Baltray Little Tern Colony Report 2015

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Abstract

Wardening of the Little Tern (*Sternula albifrons*) colony at Baltray began on May 26th 2015 and ended on August 1st 2015. Night wardening (thus 24 hour colony-coverage) was initiated on June 15th. A total of 68 nesting attempts were made by 25 breeding pairs of Little Tern in 2015, the lowest total of pairs recorded since the project began in 2007.

The first eggs were found on May 28th. The last eggs were found June 28th. A total of 102 eggs were laid. The mean clutch size was 1.5 eggs per nest. The largest loss of eggs related to 37 eggs from 25 nests that were presumably depredated by corvids. Other losses included 14 eggs from 11 nests which were washed out during the June and July spring tides, 2 eggs from 2 nests which were abandoned and 25 eggs from 20 nests which were depredated an unknown predator. A total of 20 chicks were known to have hatched out of 66 nests from July 2nd to July 12th. The modal incubation period was 25.25 days. The 20 chicks were ringed this season, and extensive re-trap data were collected to construct average growth rates. Also the diet of Little Tern chicks was studied for the second time at Baltray, showing the range of fish species and size caught by adults for their young and how it changed as they developed.

Of the 20 chicks hatched, no chick was seen been depredated by any predator.. Thus, the 20 chicks were presumed to have fledged (the lowest total recorded since the project began in 2007), which equates to productivity this year of 0.80 fledglings per breeding pair. This is likely to be an overestimate; however it gives a good indication of the success of the 2015 breeding season, which was characterized by a lack of resources (manpower and funds) means in combination with a large number of corvids present on the beach and very poor weather conditions. This outcome suggests that it is critical to have more staff present on this very large site in order to implement full protection for the Little Tern at Baltray.

1. Introduction

1.1 Background

The Little Tern (*Sternula albifrons*) is the smallest of the five tern species which breed in Ireland. Having spent the winter off the west coast of Africa, Little Terns migrate to Europe to breed, arriving in Ireland from late April. Little Terns nest on shingle beaches adjacent to sources of brackish water. Access to brackish water is important as they require fresh water fish to feed their young during the first few days of their life. In Ireland the chief prey of Little Terns are small fish and crustaceans, especially sandeels. They feed by plunge diving into shallow water (Gochfeld and Burger, 1996). A clutch of one to three eggs is laid in late May or June. If their first nest fails a pair of Little Terns may breed again in July or, exceptionally, early August. The Little Tern's nest is little more than a shallow scrape in the shingle in which they lay their eggs. They rely on the excellent camouflage of their eggs and chicks to protect them. The incubation period is around 18-22 days (Cramp, 1985). At about 14 days chicks make their first attempts at flight, but do not fully fledge until they are about 20-24 days (Gochfeld and Burger, 1996). Little terns leave their colony in August, departing Ireland before September. Most Little Terns which breed in Western Europe winter in the Gulf of Guinea area (Gochfeld and Burger, 1996).

The Little Tern is the least numerous of the five tern species which breed in Ireland. Numbers of Little Terns declined nationally by 32% from 1984 when 257 pairs were found to 174 pairs in 1995 (Whilde, 1993; corrected in Hannon *et al.*, 1997). A similar decline in the overall population of Little Tern in Britain and Ireland was recorded by the Seabird 2000 census (1998-2002), where a 25% decline was noted since the Seabird Colony Register (SCR) census in 1984-1988 (Mitchell *et al.*, 2004). The European population has also undergone a long-term decline (Fasola *et al.*, 2002), although recent counts show increases in Belgium, Poland, the Netherlands, France, and Germany. Reduced breeding success and subsequent recruitment appears to be the main cause of this decline (Mitchell *et al.*, 2004). Threats to Little Terns include human disturbance, loss of suitable habitat and flooding from extreme tides and storms. Depredation by foxes, hooded crows, magpies, rats and raptors is another significant threat to fragile breeding colonies. In some instances predation can reduce the breeding productivity to zero.

