

Contents

Portrane Little Tern project 2022	3
Sternula albifrons albifrons.....	3
Acknowledgements.....	4
Abstract.....	4
Project aims.....	5
“little” Terns.....	5
The Bird and its history in Ireland	6
The Little Terns of Portrane	6
The early years	6
The 2022 season	7
Portrane beach and site 2018-2022.....	13
Functions of wardens.....	14
Site Construction.....	16
The Site 2022.....	16
Erosion	16
Signage	18
Protection shelters.....	18
Predator Management.....	19
Public Awareness	20
Interaction with beach users	20
Group visitations and presentations.....	20
Colony output	21
Colony numbers.....	21
Nesting locations, Incubation period and clutch sizes.....	22
How we measure success	23
Ringings and biometrics	23

Sightings and re-sightings	26
Biometric data.....	26
Human disturbance.....	27
Other breeding avian species at Portrane	27
Review.....	28
The breeding season 2022	28
Table 1 Little tern egg biometrics.	31
Table 3 Parents and their eggs.....	35
Table 4 Incubation periods	37
Table 5 Ringing and Biometrics little tern.....	39
Table 7 Ringed Plover adult/chicks Bio-metrics.....	42
Conclusion.....	43
Bibliography	45

Portrane Little Tern project 2022

Thomas Kavanagh, Paul Lynch



Figure 1: Nest L1120 a little tern family

Sternula albifrons albifrons

A continuation of the attempt to save their last nesting site in county Dublin.

The Little Tern Conservation Project in Portrane, Co. Dublin is managed by Bird Watch Ireland, Fingal Branch. In 2022 this project received support from The Department of Housing, Local Government and Heritage through the National Parks and Wildlife Service's National Biodiversity Action Plan Fund, and by Fingal County Council.

Acknowledgements

I would like to thank the Department of Housing, Local Government and Heritage who provided support through the National Parks and Wildlife Service's National Biodiversity Action Plan Fund. We would also like to thank Fingal County Council for their ongoing support. In particular, we would like to thank Hans Visser, from Fingal County Council for securing the funding for the materials for this project. Special mention to Dublin National Parks and Wildlife Service ranger Mairéad Stack for her valued support. I would also wish to thank BWI staff members Roisín Kearney and Tara Adcock without whom we would not have been able to complete our restricted ringing programme. We are very grateful to the dedicated team of volunteers who contributed time and assistance to the project: Aggie Gilligan, Barney Johnson, Brendan Black, Brian n Debbie, Brian Caruthers, Brian Murray, Catherine O'Connor, Ciara Ryan, Conn Barry, Cormac Crowley, Daniele Gioppo, Declan n Lucas, Derek O'Brien, Gary White, Jan Rod, Jim English, Jim (Chick) McNally, Jim Malone, Jon Williams, Linda Mellon, Michael Keating, Pat Keely, Pat McBride, Paul Hanna, Paul Lynch, Paul O'Flaherty, Paul Scully, Philip Mullen, Rima Pojarkoviene, Rita O'Sullivan, Ronan Toomey, Sandra White, Seamus Murray, Tom n Maureen Carroll, Ulla O'Riordan, and my humblest apologies if I've left you out. I would like to thank the regular local visitors to the colony and the members of the public who not only adhered to the restrictions in place but gave us the encouragement to keep going.

Abstract

It would appear that the Portrane little tern project is becoming almost an all year round project. The coastal erosion at Portrane has continued. The nesting area at the northern end of Portrane beach has all but disappeared. Beach inspections were carried out by team members between December 2021 and April 2022. We incorrectly calculated that we might have three to four pairs for the 2022 breeding season.

Members of the team met with the newly appointed warden for Dublin north Mairéad Stack at the site on April 19th. On the 21st Barney Johnson and I met with Hans Visser and Deirdre O'Flaherty and we agreed upon the production of a site map. This site map was provided to assist in the installation of the netting and external rope for Area 1. By the following weekend the mapping phase was completed and forwarded. At 11:40 on the April 28th two little terns were seen at Portrane at roost together with 34 ringed plover. One of the little terns had a metal ring on its left leg. The number of little terns increased and a consistent 18 were sighted from May 3rd to May 9th. On May 9th I met with Hans Visser FCC at the Turvey depot to set aside what was required for the following day's installation. Wardening of the Little Tern (*Sternula albifrons*) colony at Portrane was due to begin the final week of May 2022. On May 10th together with the contractor we erected the inward netting fence around an area of the beach that looked most as a suitable breeding area for little terns. We then erected a rope fence a few meters outward from the netting. We had done so to allow the returning little terns a safer space in which to nest. During the weekend of the 14th and 15th we erected a second enclosed area to the south of the blue rope. This was done to protect the dune area to the south and thus give the ringed plover, meadow pipit and skylark a safer environment in which to breed. This area became known as the skylark and meadow pipit area. As the season progressed little terns began nesting in areas outside of Area 1. Area 2 was created south east of the skylark and pipit area. Four pairs also nested to the east of Area 1 but within the blue rope. This area would later be known as Area 4. Unfortunately all of these nests were predated by foxes. Area 5 was the final area closed off. It contained 3 nests one of which was abandoned.

After the site construction we inserted a number of shortened Wavin pipes and wooden huts to provide shelter and hiding places for the chicks to use. We also inserted a number of terra cotta little terns to encourage the little terns to nest.

Due to resource issues we were unable to operate a night wardening roster. The lack of provision for a night warden meant that night predation could only be reacted to after the initial attacks. A total of 24 little tern breeding pairs made 30 nesting attempts this season. This was a record for our site. Portrane 22 became our official title on May 13th as “we seem to have branched out” to cover meadow pipit, skylark and ringed plover. This year we had 5 extra *Sterna* one of whom was identified as the least tern (*Sterna Antillarum*). This was its third year to visit Portrane. It arrived Saturday evening the 21st of May. The first eggs were found on May 27th and the last clutch was completed on July 8th.

Project aims

Portrane little tern project strives:

“To provide a safe and secure environment in which little terns can reproduce and fledge their young and so contribute to the fulfilment of Ireland’s legal obligation under the EU Bird’s directive”.

In order to achieve this, BWI Fingal through its wardening sets out:

To promote awareness within the local community and the visiting public that it is only through their co-operation that success will be achieved.

To erect a physical barrier to discourage ground predation of the nesting site.

To maintain surveillance during daylight hours to deter avian and other predators from taking eggs, chicks or adult birds.

To monitor, record, analyse and tabulate adult behaviour, food consumption, scrape location, egg yields, egg types, hatching efficiency, fledging proficiency, the returning Portrane birds.

To expand our knowledge of little tern conservationism.

To liaise with other projects in order to gather external experiences to enhance our project.

To record and monitor the ecosystem that is Portrane Beach.

“little” Terns

There are five species of tern breeding in Ireland, Artic tern *Sterna paradisaea*, Common tern *Sterna hirundo hirundo*, Little tern *Sternula albifrons albifrons*, Roseate tern *Sterna dougallii dougallii* and Sandwich tern *Thalasseus sandvicensis*. The knowledge that the reclassification of species is an organic process, ongoing and forever. It is my understanding that science will prove that these seemingly similar species are on different branches of the phylogenetic ‘tree’ with common ancestry. According to eBird/Clements Checklist v2021 there are seven species within the Genus *Sternula* with a further twelve subspecies. Similar species, the Least tern *Sternula antillarum antillarum* breeds in North America and winters to northern Brazil.

Saunders tern *Sternula saundersi* nests from the Red Sea to India and Sri Lanka and winters to the Malay Peninsula. Little tern *Sternula albifrons albifrons* nests across the western Palearctic and winters on both sides of the African continent. The wintering location of Irish Sea little terns is as yet unknown. The relatively recent reclassification of “little” terns has led to the creation of a variety of subspecies. Future research on the migration patterns, food consumption, and the further divergence/isolation of these subspecies it is easy to conclude that the evolutionary process is occurring before our eyes on Portrane beach.

The Bird and its history in Ireland

The Little Tern (*Sternula albifrons*) is the smallest and scarcest of Ireland’s five breeding tern species. They are long distance migrants, wintering in West Africa and returning to Irish coasts to breed in late April and early May and departing again from late July to mid-September. The majority of little terns in Ireland nest on beaches that have a mixture of sand and shingle. Nests are composed of a shallow dip scraped in the beach substrate generally above the high tide line. The eggs and chicks are well camouflaged in the sand and shingle. Due to their nesting habitat, little terns are very vulnerable to recreational human disturbance, sea level rise and predation. Little terns are classed as an Annex 1 species under the EU birds Directive (79/409/EEC), requiring member states to take special conservation measures to ensure their survival and breeding success. In Ireland and the United Kingdom, the species is amber listed by BirdWatch Ireland and the RSPB (Royal Society for the Protection of Birds), indicating that this species is of medium conservation concern. The little tern is fully protected under the Wildlife Act (1976, Amended 2000).

Little tern adults, average 21-25 cm in length and have a 41-47 cm wingspan. *Sternula Albifrons Albifrons* has been recorded in Ireland by Usher and Warren before the early part of the 20th Century. They noted that the largest colony in Ireland had over 50 pairs “known to nest”. Later Kennedy, Ruttledge and Scroope noted that little tern colonies were small and were up to 25 “little terns breeding” and that perhaps the species was in decline. However they did record a colony of 40 to 50 pairs in County Wexford. Today little terns are probably the scarcest breeding tern in Ireland. Post the 2019 project I visited Tory island in Donegal and during a discussion with local birder Anton Meenan discovered that a pair of little terns had attempted to nest near the lighthouse at the western end of the island. During the 2021 project, a team member had a 2 adults flying near an island near Belmullet. In 2004 Pickerell cited in Cabot and Nisbet (p136, 2013) estimated that there were 206 breeding pairs in Ireland. This number for certain has increased and I estimate it to be approximately 370 breeding pairs in Ireland this season. However their reproductive strategy places them in perilous situations ranging from inundation by the sea, loss of habitat, human and canine disturbance, natural predation and parental skills.

