N2: Erratic course to follow dolphins	90	43%
N3: Attempted to touch, feed or swim with dolphins	2	1%
N4: Speed over 8 knots within New Quay zoned area	0	0%

The incidence of non-compliance for users of different boat types

Speedboats had the highest rate of non-compliance: in 68.2% of all encounters with a speedboat the vessel did not follow the code of conduct. Motor boats also had a high level of non-compliance at 45.7% of encounters. Canoes/kayaks/SUPs were the third highest group observed not following the code of conduct during encounters, with a non-compliance rate of 41.5% (Table 15).

Table 15: Non-compliance of different types of boat

Boat type	Number of non-compliant boats by type	Total number of encounters by type	Percentage of non-compliance by type
Speedboat (rib)	45	65	69.2%
Motor boat	70	232	45.7%
Canoe/kayak/SUP	34	82	41.5%
Commercial fishing boat	13	94	13.9%
Sailing boat	12	118	10.2%
Visitor passenger boat	38	988	3.8%
Jet-ski	0	1	0%
Other	0	1	0%
Total	**212**	**1581**	**13.4%**

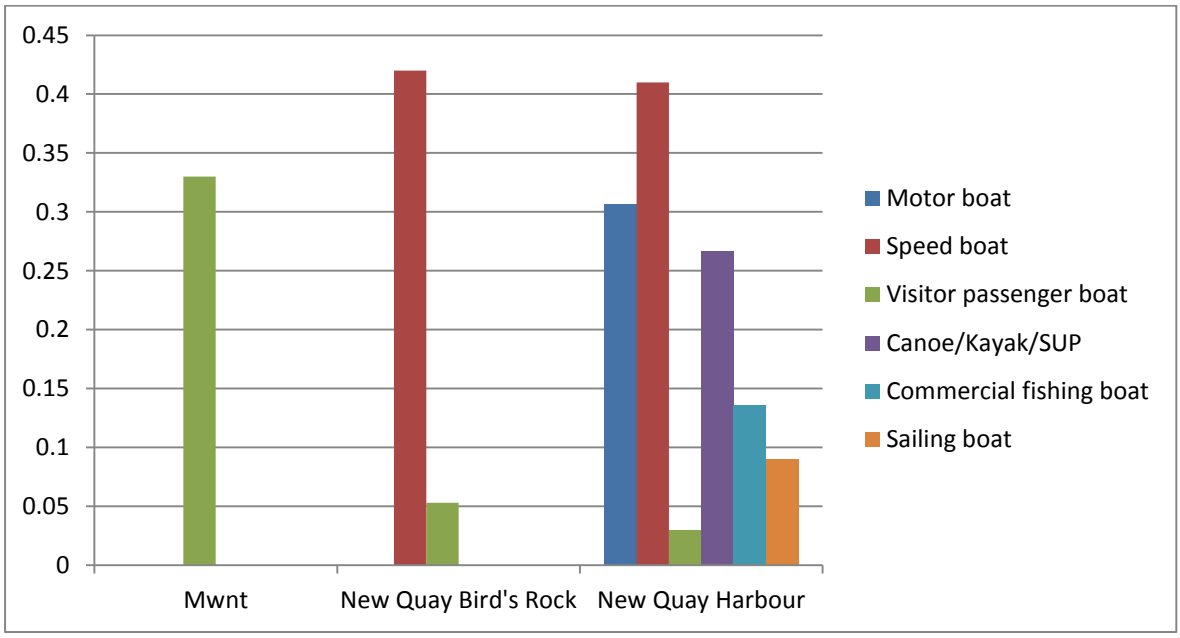
Percentage of non-compliance during encounters by vessel type by site (where more than five encounters took place)

The three sites where more than five boat encounters were recorded are Mwnt, New Quay Bird's Rock and New Quay Harbour. At Mwnt only visitor passenger boats were observed not complying with the code of conduct. The rate of non-compliance from this vessel type has dropped however from 47% in 2016, to 33% in 2017. This has followed the Marine Protected Area officer working closely with wildlife trip boat operators who use the area to promote awareness and engagement with the Ceredigion commercial marine code of conduct.

At New Quay Bird's Rock and New Quay Harbour speed boats/RIBs had the highest rate of non-compliance at 40% and 41% respectively. At New Quay Bird's Rock visitor passenger boats were the only other vessel type where non-compliant behaviour was recorded at 5.3%. At New Quay Harbour motor boats had the second highest rate of non-compliance at 30.6% followed thirdly by canoes/kayaks/SUPs at 28.7% (Table 16 & Figure 15).
(Figures for 2016 are taken from Heath, M and Vaughan, A (2019) *'Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2016'*.)