A major and long-standing cause of low breeding success in this species is human disturbance (Lloyd *et al.*, 1975; Fasola *et al.*, 2002, Ratcliffe *et al.*, 2008). Wardening schemes and the use of signs and fences to protect the breeding birds (regularly implemented since the mid-1970s in Britain and 1985 in Ireland) can effectively reduce this disturbance (Medeiros *et al.*, 2007). Recent increases at some Irish sites such as Illauntannig, Co. Kerry (O'Clery, 2007), and not least Kilcoole and Baltray, indicate that nationally the population has recovered somewhat. Seabird 2000 recorded 206 apparently occupied nests (AONs) in Ireland (Mitchell *et al.*, 2004). However, a co-ordinated national tern survey is needed to clarify this. To place the Irish breeding population in context, Seabird 2000 (1998-2002) found that 10% of the Little Tern population of Britain and Ireland breed in Ireland, which represents 1.0-1.2% of the European population, and 0.2-0.5% of the estimated world population (Mitchell *et al.*, 2004). The Little Tern is not considered to be threatened globally but many local populations are declining (Gochfeld and Burger, 1996).

The Little Tern is listed as an Annex 1 species in the EU Birds Directive (79/409/EEC), thus requiring member states to take special conservation measures to ensure the survival and breeding success of this species. It is also classified by BirdLife International as SPEC 3, that is, 'a species with global populations not concentrated in Europe, but which have an unfavourable conservation status

in Europe' (Tucker and Heath, 1994). On a national level in Ireland it is classified as both a rare and localised breeder (Coveney *et al.*, 1993) and a vulnerable species (Whilde, 1993). It is currently amber listed by BirdWatch Ireland and the RSPB (Royal Society for the Protection of Birds) (Lynas *et al.*, 2007), indicating that this species is of medium conservation concern. The Little Tern is fully protected under the Irish Wildlife Act (1976, Amended 2000).

1.2 Little Tern colonies in Ireland

Little Terns form relatively small colonies along the west and east coasts of Ireland, with 14 of the 24 colonies found in 1995 on coastal islands and 10 colonies on the mainland coast. On the east coast there are colonies from Wexford northwards to Louth, and on the west coast from Kerry to Donegal (Hannon *et al.*, 1997). The breeding population of Little Terns on the west coast is largely unknown due to the inability to survey key sites such as the Magharee Islands in Kerry (Tony Murray, pers. comm.). It is thought that there may be 150 pairs on the west coast but little is known about their breeding success. Suddaby (2012) reported that only 3 young were fledged from 96 incubating adults on the Inishkea Islands in Co. Mayo due to heavy predation from Common Gulls (*Larus canus*).

Primary sites on the east coast that have recently supported colonies of breeding Little Tern are Baltray (Co. Louth), Kilcoole/Newcastle (Co. Wicklow) and the Raven and Wexford Harbour (Co. Wexford). The North Bull Island (Co. Dublin) had up to 80 pairs in 1987 but is no longer used by Little Terns due to high levels of recreational disturbance. Up to 20 Little Terns were present at the North Bull Island at the start of the 2013 breeding season however no breeding attempts were observed due to the continuing high levels of disturbance (Niall Harmey pers. comm.) A similar situation prevails at Buckroney (Co. Wicklow) and Portrane/Rogerstown (Co. Dublin). However, in 2011 five pairs were seen prospecting at Buckroney but no exact details on nesting attempts or success were received (Richard Nairn, pers. comm.). This follows an anecdotal report from two members of the public that a pair of Little Terns bred successfully at here in 2010 raising two chicks. Successful breeding by a single pair has also taken place at Portrane/Rogerstown each year from 2009 to 2013 (Julie Roe and Niall Harmey pers. comm.). This year 3 pairs were present at the Rogerstown Estuary Nature Reserve throughout the breeding season, however only one pair bred successfully and were seen with a single fully fledged chick (Niall Harmey pers. comm.).