The Little Terns of Portrane

The early years

There are written personal accounts of little tern breeding attempts at Portrane beach between 1990 and 2017. It was during this period that the members of the Fingal branch of BWI fenced off a section of the beach using rope and fence posts. A number of signs were attached to the fence to inform the public about the conservation project. From 1990 to 2017 it is probable that chicks did fledge at Portrane, however the total number is likely to be no more than seven. Prior to 1990 it is likely that the environment at Portrane was unsuitable for breeding. There are accounts from the 1970's that little terns nested to the south of the Island Golf Club. There are also records of them breeding on the north end of Bull Island. Sadly these sites are no longer being used for breeding purposes. This abandonment may well have been due to the constant disturbance by the public of these nesting sites. In both 2016 and 2017 the Fingal branch had monitored the arrival of little terns at Portrane. Unfortunately after the initial count of approximately 20 adults in late May of both years, this number dwindled to zero within a fortnight. Most of the adults were un-ringed. The few that had a metal ring were mostly from Kilcoole. When I received a call from Paul Lynch (BWI Fingal) in May 2018 that he had counted 22 adult little terns at Portrane again, I said that I would take a look. I arrived in late May at the most southerly end of the old roped off area and scanned the area to the North. This area had been roped off by Fingal BWI branch members prior to 2016.

The 2022 season



Figure D: Trapped adult little terns and ringed plover



Figure E: little tern and ringed plover chicks

We had visited Portrane beach throughout the winter and watched the nesting area of 2021 disappear in the tide. There was a very small area suitable for little tern nests at the northern end of the beach. We speculated that we might have only 3/4 breeding pairs at the site due to its size. Our final visit post the spring tide of April confirmed our belief that they may only facilitate a small number of breeding pairs. To counteract the previous erosion we decided to bury what gardeners refer to as “bulb planters” along the edge of the grass. The eight planters were filled with beach material and it was hoped that these beach “extensions” would encourage some little terns to nest upon them. The weather conspired against us yet again on May 17th. The Spring tides together with low pressure onshore south easterly winds and rain meant that the possible east coast tern sites took a beating. The north end construction had remained intact but the southern end had 7 poles down. In places about two feet of dune were simply washed away. Among the 32 + little terns counted was IX1. The first little tern egg was laid on Friday 20th May. On Sunday 22nd it could not be found and deemed predated together with 8 ringed plover eggs. It was presumed that rooks were the cause of the predation. L0222 was completed by the 28th with 2 eggs. L0322 and L0422 were now under construction.

This year we were able to extend our project’s work to the ringing and monitoring of ringed plover. Three adult ringed plover were trapped and ringed by Jan and Roisín on Monday 30th. Afterwards we entered the site and found L0322 with 1 egg L0422 with 2 eggs L0522 2 eggs L0622 1 egg. On Tuesday 31st I checked the site twice and at day’s end we had ten nests, 2 with 3 eggs, 2 with 1 egg and 6 with 2 eggs. We also discovered a predated cracked egg south of the colony. It was compared to the photo of our first laid egg and it was different. We concluded that L0122 had had a second egg and this was it. We took the opportunity to weigh and measure the egg. Weight 6.3grms length 34.27mm width 23.7mm. By Friday the 3rd we had doubled our nest total and more than doubled our egg count. During the week of the 30th May to we placed a camera on the nests that had 3 eggs. This was done to try to identify the adults at each nest site. We decided to wait until we were certain that the 2 egg nests were complete or had received a 3rd egg to minimise disturbance to the colony. Like last year a pair had decided to nest well away from the colony. We constructed a third compound to the south to afford this nest some protection. On Saturday June 4th Jan checked the site for nests and eggs. We now had 19 active nests, 11 with 3 eggs, and 8 with 2 eggs. Among the returning nesting birds were I17 nest L0322, IX0 nest L0422, IZ8 nest L0922, PLV nest L1322 and IK2 nest L1822. Six of our nests had at that time to be checked. Other adult birds seen included ANA, IX1, A49, IZ6 and IZ9. We had our second setback on June 7th. We lost 5 little tern nests L0222, L1022, L1522, L1822, L1922 and 4 ringed plover nests to fox predation. Prints were found behind our site and along the eastern side of the site. The morning of the 9th also showed fox prints and a second set of prints of unknown origin.

From my observations of the site we decided to check all the nests inside. Two of the nests inside were abandoned. They were L1622 3 eggs and L2222 1 egg. An unknown predator at the time turned out to be a male peregrine. His overall impact upon Portrane 2022 was to be profound. One evening the peregrine killed Gronant born PLP the female from nest L2022. The tern was fishing above the river when the peregrine struck from behind. PLP's nest of 2 eggs was abandoned like L1622 and L2222. A further two nests were abandoned and due to the falling numbers of adults it was presumed that these losses were also due to the peregrine. This PLP incident offered an explanation or possible reason for the other abandoned nests. Our records show that on a number of occasions the peregrine sat in the pine trees observing the colony. This behaviour may have been the reason why the adult terns later led their chicks to the west side of the colony.

On Sunday June 12th L2322 with 1 egg was discovered behind us to the south. At first we thought that was a re-nest, however an investigation using a go-pro camera revealed that the birds were 2 year old birds and likely to be on their first nest. Various birds had been scraping and resting in this area all week. This Area 5 was enclosed on Tuesday 14th. A second nest began shortly afterwards. RL0122 was completed with 2 eggs inside the colony. Three sets of parents from the predated nests re-nested close to their original nest sites to the east of Area 1 among them was A8S. This area was enclosed on Wednesday 15th. A second nest went into the area to the south. On Sunday 19th the GoPRro camera revealed that A8S was now starting a new nest site at RL0622. It was correctly predicted that the nests to the east of the colony would be inundated on the night of the 15th. To avoid this the nests were raised in heavy flower pots. It was noted that A8S was absent from RL0422. Fearing that A8S had abandoned RL0422, the single egg was moved to RL0522. Upon its return an adult from RL0522 sat straight back on its nest now with 2 eggs. All was well at close of day. The morning of the 16th revealed that the raising of the nests was successful. As the high tide the night of the 16th was a repeat 4.2m it was believed that it would not impact upon the nests. On the morning of the 17th we discovered that the tide was far in excess of what was expected. The site was battered by the sea. The netting around Area 4 was down and the three nest sites RL0322, RL0422 and RL0522 were washed away. The following birds were noted ANA, IZ9, IZ7, PLV, A0Z, AVN, IZ5, A49, IZ6, A8S, A8T, +2 unringed + 3 BTO Kilcoole birds there was also a Kilcoole bird that was impossible to read due to its condition.



Figure B: Raised nest

Repairs were carried out and an inspection was carried out and the 14 nests in section 1 were intact. There was concern over the nests from Area 3 as to whether they had been abandoned. Investigations using the GoPro camera revealed that the parents on RL0222 were new to Portrane. RL0622 was now the nest of A8S. This is the 1st recording of a 3rd attempt to nest at Portrane. Jan lifted our spirits with the news that L0622 had hatched on Sunday June 19th. We now had 2 chicks. From my observations on the 20th I could see a chick from nest L0722. I also observed 2 chicks from L0922 within the colony. Later in the afternoon when the colony rose I entered the site to check L0822 had 2 chicks, L0522 had 2 chicks. It was noted that a number of eggs were cracking.

The following days saw a new nest laid down in Area 3. There was grave concern when mink prints were discovered outside the western side of Area 1 on two separate occasions. Portrane 22 had a very close encounter with an attacking peregrine during the evening shift of the 23rd. Despite 12 kestrel, 3 sparrowhawk, 2 buzzard and 2 peregrine encounters recorded that day, no losses were recorded. Tara, Roisin and Jan placed our 1st Darvic rings on our more developed chicks on Friday 24th. There were now 23 chicks with BTO rings and 7 with Darvic rings. This year our chicks have never been so mobile this week alone 10 different chicks have been found over one hundred metres from Area 1. Unfortunately NW55498 and 499 were found near death on Saturday morning. They were both weighed and they had both had lost weight since they had been ringed on Thursday. Both chicks had been retrieved from near the sign for the caravan park and returned to the colony. The tragedy was that a 3rd unseen chick was also nearby. As the parents had one chick they did not go looking for the other 2 who died as a result. We decided to desist from returning chicks to the colony from now on. We were notified that live traps were being inserted within the vicinity of the colony to capture the mink. Fox prints were seen along the

shoreline on Sunday morning. The avian attacks continued on into the weekend. By Monday the 27th we had 30 chicks with BTO rings of which 14 had Darvic rings.

On Friday 22nd both chicks from Area 1 were found 20 metres south of where Area 2 used to be. They were retrieved and then placed inside Area 5. They were later fed by both parents. However, later on both chicks found a way to circumvent the net. They both escaped out onto the lagoon. They were again recaptured and returned and the gap in the net was plugged. Later that day we had over 60 little terns on the tide line which included 17 juveniles.