Table 16: Percentage of non-compliance during encounters by vessel type by site
N.B. Aberporth, Ynys Lochtyn and Aberystwyth recorded less than five encounters in 2017 so are not included in the table below.

		Motor boat	Speed boat (rib)	Commercial fishing boat	Sailing boat	Visitor passenger boat	Canoe/kayak/ SUP	Jet ski	Other	Total
Mwnt	Number of non-compliant boats by type	0	0	0	0	2	0	0	0	2
	Total number of encounters by type	0	0	0	0	6	0	0	0	6
	Percentage non-compliance by type	0	0	0	0	33%	0	0	0	33%
New Quay Bird's Rock	Number of non-compliant boats by type	0	2	0	0	3	0	0	0	5
	Total number of encounters by type	2	5	3	2	57	1	0	0	70
	Percentage non-compliance by type	0	40%	0%	0%	5.3%	0	0	0	7.%
New Quay Harbour	Number of non-compliant boats by type	70	42	15	12	30	33	0	0	202
	Total number of encounters by type	229	103	110	131	1014	115	1	2	1705
	Percentage non-compliance by type	30.6%	41%	13.6%	9%	3%	28.7%	0	0	12%

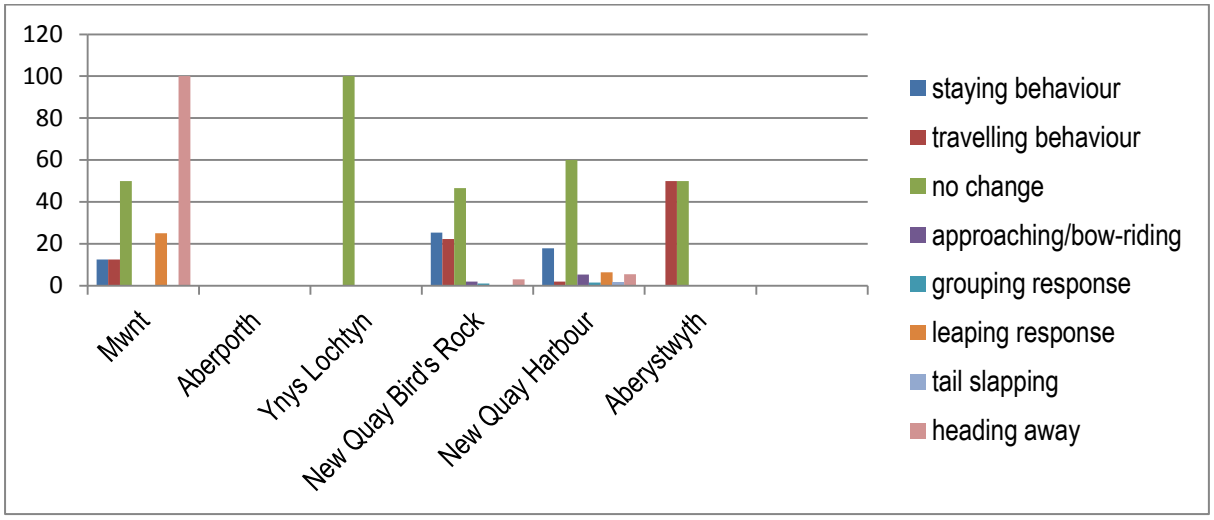


N.B. Aberporth, Ynys Lochtyn and Aberystwyth recorded less than five encounters in 2017 so are therefore not included in the chart above