The sandy beach at Cahore, north Co. Wexford, was also a traditional nesting site for the Little Tern, but was not thought to have been used for a span of 15-20 years (Anthony McElheron, pers. obs.). In 2005, approximately 40 nesting pairs were discovered at Cahore and that year breeding was successful with a minimum count of 80 adult birds and 10 fledglings on the last day the site was visited (Helen Boland, pers. comm.). Despite extensive searching between Cahore and Tinnaberna in 2010, no Little Terns could be found in this area, possibly as a result of the increased recreational use of quad bikes and horse riding along that section of coast (William Earle, pers. comm.). In 2012 a minimum of 65 Little Terns were found by the Kilcoole Little Tern wardens between Cahore Point and Ballinoulart on 28th June, however there was no breeding evidence and high levels of disturbance (Keogh *et al.*, 2012).

In 2009, 20 Little Tern nests (with 2 eggs each) were found incidentally at an apparently newly occupied site (grid ref. T119232, OS map 77) near Raven Point in southeast Wexford (Helen Boland, pers. comm.), the number of breeding pairs may have been greater than this, but it was not possible to search the whole area. Since then, the Marram Grass (*Ammophila arenaria*) covered sand bank island off Rosslare Backstrand (close to the site of the famous 'Tern Island') has become extensive enough to once again support a colony of breeding Little Terns. In July 2010, up to 30 adult

Little Terns and 10 fledglings were seen on 'New Tern Island' (Paul Kelly, pers. comm.) but it is unclear as to whether these birds nested on the island in question or nearby at Raven Point. However, in 2011, flocks of up to 200 adult Little Terns were noted over 'New Tern Island' in June with a brief census of the colony there on 29th June revealing that approximately 70-90 pairs were indeed nesting with a mean clutch size of 1.95 from 27 nests sampled (Chris Wilson and Tony Murray, pers. comm.). In 2012, a record total of 124+ nests (mean clutch 2.27) on 'Tern Island' were washed away by bad weather during the first weekend in June (D. Daly & T. Murray, pers. comm.). Some of these may have attempted to re-nest on the Dogger sandbanks, just off Raven Point but it is thought that these were overwashed again a week or so later (D. Daly, pers. comm.).

The Little Tern has been recorded breeding at Kilcoole/Newcastle since at least 1879 (O'Briain and Farrelly, 1990). By the 1980s breeding success at the colony was consistently low due to predation and disturbance. In response to this, the Little Tern protection scheme was set up in 1985. The colony has experienced several years of high productivity as a direct result of the scheme, notably in 1989 when 68 fledglings were produced, and more recently 2003 – 2005 and 2008 - 2010. Other years have not been as successful; despite a high number of breeding pairs (106) and high initial productivity (178 chicks hatched) in 2006, the colony was later devastated by foxes such that only 21 chicks fledged (Lynch *et al.*, 2006). Again in 2007 high levels of predation resulted in only 31 chicks fledging (O'Connell *et al.*, 2007). Since 2008 however, numbers of pairs and fledged chicks have been increasing despite initial heavy losses at times. In 2008, 74 breeding pairs fledged 130 chicks (Cockram *et al.*, 2008), 50 pairs fledged a total of 80 chicks in 2009 (Hall *et al.*, 2009) whilst in 2010, 66 pairs fledged 115 chicks (Keogh *et al.*, 2010). In 2011 99 pairs fledged 155 chicks (Keogh *et al.*, 2011). There was zero productivity at Kilcoole in 2012 due to the site being washed out by two severe storms in June and experiencing heavy hooded crow predation (Keogh *et al*., 2012). There was some recovery in 2013 with 45 pairs fledging 75 chicks (Keogh *et al*., 2013). A very good year was experienced in 2014 with xx pairs fledging xxx young. The success of the long term wardening effort at this site can be seen in the fact that Kilcoole/Newcastle is probably the only site on the east coast to have attracted nesting Little Terns every year since 1984 (Farrelly, 1993).