In the past we had been advised that oystercatchers were a threat to nesting little terns. On Tuesday the 28th at the high tide roost approximately 40 oystercatchers came into land at the roost site. Upon landing they proceeded to attack an adult little tern that was sitting on its chicks. We immediately ran towards the roost blasting the air horns and drove them away saving the chicks. On Wednesday 29th most of our chicks had left the maternity ward and moved to the area known as the crèche 80 metres west. The following days a fox family (amount of footprints) killed and ate 31 chicks. Our eldest chick to survive was ringed B1P on Thursday 30th. We still had 3 nests and 6 eggs. On Sunday the 10th the 1st of the 3 remaining nests began to hatch. B1P by now had fledged and a week later the other 2 nests starting hatching. Unfortunately one of the eggs was infertile.



Figure 2: Previous sites



Figure A: Area 1 2022

When we started our 13 hour roster programme in 2018 we started a process that has led to the following code for the little tern nests. The example L0719 may be decoded as follows. L = little tern, 07 = the 7th located nest in the season, 19 = the year of the project. Re-nests are registered as follows R0520 R = little tern, 05 = the 5th located re-nest in the season, 20 = the year of the project. This year we decided to label the ringed plover nests in the vicinity of the site in a similar fashion. This process was started in late May as part of an attempt to ring the adult ringed plover and monitor their progress.

There was little impact of the Covid-19 pandemic on the 2022 project. Thankfully we had encouragement and support from National Parks and Wildlife Service (NPWS), Bird Watch Ireland (BWI), and Fingal County Council (F.C.C.). We were able to erect the netting on May 10th with the assistance of F.C.C. as planned. Unfortunately the risk of bird flu caused us to abandon our ringing programme.

Having referenced as much material as we could we discovered that in the cases where nests are lost, little terns lay a single replacement egg at a new scrape. With regards to the 2018 inundation it was recorded that little terns waited four days before using the inundated area again. We had six re-nests that year. Four re-nests had two eggs, one had three eggs, with only one having a single egg. This year 3 of our re-nests were inundated in Area 4. A re-nest was abandoned in both Area 1 and Area 5. The reason for this is unknown. In 2022 adult female A8S and partner B0B created L0222 with two eggs. Unfortunately this nest was predated by a fox. The pair then created R0422 with 1 egg. This egg was abandoned. Then A8S laid two eggs in R0622. Both eggs hatched and were fledged successfully.

From further observation this year there were a number of factors that contributed to the length of the incubation period. These factors included the adult's previous experience as a breeder, the number of eggs being incubated. However our experiences in 2020 adds a caveat to this statement. Weather at the Portrane site does not appear to influence incubation times. During our breeding season we were in constant contact with the Baltray wardens. They noted a successful incubation period of 30 days. The nest had been inundated by a high tide. Despite this the pair were successful at fledging their chicks. Our observations in 2022 revealed that our incubation periods were well within the norms expected for little terns of 18 to 21 days. We are fortunate to have a small colony and these observations are not too difficult to collect.

Interestingly Ehrlich et al suggest a general fledging period of 19 to 21 days but add a cautionary "(15-18)" possibility. 2020's fledglings IV0 to IV5 were most definitely in the 15-18 group whereas IV7 and IV8 were 21 to 22 days. We can safely discount food supply or weather as influencing factors. Portrane has more than enough sand eels, shrimp and other small fish for both the colony and other tern species that visit.

When our 14 fledged chicks departed from Portrane in August 2018 we had no idea whether or not if any would survive to return to nest successfully. We hoped that if any of them returned we might learn more about little terns through observation. The list of Portrane birds returning to the east coast of Ireland in 2022 to nest would include IX0 IX1 IZ5 IZ6 IZ8 and IZ9. Female IX0 paired with IN1 (3 chicks died), male IX1 paired successfully with Kilcoole female (2 chicks fledged). Male IZ5 paired with female A8V (1 egg was cracked at incubation and the other 2 chicks were eaten by foxes). IZ6 paired with Kilcoole female, both eggs were predated by fox. IZ8 female paired with A9H male Kilcoole (3 chicks predated by fox). IZ9 male paired with PLP

female Gronant. PLP was killed by peregrine and the 2 eggs were abandoned. Since 2018 we noted that after the last nest was put down we always had a number of birds flying about looking like they too were about to nest. Similar in appearance to the breeding little terns these turned out to be non-breeding birds. They would fly over the site in groups of three or four. They always announced their arrival with what I refer to as a trumpet call. This behaviour was observed at various times throughout the day. On occasion the birds would land within the site for a very short period, usually less than 30 seconds. Landings were also noted at the shoreline at high tide. Normally one of these birds carried a fish and initiated a behaviour that mimicked part of little tern courtship. However as soon as the fish was presented the prospective recipient would take off. A most definite refusal to nest. The 2020 season gave us an explanation for this behaviour. In 2020 we had ringed birds to observe. With this information we hypothesised that what we were looking at were either looking at young or inexperienced birds. We now refer to them as “teenagers”. Our visits of support to Baltray revealed that they too had similarly behaving little terns. As in previous years 2022 had its “teenagers”. We had 4 who were accompanied by the least tern. There has been outright rejection of the least tern by little tern breeding adults. It appears to spend most of its time associating with young or inexperienced birds.

Portrane beach and site 2018-2022

The entire beach and dune/saltmarsh of Portrane beach is classified as a Special Area of Conservation (SAC) and a Special Protection Area (SPA) National Parks and Wildlife Service (NPWS). It is thus a protected area by law. The area also falls within the jurisdiction of Fingal County Council (F.C.C.) and is also protected by their bye-laws. At high tide the area becomes a peninsula with The Burrow to the West and Rogerstown outer estuary. The outflow of the Ballyboghil and Ballough rivers are the main two feeders. There are also Bride's Stream, Jone's Stream and Baleally Stream feeding the estuary. They flow from the surrounding farmland and feed a deep channel to the sea to the East.

Prior to 2018 BWI Fingal had an area of shingle beach cordoned off with 2 meter poles 10 meters apart with a single connecting blue rope 90-100 cms high. The site's length was 150 meters north-south 40 meters East-West. The signage attached was bleached with age but was still serving Bird Watch Ireland (BWI), BWI Fingal and FCC. The sands of time had buried the western side to the extent that the rope was 20 to 30 cms from the ground. The other 3 sides still had purpose. This area was referred to as the old area. By 2021 most of the area to the southern and eastern ends of the beach had been washed away, by high tides. This year's site contained approximately a 20m by 15m portion of the old area. The remainder of the site bordered the river to the North at high tide and was 30m to 40m wide in places East West. The Portrane site is subject to very high tides. The intertidal area exposed at low tide is approximately 1.5km by 1km. This area is very uneven and thus is pock marked by intertidal pools. Most of this area is covered by a fine sand however there are two areas of shingle. Both shingle areas are adjacent to the river. In 2022 the shingle area started about 5m from the river's edge at the northern end of Area 1. Its area was approximately 35m East-West by 70m North South. Half of this area was used by prospecting males as the remaining was covered by

grass which was generally unused.

Functions of wardens.

Monitoring the arrival of little terns at Portrane began prior to May 1st. However, following the erection of the fencing the warden's duties included the checking of the external netting for any night-time activity by predators. At first the daily visits were to take counts of little terns and observe what other species were nesting and the type and number of predators that were in the area. The activation of the on-line roster was held off for as long as possible. This was done in order to conserve our resources for the actual breeding season. The roster was activated when the little terns started scraping.

One of our non-beach wardens wrote the programming for an agreed design for the roster. It is an Excel spreadsheet with four columns for each day. Each row represented a 30 minute period from 06:00 until 20:00. Each week the wardens received a text asking for them to notify the administrator of their availability which was then updated. Wardens could then check to see the critical times that were not covered and thus fill any gap. For health and safety reasons a minimum of two wardens were allocated where possible.

The roster can be used year on year.

It was decided to utilise the human resources differently in 2022. There was less data collection in 2022 because most of the nests were impossible to observe without disturbing the colony. However we did accomplish sufficient monitoring to note that the food supply was as good as the previous years. Those who were new to the collection of data this year were given a very basic outline on data collection. "This is the nest you will be recording, note down what you see". This was an attempt to avoid influencing the type of data being collected which would reduce the quality of the data being recorded. From our records "When eggs are being laid down there is a time when the observer notices the laying adult that is sitting exchanges her position with her male counterpart". This is the moment when we know when incubation starts. We can then calculate the approximate hatching date. As this day approaches we intensify our observations and in certain circumstances video trail cameras were installed. The adult's behaviour alters during the period of actual hatching. Shell removal does not occur immediately after hatching. Observations this year show that the removal of the shell from the scrape can take several hours. Our experiences in 2022 differed from our previous experiences in eggshell removing. The data collectors other duties pre-hatching included the length of time adults spent sitting, the time changeovers occurred and whether feeding took place. Post hatching the documentation of feeds to chicks is of paramount importance. This data informs us about the food supply and its quality. It also informs us about the hunting capabilities of the parents and the likelihood of the chicks fledging successfully.

In order to simplify this data recording as much as possible. We continued with the standardisation of fish sizes (small, medium and large) that were based upon the length of the bill of the adult little tern. Thus a small fish feed was any fish that was smaller than the adult bill length. Post ringing the identification of recipients was also recorded where possible. However the identification the recipient is more problematic when the chicks become more mobile. On many occasions all that the observer saw was the adult deliver a fish to a location hidden by vegetation and depart without any. As more wardens became available the number of

observers were increased. Nest observation can become a tedious task. In order to ease the boredom some of those on protection duty exchanged roles with certain data recorders. Protection duty always held the highest priority thus in emergency situations wardens were permitted to enter the site to ward off avian predators. The only other occasions where we entered the site were to insert or remove cameras or recording devices. During the ringing sessions in order to minimise the disturbance we created a procedure for these and future events.