Figure 15: Percentage of non-compliance during encounters by vessel type by site

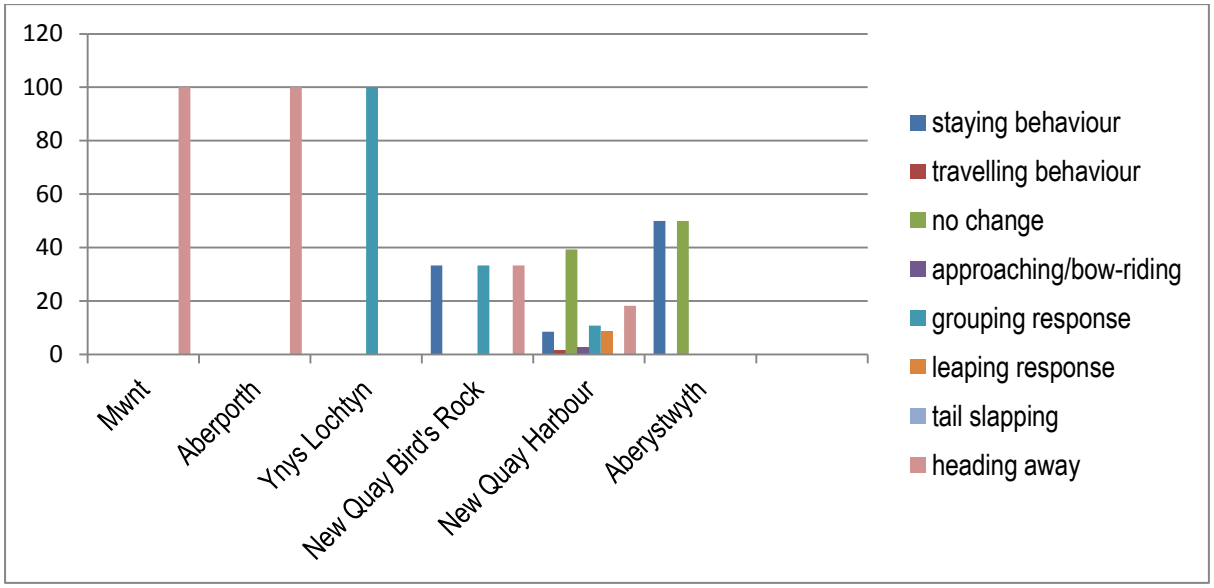
Effects of boat encounters on bottlenose dolphin behaviour

How dolphins responded to positive and negative encounters with boats (whether vessels followed the codes of conduct) was also examined. Observers recorded the different dolphin responses during encounters. In the analyses certain behaviours are grouped together; for example 'heading away fast swimming' and 'heading away steadily' (HS or HF) are grouped together as a negative response (i.e. a change in dolphin behaviour to move away from a boat). Likewise 'approaching' (AP) and 'bow-riding' (B) are grouped together as positive responses. 'Leaping' or 'begin leaping' (L or BL), 'tail-slap' (TS) and 'grouping' (GS or GF) are listed as separate categories.



N.B. Aberporth, Ynys Lochtyn and Aberystwyth recorded less than 5 encounters in 2017. Aberporth recorded no positive encounters in 2017.

Figure 16: Dolphin behavioural responses to positive boat encounters (vessels following the Ceredigion Marine Codes of Conduct).



N.B. Aberporth, Ynys Lochtyn and Aberystwyth recorded less than 5 encounters in 2017

Figure 17: Dolphin behavioural responses to negative boat encounters (vessels not following the Ceredigion Marine Codes of Conduct).

All sites showed that when the Ceredigion Marine Codes of Conduct were followed, 'no change' in behaviour was the most frequently recorded response (Figure 16).

During encounters where the codes were not complied with; at Mwnt and Aberporth 'heading away' was the most frequently recorded response. At Ynys Lochtyn 'grouping' behaviours were recorded in response to negative encounters while at Bird's Rock; 'staying', 'grouping' and 'heading away' were all observed in response to negative encounters. In Aberystwyth 'staying' and 'no change' were recorded. At New Quay Harbour, even when vessels did not follow the codes, 'no change' was still the most frequently recorded behaviour, followed by 'heading away' (Figure 17).

This data supports the findings of the 2016 report Heath, M and Vaughan, A (2019) *'Dolphin Watch: Bottlenose dolphins and boat traffic on the Ceredigion coast, West Wales 2016'* which suggests that both constant low levels of disturbance from the volume of water craft at the New Quay Harbour site (figures 12 and 13) along with individual incidents of non-compliance with the Ceredigion marine codes of conduct influence site usage by the bottlenose dolphin population in southern Cardigan Bay.

Acknowledgements

Thank you to all the hundreds of people that have contributed to the Dolphin Watch data collection over the last twenty four years. More than 80 people contributed observations in 2017. Observers' names are listed below, with apologies for any errors or omissions.

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Appendix

Site use by harbour porpoise and Atlantic grey seal

Atlantic grey seal

	Mwnt	Aberporth	New Quay Bird's Rock	New Quay Harbour	Aberystwyth	Ynys Lochtyn
Number of watches with seals recorded	12	0	18	205	3	2
Mean average number per watch	3	-	6.1	1.8	5.3	1.5

Harbour porpoise

	Mwnt	Aberporth	New Quay Bird's Rock	New Quay Harbour	Aberystwyth	Ynys Lochtyn
Number of watches with harbour porpoise recorded	0	0	2	11	0	1
Mean average number per watch	-	-	17	2.5	-	3