1.3 Little Tern Colony in Baltray

Historically the Little Terns at Baltray have undergone a series of extremely poor breeding seasons interspersed with productivity hovering just above zero. Attempts were made to monitor the site from 1984 onwards, with observers noting that Little Terns continued to attempt to breed at Baltray but that breeding success was very low (Larry Lenehan, pers. comm.). Principally, breeding productivity of the colony was hampered by a combination of disturbance and predation by a range of nest predators. It is from this point that the project at Baltray began in 2007, run by a team from the Louth Nature Trust spearheaded by Sandra McKeever and Margaret Reilly, with the help of funding from the Heritage Council and NPWS. The implementation of wardening by dedicated volunteers, in conjunction with fencing to protect the colony, led to a dramatic improvement in the breeding success of the Little Terns at Baltray. In 2007 21 pairs fledged 41 chicks (McKeever and Reilly, 2007) and in 2008 25 pairs fledged 29 chicks (Reilly, 2008). In 2007 and 2008 the project didn't have sufficient funding for paid night wardens and suffered heavily from depredation by Hooded Crows (*Corvus cornix*) (2007) and gull spp. (*Larus spp.*) (2008). The project reached its peak success in 2009 and 2010 when funding from both the NPWS and Heritage Council helped pay for wardens to cover the entire night, providing the colony with 24 hour protection. In both 2009 and 2010 43 pairs

bred fledging 94 and 96 chicks respectively (Reilly, 2009; 2010). In 2011 withdrawal of NPWS funding meant that 24 hour wardening could not be provided, leading to the predation of 37 eggs, mostly between 11 pm and 4am when wardens were absent. However 2011 was still very successful with 49 pairs fledging 84 chicks (Reilly, 2011). 2012 proved to be a difficult year as extremely inclement weather lead to the loss of 41 eggs to spring tides and 45 eggs were depredated by a fox in the early hours of 17/06/2012 before the night warden arrived, therefore only 33 pairs fledged 24 chicks (Reilly, 2012). This was the worst breeding year experienced by the project so far, however given the very poor conditions for breeding in 2012 even 24 fledged chicks was a significant achievement and a testament to the hard work of the project wardens. This is especially true considering that Kilcoole experienced zero breeding success in 2012 due to similar circumstances (Keogh *et al*., 2012).

The 2012 breeding season illustrates the importance of the Little Tern protection scheme at Baltray. Since the Little Tern protection scheme at Kilcoole was set up in 1985 the breeding success of Little Terns on the east coast has been largely dependent on this one site. Such heavy dependence on one site would leave the east coast population very vulnerable if Kilcoole were to suffer a number of disastrous washout years such as they experienced in 2012. The upturn in fortunes in the Little Terns breeding in the vicinity of Wexford Harbour has helped to alleviate this problem, however this site does not enjoy the intensive protection enjoyed at Kilcoole and breeding success has been more intermittent. Therefore the setting up of a second intensively wardening Little Tern protection scheme at Baltray has been vitally important. It is helping the Irish Little Tern population to grow as well as reducing the dependence on a single breeding site.

2013 and 2014 were very successful years with respectively 102 breeding pairs, 203 hatched chicks and 193 fledglings, and 150 nesting attempts, 170 hatched chicks and 91 successfully fledged Little Tern chicks.

1.4 Project Aims

The principal aim of the Little Tern Protection Scheme is:
"To ensure the survival and breeding success of Little Terns at Baltray by minimising disturbance by humans and predation, in order to fulfil Ireland's legal obligations under the EU Birds Directive".
Strategies employed by BirdWatch Ireland in order to achieve this aim are:

- To promote awareness amongst the visiting public, in order to seek their co-operation in minimising human disturbance.
- To create physical barriers to prevent predators accessing nest sites, where possible.
- To maintain surveillance in order to achieve the early detection of predator threats, and take appropriate steps to prevent loss to predators.
- To monitor the breeding performance of the colony, in order to measure the success of the project and increase our knowledge of Little Tern ecology.