Nests were targeted for ringing based upon the age of the chicks. Ideally chicks should be less than ten days old but more than three days old. The chicks at Portrane did wander and therefore we had difficulty in catching the entire clutch together. To assist us in chick, nest and parent relationships we decided to attempt to ring all adults that had only a metal ring or were un-ringed. Jan built traps and these were used very successfully on both the ringed plover and little tern adults. This practice it is hoped will aid us to create an historical profile/map of relationships at the Portrane site that will also contain egg types together with a full biometric profile for each nest.

Our policy on disturbance is that other than for the ringing of chicks we always wait for the colony to rise before entering the site. From our observations there is a vast amount that we have yet to understand and so we must be vigilant in keeping our interaction to a minimum. We are in a sense a service provider for the little terns that choose to spend their summer at Portrane. The total amount of hours spent wardening by the team was in excess of 2500 hours.



Figure 3: Site construction

Site Construction

An example of why the nesting area needs to be cordoned off from the public follows. This year there was an increase in traffic in and out of Rogerstown harbour in the form of yachts, canoes, rowing boats, motorised ribs and other craft. There was little impact upon the colony by this traffic, however canoeists and paddle boarders who crossed over from Rush did impact the colony during the incubation period. Visitors to the beach from the caravan park did cause some issues with their jet skis at the very northern end. The brooding birds rose to investigate but after a while they settled again. These disturbances disappeared when the jet ski owners went home.

This year an area of shingle beach was cordoned off with 2.5 meter poles placed 10 meters apart on the seaward side. Some 2.5 metre poles were used on the north side of the site. These poles were inserted to a depth of 1.80m. The remaining poles used were 1.85 metres long were inserted to depth of 1m. The netting in 50m lengths were attached with the base of the netting buried beneath the sand to discourage predators. The site's inner perimeter was 260 meters in circumference and 45 meters at its widest East-West. We added a number of new signs and these were attached to every second post. It was informative and served Bird Watch Ireland (BWI), BWI Fingal, NPWS, and F.C.C. A number of signs were strategically placed beyond the site asking the public to maintain a 10 metre distance from the netting. Most of the public were very supportive but unfortunately a small number did not stay 10m out from the netting. It was very apparent that walkers and their pets who walked in close proximity to the site were a significant disturbance to the colony. We erected an outer rope 10m outside of the netting. A second enclosure Area 2 was created to the south of Area 1. This was an experimental site meant to offer ringed plover, meadow pipit and skylark a safer nesting area.

Blackboards were located at both the northern and southern ends of the site. The idea of a notice board had been discussed at the beginning of the 2018 project. We had used them in 2019 but their true impact was revealed during the 2020 project. The blackboards were updated regularly to give a concise report on the colony's development. The blackboards functioned extremely well as the public at large seemed to be drawn to them. Usually the passing public would stop for a short period and depart with a wave or a thumbs up. This behaviour was in sharp contrast to the informational signage which was generally ignored by the public.

The Site 2022

Erosion

Compared to the 2021 site it was obvious that we had lost the entire site from that year the eastern side of the site was gone and up to 2 metres lower in most places. The previous 2022 spring tides together with wind action had created one ridge on the eastern edge. We noted that the entire easterly outer ridge was breached by tides greater than three point six meters. This ridge was situated beyond the external blue rope fence to the east of the site and the

eastern side of the netting. Fortunately no little tern nest was established in this area. However four nests were established on the eastern side outside the netting. A fifth nest was established almost 200 metres to the south. Their locations would be prone to the tidal inundations greater than three point eight metres. Under normal weather conditions most of the northern half of the site was of higher elevation and I believed that any nest established within this area would be safe from any tidal inundation. The volume of shingle was much less than the area available in previous years.

There is no doubt that the beach at Portrane is undergoing a significant change in structure and thus the breeding site available to the little terns is likely to disappear. The dune system has been washed away to a depth of five metres in places. The Western part of the site still has a dune system containing marram grass whose extensive systems of creeping underground rhizomes helped stabilise the dune system. This area contains depressions and mounds of sand with scant growth containing various shoreline plants. The current north end of the site contains stands of marram grass and although the adult birds generally avoid this when nest prospecting, the chicks initially used the area for shelter from both the weather and predators. Nest L0122 was placed at the edge of this area however it was predated.



Figure 4: 2022 site of most nest locations

Signage

This year we updated our signage content and we increased the number of their locations. The signs were placed strategically around the outer perimeter of the site. There are a number of public access points to Portrane beach. There are a number of access points to the beach that include "The Brook", Beach lane, Valley lane and from the caravan park near Rogerstown harbour. It was necessary to post signage at most of the access points asking the public to circumvent the nesting site and if appropriate to keep dogs under control. Our initial signage contains basic informational text and photographs to notify the public about the project. Some signs describe briefly the little tern and its nesting behaviour. Other signs request the public's co-operation with the project's wardens. The public in general have become very supportive of the project. Many of the locals who walk the beach on a daily basis stop to inquire about the little terns.

We also added blackboards at either end of the colony. The role of the blackboards was to give the public up to date colony news. It is hoped to increase the number and variety of signs for next year. Due to the undulating nature of the site it was decided not to erect the electric fencing in 2022.

Protection shelters

In 2022 we used both wooden and plastic shelters to offer the chicks some protection from predators and the elements. The plastic piping was given to us by Wavin gratis and was cut into sections and placed about the site prior to nesting. As in 2021 trail cams installed to observe the behaviour of the little terns. We also used a GoPro camera as a first step of identifying un-ringed adults at their nest sites. The data recorded will be used to increase our knowledge of the little tern behaviour during the hours of darkness. This year the wooden tents created in 2021 were used extensively by the chicks. From our observations we can safely say that the shelters have proved an essential addition to maintenance of the welfare of our chicks.



Figure 5: Feeding time at Portrane

Predator Management

“Not on my watch” was a phrase coined by a volunteer during the 2018 project. This statement is central to our attitude towards the predation of our charges. Jackdaws (*Corvus monedula*) were the main predator of 2018 but were only a small threat in 2022. Red foxes (*Vulpes vulpes*) however were the main predator for 2022. They consumed both nests and chicks in 2022. A male peregrine falcon was added to the successful predator list in 2022. We estimate that from two observed kills that the peregrine killed 6 adult little terns and was the cause of 5 nests to be abandoned. We at Portrane had been warned that oystercatcher (*Haematopus ostraeus*) were a species that took eggs and young chicks. We had a close encounter with a roosting flock of oystercatcher that attempted to predate chicks. Having recognised the imminent threat the flock were driven off by the wardens. The losses due to predation were so significant this year that it has been decided that a night wardening scheme is essential for the future success of the project. Future discussions with NPWS (M Stack) and F.C.C. (H Visser) will be required to resolve this issue for Portrane. More electric fencing shall be required to establish a more secure area for nesting. It is hoped that future funding from the NPWS will enable us to purchase the electric fencing necessary. The electric fence was not installed this year due to the unsuitable nature of the terrain. If we have a similar sized colony in 2023 it will be necessary to increase the electric fencing to 600 metres. I suggest that we use a patchwork system similar to Baltray to defend against predators. The electric fencing will be activated for night time usage and will be as a second line of defence. Daytime wardens carry air horns and whistles to ward off avian predators. Avian predators at the Portrane site include sparrowhawk (*Accipiter nisus*), kestrel

(*Falco tinnunculus*), peregrine (*Falco peregrinus*), merlin (*Falco columbarius*), and buzzard (*buteo buteo*). Ground predators included foxes, feral cat, mink, and roaming dogs.

Public Awareness

Interaction with beach users

There are four categories of visitors to the beach at Portrane. There are the residents of the burrow who frequent the beach on a regular basis. They have an understanding of what we are about. Many take an active interest in what is happening at the colony through regular interaction with wardens. Secondly there were the anglers who visited the area in numbers particularly at period around the spring tides. Despite being in close proximity to the colony they had little effect upon it and the birds seen to ignore them. Many of the anglers would stop and chat about the colony and how well it was feeding.

There were also the holiday makers from the caravan parks who may have been visiting for the first time. Once they were informed about what was going on they appeared to supportive of the project. However a small number of these visitors were the source of some difficulties for the colony. Being on “holidays” some brought scramblers into the dunes. This practice usually occurred post 19:30. Despite our pleading they simple ignored the wardens. Fortunately the soft sand to the North, East and West of the site again prevented these visitors from causing too much disturbance to the colony. Happily we had no incidents with photographers this year.

Group visitations and presentations

A presentation was made to the South Dublin Branch BWI on the work being carried out at Portrane on the 1st February 2022. A small number of family groups also asked if they could have more information on the project. They were offered and accepted scope views of the nesting adults and wandering chicks. Paul Lynch gave an interview to Independent newspapers. A photographer took some photographs and a two page article was printed in the Sunday Independent. It was also suggested that a business card be produced detailing the projects activities. It was proposed that a number of these cards be placed in the North and South hides to be distributed to the visiting public.

Colony output



Chick B1P 2022

Colony numbers

One of the advantages of the size of the colony at Portrane is that it is easy to get an accurate count of the colony. For the breeding season of 2022 we had 24 pairs plus 4 non-breeders and a least tern (*sternula antillarum*). Of the 48 breeding adults 15 were trapped. Of these six Kilcoole adults were trapped and had a Darvic attached to left leg. Seven un-ringed adults had both Darvic right leg and BTO left leg added. A Baltray bird I17 had its Darvic replaced and Gronant bird was unchanged. Of the remaining adults six were from Portrane, one from Gronant, five from Kilcoole non-Darvic, three were from Baltray non-Darvic and fourteen either un-ringed or unseen.