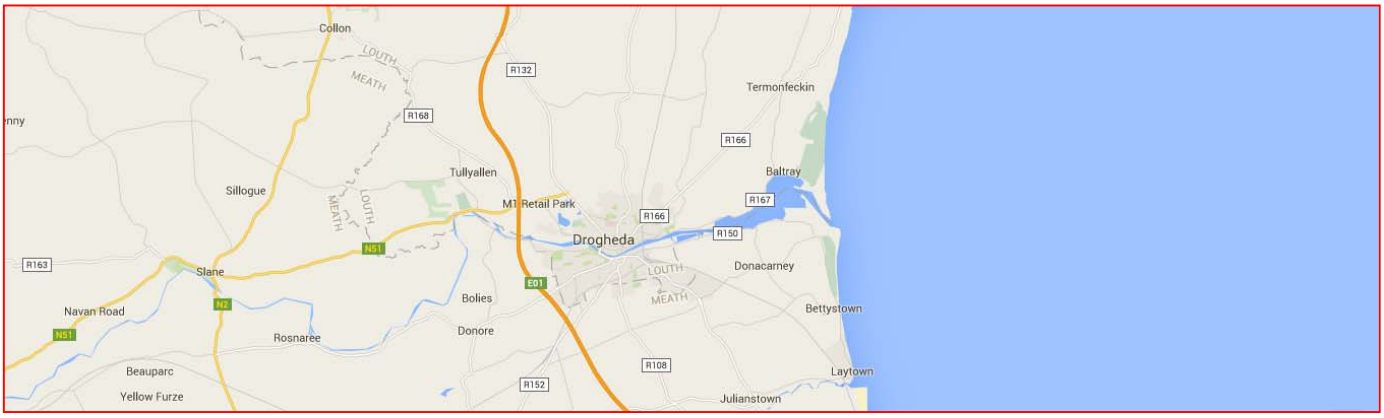


Figure n°1: Baltray beach localization (sources: www.routard.com & www.googlemaps.com)

Figure n°2 : Little Tern nesting attempts at Baltray in 2015 (buffer fence in orange; electric fence in violet; the red nests are those where at least one chick hatched, all the black nests were depredated or washed out by the tide).