Little tern counts varied greatly post hatching and in particular post predation. Due to the heavy losses at Kilcoole very few Kilcoole fledglings and adults were sighted this season. Baltray had a successful year but their birds were about 18-24 days behind us. A directive was issued by the NPWS which suspended the ringing of all seabirds. Post fledging over 120 little terns were counted at Portrane. This number included little terns from 4 colonies. Shortly afterwards in

early August we visited both Kilcoole and Baltray and discovered that both colonies appeared deserted. This poses the question as to why do little terns congregate at Portrane? It is our belief that the food supply is so good that little terns congregate there to prepare for migration. Our first egg was laid on May 20th it was found at 17:26. Our final egg was laid on June 27th.

Nesting locations, Incubation period and clutch sizes

The nest/scrape sites at Portrane are typical in that they are a bare scrape in the shingle. In comparison to ringed plover the little tern scrapes are shallower. It has been our experience that little terns seldom have a nest that is decorated. It has been recorded that little terns usually have between two and three eggs but on rare occasions four.

In our experience there is a direct link between the incubation period and the number of eggs being incubated. However, our experiences in 2020 adds a caveat to this statement. Our experiences to date noted that inexperienced breeding birds do not always get it right and thus their immaturity may contribute to a delay in incubation time. Likewise experienced adults are likely to have shorter incubation times. Our observations in 2020 revealed a wider spectrum of incubation times than in 2018. Ehrlich et al suggest that incubation periods vary from 18 to 21 days. In 2020 however we have records of 22 day incubation periods. We are fortunate to have a small colony and these observations are not too difficult to collect. Interestingly Ehrlich et al suggest a general fledging period of 19 to 21 days but add a cautionary “(15-18)” possibility. 2020’s fledglings IV0 to IV5 were most definitely in the 15-18 group whereas IV7 and IV8 were 21 to 22 days. We can safely discount food supply or weather as influencing factors. Portrane has more than enough sand eels, shrimp, and other small fish for both the colony and other tern species that visit. In 2022 the shortest fledging period that year was 18 days, whilst the longest was 19 days. Despite the erosion that took place at Portrane beach again during the winter of 2021 it was agreed that there was a possible area at the North end of the beach for the little terns to breed in 2022.

On April 28th 2022 it was noted that 2 little terns were now at Portrane. On May 11th the number of little terns at Portrane was recorded at 10+. From discussions I had with both the Baltray and Kilcoole wardens it would appear that the little terns returned in two migration surges this year. The weather patterns we experienced this year may have contributed to this. By May 18th we had 40+ little terns. Nest L0122 2 eggs was predated by corvids around May 21st. It was not until May 29th that nests L0222 and L0322 were quickly established by our first arrivals. What unfolded in 2022 at the North end of Portrane beach during the latter days of May through to mid-August added another chapter to the conservation of little terns in Dublin. We had studied the beach in March and April for likely nesting locations at Portrane. Due to the relatively small area available we speculated that we may have two to three nesting pairs and maybe four maximum. We mapped out the area see *Figure 4*. The red enclosed area is the where the netting was erected. The blue line represents the external perimeter that was placed approximately 10 metres outside of the netting. *Figure 4* also contains all of the little tern scrape locations.

How we measure success

At Portrane only chicks seen flying are considered fledged. Hence this year we have 6 fledglings. At the finish of the 2018 project we reviewed the assortment of data collected. We concluded that together with the 14 fledged (13 ringed) chicks, the knowledge gathered/studied was also considered to be part of the success of the project. We know that IX1, IX0, IZ8, IZ9, IZ5 and IZ6 bred at Portrane this year and produced 6 fledglings. Whilst IX2 bred at Chesil, Dorset, England 2021. Other sightings from 2018 included IZ0 at Gronant, Wales. Non-breeding IZ5, IZ7, IZ9 (2018) and IV0, IV5 (2020) were also sighted. We have no idea who will return next year to breed or where they might breed. From a statistics perspective our team of volunteers have had success in facilitating the colony in 2022. This year we had our highest number of hatchlings, our highest number of eggs laid and our highest number of breeding pairs. Unfortunately our predation numbers were also the highest ever. Portrane's little tern colony is becoming an efficient and effective reproducer of little terns on Ireland's east coast. In 2022 we have added 6 little terns to the Irish Sea community. We believe that due to the excellent supply of food at Portrane this year's chicks have an excellent chance of returning to breed in the years to come.

Year	2018	2019	2020	2021	2022
Number of breeding pairs	11	18	05	11	24
Number of eggs	27	44	12	26	57
Number of eggs lost	09	17	00	00	29
Number of nests lost	22	41	00	00	08
Number of re-nests	06	03	00	00	06
Number of re-nest eggs	12	05	00	00	09
Number of re-nests lost	01	03	00	00	04
Number of re-nests eggs lost	02	05	00	00	05
Total eggs laid	39	49	12	26	66
Total eggs hatched	15	03	12	26	37
Total eggs fledged	14	03	09	24	06
Total chicks ringed	13	02	08	25	31
Mortification of chicks	01	00	03	02	31

N.B. 2018 statistics are based upon an estimation of the original nests lost added to the actual output,

Ringling and biometrics

We were all acutely aware of the expansion of Avian Flu throughout the British Isles. As a result those who were ringing our birds adopted a strict equipment sterilization policy. Trapping and ringing of ringed plover and little tern proceeded apace. However this year we were informed

by the NPWS to cease the ringing of sea birds during the project. There was a belief there was a risk of transferring Avian Flu from site to site and this action was taken to prevent this. The handling of sick birds was also considered a bio-hazard. As a result we were unable to ring all of our chicks.

Table 1:

Year	Code	Sex	Comment	Breeding
2018	IZ0		single chick, seen in Gronant, Wales July 21 2020	
2018	IZ1		family of 3	
2018	IZ2		family of 3, seen in 2020	
2018	IX2		family of 3	
2018	IZ3		family of 2	
2018	IZ4		family of 2	
2018	IZ5		family of 2, seen in 2020, Baltray	2022 3E
2018	IZ6	M	family of 2, seen in 2020, Portrane	2021 2F 2022 2E
2018	IZ7	M	family of 2, sibling unringed	
2018	IZ8	F	family of 2, female	2021 2F 2022 3E
2018	IZ9	M	family of 2, seen in 2020, Portrane	2022 2E
2018	IX0	F	family of 2, seen in 2020, Portrane	2021 2F 2022 3E
2018	IX1	F	family of 2, seen in 2020, Portrane	2022 2E
2019	IX4		Family of 3, 3rd one not ringed	
2019	IX5		Family of 3, 3rd one not ringed	
2020	IV5		family of 2, sibling unringed	
2020	IV0		family of 2	
2020	IV1		family of 2	
2020	IV2		family of 3, not seen after fledging, siblings have been seen multiple times	
2020	IV3		family of 3	
2020	IV4		family of 3	
2020	IV7		family of 3	
2020	IV8		family of 3	
2020	IV9		family of 3, Disappeared on or before 18th July, prior to fledging, remains found 2/8/20, was not predated.	
2021	A0E		Family of 3	
2021	A0C		Family of 3	
2021	A0J		Family of 3	
2021	A0A		Family of 2	

2021	A0B	Family of 2	
2021	A0L	Family of 3	
2021	A0N	Family of 3	
2021	A0K	Family of 3	
2021	A1K	Family of 2	
2021	A1J	Family of 2	
2021	A0H	Family of 2	
2021	A0Z	Family of 2	
2021	A1A	Family of 2	
2021	A1B	Family of 2	
2021	A0T	Family of 2	
2021	A0S	Family of 2	
2021	A0P	Family of 2	
2021	A0V	Family of 2	
2021	A1C	Family of 3	
2021	A1E	Family of 3	
2021	A1H	Family of 3	
2021	A2Z	Family of 2	
2021	A3A	Family of 2	
2021	A5S	Family of 2	
2021	A5T	Family of 2	
2022	B1P	Family of 3 fledged	
2022	B0E	Family of 3 predated	
2022		Family of 3 Cracked	
2022	B0P	Family of 3 predated	
2022		Family of 3 dead	
2022		Family of 3 dead	
2022	B0A	Family of 3 predated	
2022		Family of 3 predated	
2022	B0D	Family of 3 predated	
2022	B0C	Family of 2 predated	
2022	B0J	Family of 2 predated	
2022	B0K	Family of 3 predated	
2022	B0L	Family of 3 predated	
2022	B0S	Family of 3 predated	
2022	B1B	Family of 2 predated	
2022	B0H	Family of 2 predated	
2022	B1J	Family of 3 predated	
2022	B1D	Family of 3 predated	
2022	B1H	Family of 3 predated	
2022		Family of 3 predated	

2022	B0V		Family of 3 predated	
2022			Family of 3 cracked	
2022			Family of 2 predated	
2022			Family of 2 predated	
2022	B1K		Family of 3 predated	
2022	B1L		Family of 3 predated	
2022			Family of 3 predated	
2022	B0Z		Family of 3 predated	
2022	B1A		Family of 3 predated	
2022			Family of 3 predated	
2022			Family of 2 predated	
2022			Family of 2 predated	
2022			Family of 2 predated	
2022			Family of 2 predated	
2022			Family of 2 predated	
2022			Family of 2 predated	
2022			Family of 2 fledged	
2022			Family of 2 fledged	
2022			Family of 2 fledged	
2022			Family of 2 non-viable	
2022			Family of 2 fledged	
2022			Family of 2 fledged	

Sightings and re-sightings

For convenience of reporting, sightings of Darvic ringed birds at Rush Point and Portrane are considered as one area. Over 700 sightings from 136 birds were recorded by Paul Lynch, Jan Rodd and myself at Baltray, Gormanstown, Laytown and Portrane/Rush roosting sites. On November 10th we received notification that IX2 was re-trapped on April 5th at La Langue de Barbarie National Park in Senegal. On April 27th IX2 was sighted at Chesil in Dorset a distance of over 6000 kilometers.

Biometric data

At Portrane 2022 biometric data was collected on both ringed plover and little tern adults. Biometrics are collected only at ringing sessions to reduce any possible stress or disturbance to the nesting birds. The data below represents a total of 39 biometric readings taken on adult birds this year during the ringing sessions. Prior to the ban on ringing we were able to take readings on 58 little tern and 12 ringed plover chicks. In Table 2 below (F) = Female (M) = Male (Unk) = Unknown.

Table 2:

Type. of birds		Min Val	Wing mm. Mean Val	Max Val		Min Val	Weight gr. Mean Val	Max Val
LITTE(all)	15	166	179	190		51.7	55.2	58.0
LITTE(F)	7	170	178	181		51.8	55.3	57.9
LITTE(M)	4	180	185	190		51.7	54.5	58.0
LITTE(Unk)	4	166	175	182		54.3	55.8	57.2
RINPL(all)	24	132	137	144		60.5	66.6	79.2
RINPL(F)	14	133	138	144		61.0	68.0	79.2
RINPL(M)	10	132	137	142		60.5	64.8	69.4

Human disturbance

There was an increase in the number of holidaying visitors to Portrane beach in 2022. Again many of these were completely unaware of the project. Most took an interest and showed an appreciation for the work we were doing, others however were problematic. A few climbed through the outer perimeter despite the signage requesting them to stay away and use alternative paths. The adult birds got used to the daily walkers and only seemed troubled if people stopped opposite the eastern side of the perimeter.

Drones were less of an issue this year. There is little we could do when their owners were controlling them from North of the river. We had signage requesting drone operators not to use them near the colony.

Other breeding avian species at Portrane

This year we counted at least 14 nesting pairs of ringed plover (*Charadrius hiaticula*), 2 of skylark (*Alauda arvensis*), one male appeared to have two females and therefore we had 3 nesting sites. We had in excess of 15 meadow pipit (*Anthus pratensis*), and 2 stonechat (*Saxicola rubicola*). The 1st ringed plover clutches were again put down before any little tern had laid an egg. At this time we had counted 6 ringed plover nest sites. These clutches of four eggs were predated by corvids with none of the 6 nests hatching. The 2nd attempts also failed, some to fox predation others to a feral cat and yet others to inundation. Ringed plover chicks are extremely vulnerable to predation as they wander unprotected to the tide line at all times of

the day. This behaviour brings them close to *Larus* ssp. Grey heron (*Ardea cinerea*) also patrol this area on a daily basis. As the season progressed more and more ringed plover nesting. The 3rd attempt saw our 1st ringed plover chicks. It is possible that one chick made it to fledging. The 4th attempt was slightly more successful. It is likely that no more than five ringed plover chicks fledged. The skylark chicks were more successful and the pair inside Area 2 fledged 2 clutches. The other male skylark also fledged a clutch. Meadow pipit fledglings were also seen feeding in the area. The stonechat nearest the colony fledged 4 chicks.

Review

The breeding season 2022

We now have five breeding seasons behind us. If we have a beach in 2023 we are reasonably confident that we would get fledglings away. On Friday April 28th 2 little tern flew over the point at the northern end of Rush beach. The following day I visited Kilcoole and counted 70+ little terns. Having had the experiences since 2018 we were better informed as to how to go about the business of little tern conservation in 2022. We were unable to construct our site on the May Bank Holiday as scheduled and it wasn't until May 10th that Areas 1 and 2 were constructed.

Our daily visits to Portrane recorded varying numbers of little tern adults at the roost. The time of day and tide position are important in relation to pre-nesting little tern observations. When I visited the site on the May 12th at 10:08 I had 27 little tern. The following day I returned with Cormac before high tide and recorded 35 little tern at 11:17.

A south easterly wind pummelled the site on the 17th which caused damage to Area 2. There was also minor damage to Area 1. Later in the day I did some emergency repairs. The better news of the day was a pair scraping to the southern end as well as three pairs at the northern end. There were many others flying about and landing alongside the edge of the tide.

On May 18th at 14:06 saw our little tern count rise to 40+. This count was repeated on May 24th. The least tern was heard and then seen the same day. Two pairs were scraping at the site. Our 1st little tern egg was laid on the 20th of May in L0122. This nest was high up in the area that the bulb planters had been buried. However when I arrived on Sunday May 22nd L0122 was gone. There had been rooks seen above the area and considerable activity within the site. It was noted that the little terns were chasing every corvid that came too close. We noted that we had 3 definite pairs with a possible 4th. It looked likely that we would have more completed nests by Wednesday 25th.

This year the corvid threat was from rook *Corvus frugilegus* and hooded crow *Corvus cornix* with the occasional Eurasian Magpie *Pica pica*. The rooks and hooded crows were persistent and unwelcomed visitors throughout the project. On Tuesday 24th I arrived at the beach at 09:45 and I was surprised to see 42+ LT's. The birds were performing all of the usual behaviour associated with the early part of the breeding season. There was plenty of scraping, prospecting, and mating throughout the entire beach area. After about an hour most of the

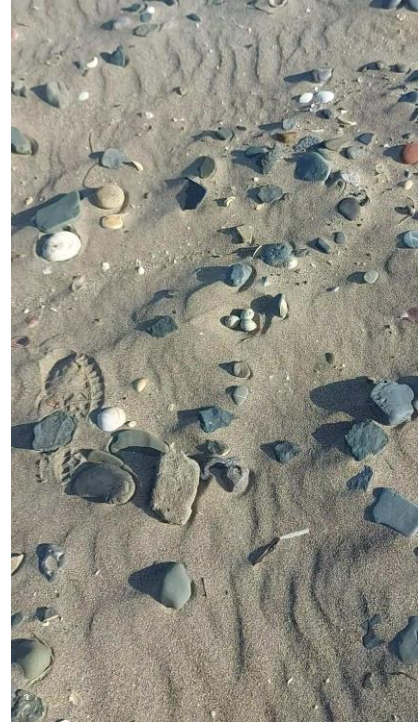
birds went out to sea. Small numbers of little terns returned from time to time during the day. Those adults who were brooding were fed continuously throughout the day. By mid-May the ringed plovers had begun to re-nest. Unlike the terns their nests were much further apart and were thus much more difficult to observe. Ringed plover nests were generally checked once a day.



L0222



L0522



L1422



L0422



L1122

Figure 6: Some nest sites from 2022

There was a noticeable number of new arrivals in early June. By Monday the 30th we had 5 active nests with a total of 8 eggs. The 31st saw an intensification of attacks by both hooded crows and rooks. During our daily inspection we found the second egg from L0122 with scratches that fitted the beak of a corvid. On June 1st our active nest count was 14 with 27 eggs. Of the 7 ringed plover nests inspected we had a total of 28 eggs.

June 3rd saw an increase of little tern nests 17 active with a count of 32 eggs. The ringed plover were also increasing to 10 active nests and 36 eggs. We received news that Kilcoole were at 227 active nests with 516 eggs. By June 5th our active nest count was at 20 with 51 eggs. On June 6th Jan trapped and ringed our 1st adult little tern at Portrane. A8S a female 2011 Kilcoole chick was brooding on L0222. This bird together with B0B (unknown origin) were trapped and ringed as adults. The pair would have their nest predated by a fox, loose their second nest to flooding, but would successfully fledge 2 chicks from R0622.

With the amount of eggs being laid and the close proximity of many of the nests it was decided that we would need a backup plan to assist in identification of the family units at Portrane 22. Jan built some traps and designed a process to minimise any stress on the adults being trapped. Nests with 3 eggs were chosen first to maximise our efforts. A GoPro camera was placed to observe the adult pair at each nest. If the adults were ringed with both BTO and Darvic rings we targeted the next nest. When partially ringed adults were observed we took note how they approached the nest. This would show us which direction to set the trap. When a targeted adult rose upon being disturbed we went to the nest. We replaced the eggs with fake eggs to prevent accidental damage if the trapped adult panicked. The live eggs were placed in cotton wool in an insulated box. We then immediately placed the trap over the nest. Most adults returned within seconds and entered the trap. Once the trap was sprung the adult was removed and the live eggs were returned. Biometrics were taken and the adult was ringed and released. With one exception the adults returned within two minutes to their eggs.

On Tuesday the 7th of June I arrived onsite to discover that we had had a visit from the fox. We lost 5 little tern nests 17 eggs along with 17 ringed plover eggs. Those little terns who were bereaved were sitting on the tide line. Fox prints were seen again on the 9th, but there were no losses. Roisín returned to administer the continued ringing of seven more adult little terns on the 10th.

The forthcoming tides were due to be high and there was a danger that the three re-nests to the east of Area 1 would be washed away. It was decided to raise the nests by placing them in large flower pots. This practice of raising nests is not uncommon at little tern colonies. We took a photograph of each nest so that we could reconstruct it accurately. The egg/eggs were secured and the surface area of the nest was removed using a flat shovel. A hole was dug and the pot which had been filled with stones was inserted into the hole to a depth of two thirds. Sand was added to the top of the pot and the contents of the shovel was arranged according to the photograph on top of the pot. The egg/eggs were carefully placed in position and we then withdrew.



Figure 8: IX0 born at Portrane 2018 laid and brooded 3 eggs successfully. Chicks were predated.