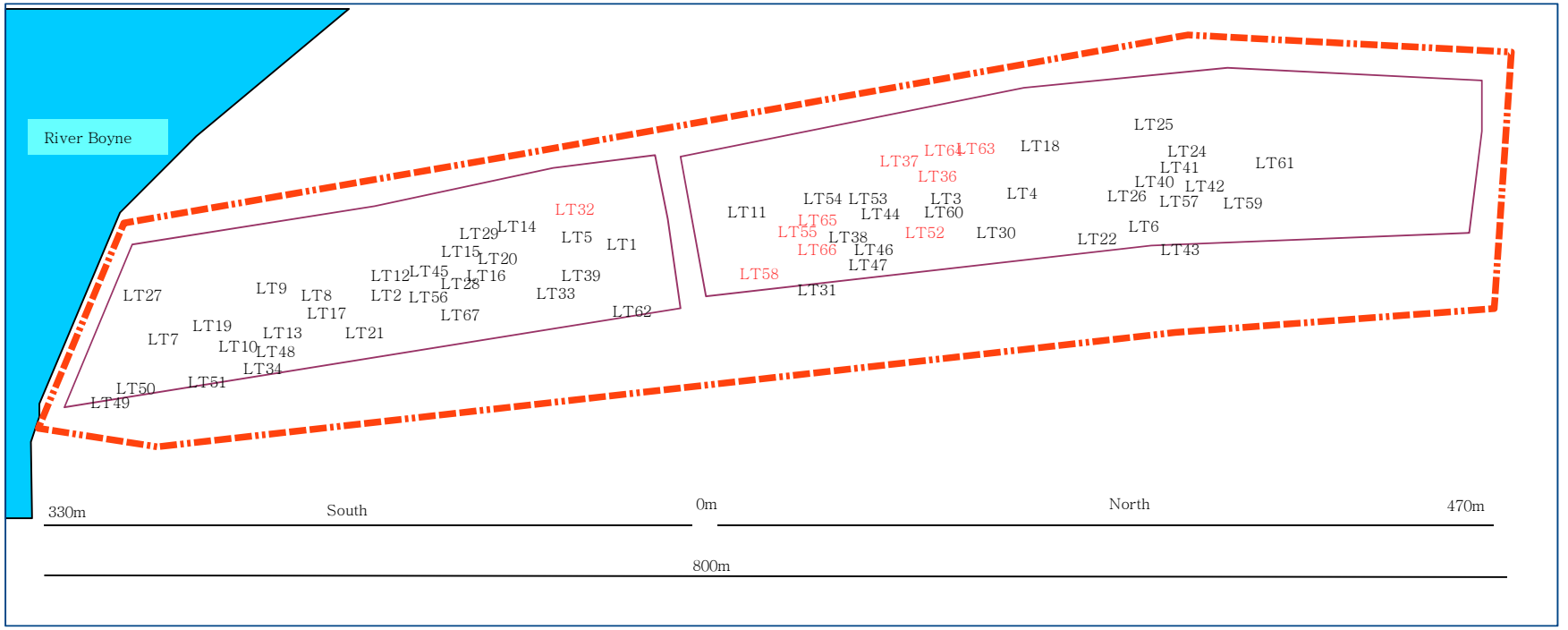
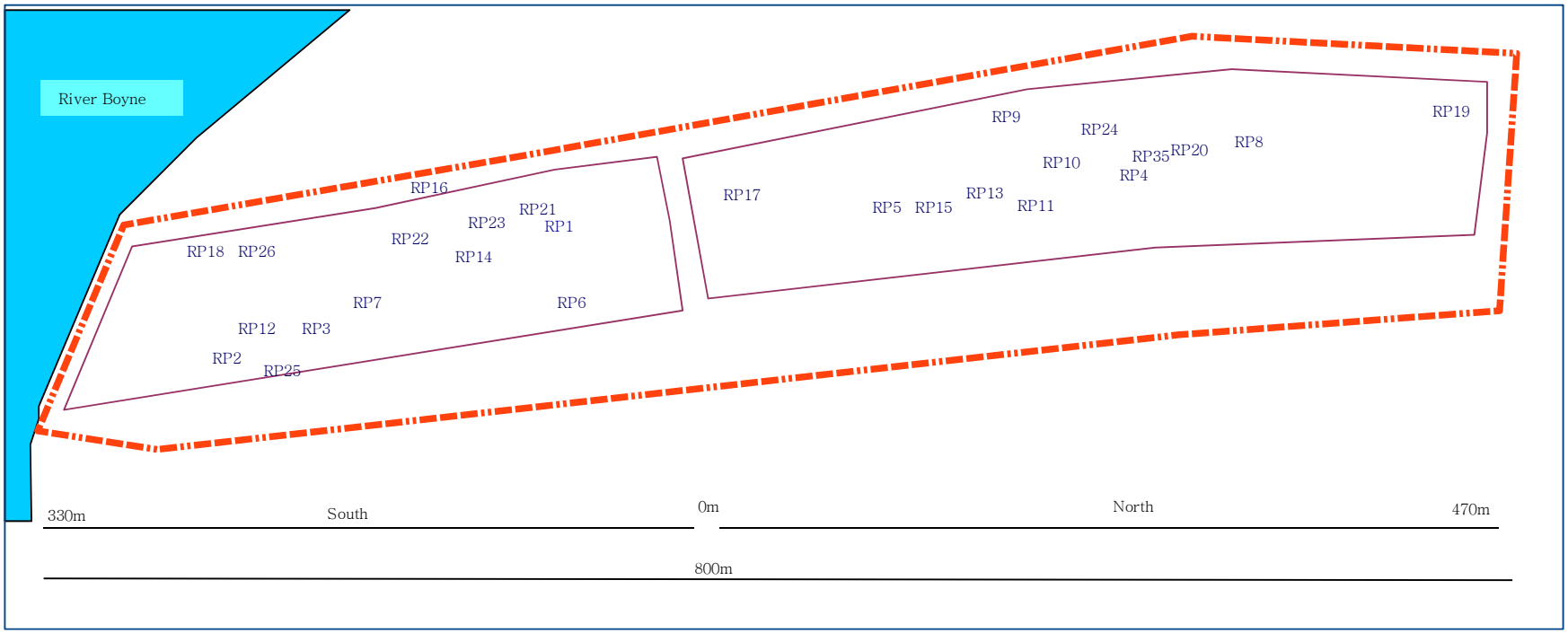