In all cases the adults returned to sit on the eggs within a very short time. On one occasion we took the opportunity to place an abandoned egg from a different nest on one of the re-potted nests. This was done in the hope that the brooding adult might accept it. As both eggs had been laid within 24hrs of each other it was believed that it was still viable. This process was also a success as the brooding adult had no difficulty sitting on two rather than one egg. During this process we took the opportunity to take some biometrics on little tern eggs. See Table 1 below for details of this.

Table 1 Little tern egg biometrics.

Nest	Length	Width	Weight
RL0322	33.00mm	24.23mm	11.20gm
RL0422	31.72mm	22.86mm	08.90gm
RL0522	34.00mm	24.07mm	10.44gm

L1622	32.76mm	23.92mm	09.82gm
L1622	32.71mm	23.26mm	09.16gm
L2022	32.35mm	23.26mm	09.39gm
L2022	34.59mm	23.32mm	09.39gm
L2222	33.88mm	22.65mm	08.90gm

Our first chicks arrived on Sunday the 19th of June. By the following day the number had risen to ten chicks. We were acutely aware that this period of the project would be extremely dangerous for all of the chicks. We have learnt from our past experiences that predators become aware of a new food source very quickly. Thursday the 23rd saw many of our predators visit the colony. We discovered mink prints early in the morning which resulted in the deployment of baited live traps. Kestrel, sparrowhawk, buzzard and peregrine all made forays around the colony. On Saturday June 25th it was noted that one of our chicks was seen to the west on the other side of the lagoon. This was a concern as this area was unprotected. Unknown to us at the time was the fact that its sibling was also there and that in time all of our chicks would go there. At first we attempted to return the chicks to Area 1. This became a fruitless exercise. The chicks very quickly started their journey back to where they had been captured. On Monday the 27th June our records showed that we had 30 chicks with BTO rings of whom 14 had a Darvic. Unknown to us at the time a fox family was about to predate all of them. Notes from this period stated “plenty of kestrel activity and every gull is being chased”, “the peregrine is killing”, “if anything gets away this year it will be a miracle”. At high tide (12:16) on the 28th a flock of 40+ oystercatcher came in to roost. Landing close to a little tern family they made an attempt to predate the little tern chicks. Fortunately we managed to prevent this but a new danger was added to the list. B1P was ringed on the 30th of June. B1P fledged on July 9th we had had our first miracle.

The morale of the volunteers was low due to the heavy losses, however we had good news, RL0622 had begun to hatch. One of the last five eggs was infertile. To prevent the chicks from wandering we placed a fine mesh around Area 5. All of the remaining chicks were placed in this area. For them the only way out was by flying and each in turn did so. Friday August 5th saw the final 2 chicks fledge. Due to the restrictions around avian flu we were unable to ring the last 5 fledglings. Our final casualty was an adult taken by the peregrine at 17:30 on Sunday August 7th. The twitchers came and went throughout the duration of the project. With the easing of the restrictions around covid-19 many were from abroad.



Figure 7: B1P went swimming on 2 occasions and I was fortunate to observe this and was able to rescue it.

A total of 66 eggs were laid, the mean clutch size was 2.4 eggs per nest. Unfortunately nest L0122 with 2 eggs was predated. We had 15 eggs eaten by foxes in 2022. A further three eggs were lost to high tides. Five nests were abandoned with a loss of 9 eggs. Two chicks failed to break out from their shells and one egg was infertile. The total loss of eggs was 29. A total of 37 chicks hatched from the 16 nests between 15th June and 28th July. The mean incubation period was 19.22 days. In total 20 chicks were ringed with Darvic and BTO metal rings and a further 11 with BTO only this season. Due to the danger of Bird-Flu spreading to the colony 6 chicks were left un-ringed one of which was predated with the remaining five fledging. We also enabled an adult re-trapping policy this year. Jan had constructed a trap for the Kilcoole project to aid them in their efforts at conservation. We used this trap to ring 14 adults. Of the 37 chicks hatched, 31 are known to have been predated. B1P was the only ringed chick seen fledged at the shoreline. Five other chicks were known to have fledged in 2022, which equates to 9% productivity of fledglings per egg total this year. This we believe is due to the level of predators attracted by the colony. Despite the losses, this year has seen the colony grow and our highest egg count ever since we began in earnest in 2018. The least tern was not as obliging as it had been in previous years but most visitors were able to see it. We know that the least tern had visited both the Kilcoole and Baltray colonies. I am of the opinion that the least tern spent time elsewhere at an unknown location.

Through our efforts six little tern chicks fledged and approximately 4 ringed plover chicks fledged this season. The losses however were extensive.



Figure 9: little terns over Portrane 2022



Figure 10: These 2 will fledge un-ringed from L2422.

The following tables record the details of each breeding pair for Portrane 2022.

Table 3 Parents and their eggs

Nest No.	Male	Female	Clutch size	Loses (eggs)	Chicks hatched	Loses (chicks)
L01	?	?	2	2	0	
<i>Fake Beach</i>						
L02	B0B	A8S	2	2	0	
<i>Outside</i>						
L03	U	A9J	3	1	2	1
		(I17)				
L04	IN1	IX0	3	0	3	3
L05	A9B	Metal R	3	0	3	3
L06	U	A8X	2	0	2	2
L07	Metal L	A8T	3	0	3	3
L08	U	A8Z	2	0	2	2
L09	A9H	IZ8	3	0	3	3
L10	IZ6	Metal R	2	2	0	
<i>Outside</i>	<i>not confirmed</i>	<i>not confirmed</i>				
L11	IZ5	A8V	3	1	2	2
L12	ANA	A9K	2	0	2	2
L13	U	PLV	3	0	3	3
L14	U	A9E	3	0	3	3
L15	U	?	2	2	0	
<i>Hermitage</i>						

L16	Metal R	?	3	3	0	
<i>Fake Beach</i>						
L17	A9L	Metal L	2	0	2	2
<i>Fake Beach</i>						
L18	?	IK2	3	3	0	
<i>Outside</i>						
L19	Metal R	?	3	3	0	
<i>Outside</i>						
L20	IZ9	PLP	2	2	0	
L21	Metal L	A9C	2	0	2	2
L22	?	?	1	1	0	
R01	?	?	2	2	0	
L23	A49	BOX	1	1	0	
<i>New Hermitage</i>						
R03	Metal R	?	1	1	0	
<i>Outside</i>						
R04	B0B	A8S	1	1	0	
<i>Outside</i>	<i>not confirmed</i>	<i>not confirmed</i>				
R05	Metal R	IZ6	1	1	0	
<i>Outside</i>		<i>not confirmed</i>				
R06	B0B	A8S	2	0	2	
<i>New Hermitage</i>						
R07	A49	BOX	2	1	1	
<i>New Hermitage</i>						
L24	IX1	Metal R	2	0	2	
<i>The Point</i>						
			66	29	37	31

Table 4 Incubation periods

Nest No.	Chick 1	Chick 2	Chick 3	Total Fledged	Notes
L01	X	X	/		Predated
<i>Fake Beach</i>					
L02	X	X	/		Predated
<i>Outside</i>					
L03	B1P	B0E	X	1	Hatched
	Fledged	Missing	Cracked		1 egg cracked
L04	B0P	NW55498	NW55499		Hatched
	Missing	Dead	Dead		
L05	B0A	NW55494	B0D		Hatched
	Missing	Missing	Missing		
L06	B0C	B0J	/		Hatched
	Missing	Missing			
L07	B0L	B0K	B0S		Hatched
	Missing	Missing	Missing		
L08	B1B	B0H	/		Hatched
	Missing	Missing			
L09	B1J	B1D	B1H		Hatched
	Missing	Missing	Missing		
L10	X	X	/		Predated
<i>Outside</i>					
L11	NW55901	B0V	X		Hatched
	Missing	Missing	Cracked		1 egg cracked
L12	NW55916	U	/		Hatched
	Missing	Missing			
L13	B1K	B1L	NW55915		Hatched
	Missing	Missing	Missing		
L14	B0Z	B1A	NW55907		Hatched
	Missing	Missing	Missing		
L15	X	X	X		Predated
<i>Hermitage</i>					
L16	X	X	X		Abandoned
<i>Fake Beach</i>					
L17	NW55913	NW55914	/		Hatched
<i>Fake Beach</i>	Missing	Missing			

L18	X	X	X		Predated
<i>Outside</i>					
L19	X	X	X		Predated
<i>Outside</i>					
L20	X	X	/		Abandoned
					Female killed?
L21	NW55911	NW55912	/		Hatched
	Missing	Missing			
L22	X	/	/		Egg dump
R01	X	X	/		Abandoned
L23	X	/	/		Abandoned
<i>New Hermitage</i>					
R03	X	/	/		Tide
<i>Outside</i>					
R04	X	/	/		Abandoned
<i>Outside</i>					
R05	X	/	/		Tide
<i>Outside</i>					
R06	U	U		2	Hatched
<i>New Hermitage</i>	Fledged	Fledged			
R07	U	X		1	Hatched
<i>New Hermitage</i>	Fledged	Unviable			
L24	U	U		2	Hatched
<i>The Point</i>	Fledged	Fledged			
				6	

Table 5 Ringing and Biometrics little tern

Ring No.	Retrap	Darvic	Wing	Weight
NW38362	RBM,Colour ring added	A8S	181	57.3
NW55481		A8T	176	55.5
NW55482		A8V	166	56.2
NW55483		A8X	178	55.4
NW55484		A8Z	175	57.9
NW55485		A9B	180	51.7
NW45543	RBM,Colour ring added	A9C	182	54.3
NW46250	RBM,Colour ring added	A9E	177	57.2
NW55486		A9H	190	53.7
NW38780	LBM;RBGW(I17),Colour ring replaced	A9J	181	54.8
NW89429	LBM;RBYN(PLV)	not changed	180	53.4
NW70783	RBM,Colour ring added	A9K	170	51.8
NW46822	RBM,Colour ring added	A9L	188	54.4
NW55918		B0B	182	58
NW46530	RBM,Colour ring added	B0X	181	56.3

NW55487			17	8.1
NW55488			13	7.4
NW55489			15	10.5
NW55490			13	7.5
NW55491			12	8.4
NW55492			17	11
NW55493			13	8.5

NW55494			15	9.8
NW55495			14	8.9
NW55496			14	9.6
NW55497			13	8
NW55498			13	7.3
NW55499			14	7.7
NW55500			14	9.3
NW55487	LBM, Biometrics only		18	14.3
NW55488	LBM, Biometrics only		17	12.6
NW55901			16	8.7
NW55902			14	8.2
NW55903			12	8
NW55904			15	9
NW55905			14	7.8
NW55906			14	8
NW55907			12	6
NW55493	LBM,Colour ring added	B0A	21	16.3
NW55498	LBM, Biometrics only		18	13.2
NW55499	LBM, Biometrics only		20	14.6
NW55908		B0D	28	20
NW55909			18	15.1
NW55487	LBM,Colour ring added	B0C	33	23.8
NW55497	LBM, Biometrics only		19	15.6
NW55495	LBM,Colour ring added	B0E	22	16.5
NW55496	LBM,Colour ring added	B0H	23	16.2
NW55488	LBM,Colour ring added	B0J	32	22.1
NW55492	LBM,Colour ring added	B1B	30	20
NW55910			17	13.4

NW55490	LBM,Colour ring added	B0K	24	17.7
NW55498	LBM, Biometrics only			12.7
NW55499	LBM, Biometrics only			14.3
NW55911			12	7.3
NW55912			13	7.4
NW55909	LBM,Colour ring added	B0P		19.4
NW55489	LBM,Colour ring added	B0L		25.4
NW55490	LBM;RBGW(B0K),Biometrics only			22.6
NW55910	LBM,Colour ring added	B0S		17.5
NW55902	LBM,Colour ring added	B0V	25	19
NW55905	LBM,Colour ring added	B0Z	26	17.8
NW55907	LBM, Biometrics only		19	14.3
NW55906	LBM,Colour ring added	B1A	20	18.3
NW55913			15	9.9
NW55914			15	10.1
NW55915			14	8.4
NW55916			14	12
NW55500	LBM,Colour ring added	B1D	49	27.2
NW55917		B1H	39	29.8
NW55497	LBM,Colour ring added	B1J	43	28.3
NW55903	LBM,Colour ring added	B1K	26	19.5
NW55904	LBM,Colour ring added	B1L	30	21.8
NW55491	LBM,Colour ring added	B1P	56	37

Table 7 Ringed Plover adult/chicks Bio-metrics.

Ring No.	Retrap	Darvic	Sex	Gender	Wing	Weight
NW12901		PC	6	F	141	72.6
NW12902		PE	6	M	142	69.4
NW12903		PH	6	M	138	66.5
NW12904		PJ	6	F	133	68.3
NW12905		PK	6	F	144	68.9
NW12906		PL	6	F	139	79.2
NW12907		PM	6	M	138	62.2
NW12908		PN	6	M	137	66.4
NW12909		PP	5	F	134	70.6
NW12910		PU	6	F	141	63.1
NW12911		PX	6	F	138	74.4
NW12912		PV	6	M	135	60.5
NW12913		JU	6	F	136	63.9
NW12914		JK	6	M	133	63.2
NW12915		JL	6	F	136	61
NW12941		JN	6	M	138	67.6
NW12942		JP	6	F	135	68.9
NW12943		JT	6	F	138	67.1
NW12944		JV	6	F	139	63.3
NW12945		JX	6	M	140	67.2
NW12948		JY	6	F	142	65.8
NW45467	RAM, Colour rings added	JJ	6	M	135	58.8
NW12924		JH	6	M	132	65.8
NW12925		JE	6	F	134	64.6

NW12946			1		7.6	17:19
NW12947			1		7.1	17:26
NW12949			1		8.71	17:00
NW12950			1		8	17:06
NW12916			1		8.5	10:15
NW12917			1		8.4	12:51
NW12918			1		8.9	08:11
NW12919			1		8.2	13:29

NW12920			1	8	13:32
NW12921			1	8.6	17:45
NW12922			1	7.95	17:45
NW12923			1	8.4	17:50

Conclusion

Portrane little tern project 2022 has once again presented those who wardened with new challenges. Without the wardens to protect the site the beach would be devoid of breeding little terns. We can say with some certainty that we have had some success in 2022. As in our previous years our efforts in time and resources could possibly be measured against the project's outcome. The learning experience, the shared social capital, the observation data gathered, the 24 breeding pairs, the 66 eggs laid, the 37 hatched chicks and the 6 fledged chicks must be considered when measuring success. Again we were fortunate that the resources were available for the critical in early May.

With the level of erosion in 2022 we anticipate that if nesting occurs in 2023 it shall be on the western side of the lagoon. Like in 2022 it will be the winter storms and the birds themselves that will decide whether Portrane 2023 will be a breeding site for little terns. The early start to the nesting period in 2022 gave us a lead on the breeding sparrowhawk and kestrels and so reduced the stress of their visits. However the Lambay peregrines and our ground predators caused very serious damage to our colony. It is imperative therefore that we have night wardens for 2023's project.

Finally, my gratitude to the people of BWI Fingal who asked me to participate in this project and for their support. To participate in the protection and preservation of our heritage is indeed a worthwhile privilege. To the public who despite the inconvenience we caused to their leisure time thanks for your curiosity, acceptance, cooperation and toleration. Without this we would surely have failed. To the agencies, Fingal County Council, National Parks and Wildlife Service and Birdwatch Ireland thank you for your resources, support, and approval. Most importantly to Hans Visser without who's help we would surely have never got started. The volunteers, you came, your efforts protected our charges and once again gave hope for little terns at Portrane. A motley crew, your commitment, enthusiasm, and resolve made possible a shale full of wonder. Because of you there are 6 new little terns from Portrane. It is a wish that some of the 2022 chicks might return to breed sometime in the future and continue their species.



Figure 11: B1P sole survivor from L0322, whose mom is A9J formally I17

Bibliography

Blomdahl A. Breife B. Holmström N. (2012) reprint, *Flight Identification of European Seabirds*, Helm, London

Cabot D. Nisbet I. (2013) *Terns*, Collins, London.

Ehrlich P. R. Dobkin D. S. Wheye D. Pimm S. L. (1994), *The Birdwatcher's Handbook, a guide to the natural history of the birds of Britain and Europe*, pp. 219-230, Oxford University Press.

Harrison P. Perrow M. Larrson H. (2021), *Seabirds, the new identification guide*, Lynx, Barcelona

Kennedy, P. G., Ruttledge R. F., Scroope, C. F., Humphreys G. R. (1954), *The Birds of Ireland, an account of the distribution, migrations and habits of birds as observed in Ireland*, Oliver and Boyd, Edinburgh and London.

Massey, B. W, Jack M. Fancher, J. M, (1989), *Renesting by California Least Terns (Reanidamiento de Sterna antillarum browni en California)*, *Journal of Field Ornithology*, Vol. 60, No. 3 (Summer, 1989), pp. 350-357

Medeiros R^{ab}, Ramos J^a, A, Paiva V. H^a, Almeida A^e, Pedro Patrícia^a, Antunes S, (2006), *Signage reduces the impact of human disturbance on Little tern nesting success in Portugal*.

^aInstitute of Marine Research(IMAR), Departamento de Zoologia, Universidade de Coimbra, 3004-517 Coimbra, Portugal.

^bA Rocha – Associação Cristã de Estudo e Defesa do Ambiente, apartado 41, 8501-903 Mexilhoeira Grande, Algarve, Portugal.

^eCentro de Ciências do Mar do Algarve {CCMar), Universidade di Algarve, FCMA, Campus de Gambelas, 8005-139 Faro, Portugal.

McManus, A., (2018), *Nesting behaviour and colony dynamics of the Little Tern (Sternula albifrons) at Kilcoole, Co Wicklow, Trinity College, Dublin*.

O'Connell, D. P^{1/2}, Power. A¹, Keogh N. T.¹, McGuirk J¹, Macey C¹, Newton S. F¹, *Egg fostering in Little Terns (Sternula albifrons) in response to nest abandonment following depredation*.

¹*Birdwatch Ireland Unit 20 Block D Bullford Business Campus, Kilcoole, Co Wicklow.*

²Department of Zoology, Trinity College Dublin, College Green. Dublin 2.

O'Connell, D. P.^{1/2}, Power. A¹, Doyle S¹, Newton S. F¹, *Nest movement by Little Terns (Sternula*

albifrons) and Ringed Plovers (*Charadrius hiaticula*) in response to nest to inundation by high tides.

¹*Birdwatch Ireland Unit 20 Block D Bullford Business Campus, Kilcoole, Co Wicklow.*

²Department of Zoology, Trinity College Dublin, College Green. Dublin 2.

Olsen, K. M. Larsson, H. (1995) Terns of Europe and North America, Helm, A & C Black London

Sibley, C. G., Monroe Jr, B. L., (1990), Distribution and Taxonomy of Birds of the World, Yale University, USA.

Ussher, R. J. Warren, R. (1900), reprint, The Birds of Ireland, an account of the distribution, migrations and habits of birds as observed in Ireland, with all additions to the Irish list. Gurney and Jackson, London.

Baltray reports can be downloaded from <https://www.louthnaturetrust.org/publications/>

<http://www.birds.cornell.edu/clementschecklist/download/>