Figure n°3 : Ringed Plover nesting attempts at Baltray in 2015 (buffer fence in orange; electric fence in violet).



2. Methods

2.1 Study Site

Little terns at Baltray breed in an area known as the Haven. The colony is situated within the boundary of the Boyne Coast and Estuary Special Area of Conservation (SAC) and the Boyne Estuary Special Protected Area (SPA). Little Terns have very specific requirements for nesting and this area is suitable because of the presence of a ridge of shingle and its proximity to the river Boyne. As a consequence of winter storms, the beach at the Haven changes dramatically year on year. A combination of embryonic dune formation, vegetation encroachment and wave dynamics act together to shape the topography of the area. The nesting site was considerably larger than in 2013 and 2014, approximately 850m long x 50m wide, the largest the nesting area has been since the project was initiated (see colony map, page 6).

The Baltray site is hugely tidal, with a tidal range of c.300m between the Mean High Water (MHW) and Mean Low Water (MLW) mark. The nesting area stretched from the MHW mark c.50m inland, though much less in certain areas. From the MHW there was c.20m gently sloped sand/small shingle followed by a c.10m transitional zone of mixed sand/medium shingle straddling a ridge which marked the beginning of the vegetation line and embryonic dune formation dominated by Marram Grass (*Ammophila arenaria*) and Sea Lyme Grass (*Elymus arenarius)*. In some sections of the colony the nesting area extended another c.20m into an area of large shingle mixed with patches of vegetation, though in much of the colony the vegetation was too thick. A track runs along behind the breeding area, separating it from the dunes, and is used to service the colony during the setting up and taking down of the fence.

To facilitate the wardens and volunteers life on site, a portaloo was rented in 2015. The day wardens lived onsite in caravans provided. These facilities are vital to the running of this project.

2.2. Monitoring

Regular day wardening was initiated on May 26th and continued till the end of July. The day wardens were responsible for wardening the beach from 06:00-22:00 and were relieved at intermittent periods during the course of each working week when possible by volunteers. This role was filled by Amélie Boué on an average of 5 hours a day during the project period. From the 9th June to the 21th of July, Andrew O'Donoghue joined the project as a day warden for 3.5 days a week.

The warden's daily routine consisted of locating new nests and monitoring existing nests for the presence or absence of incubating birds. Nest visits were made to check the number eggs and/or chicks present. In addition to Little Terns, Ringed Plovers (*Charadrius hiaticula*) which nested within the colony were monitored in the same way. A daily log was kept, where details of personnel present, weather, tides, work done, tern activity, nest status, disturbances, visitors and all wildlife observations were recorded. Nest data tables were kept outlining the progress and due hatching dates for each nest. However, as entering the colony (beyond the string fence) causes disturbance which may result in nests being abandoned, every effort was made to coordinate activities so that visits into the colony were minimized. The colony was never entered in adverse weather conditions (during rainfall, high winds or fog). In addition to these duties, the wardens were responsible for erecting and maintaining the colony fence.

Night duty was initiated when on June 15th and continued until 23th of July. This was conducted by Tony Glass (Monday and Tuesday), Will Connell (Wednesday and Sunday) and James

Wilton (Thurday to Saturday). The night wardens covered the hours between 22:00 and 06:00 with one hour break between 2:00 and 3:00. This provided protection to the Little Terns was thought to be close enough to 24 hours.

The value of 24 hour protection was shown by the huge success of the 2009 and 2010 breeding seasons (Reilly, 2009; 2010). The night wardens' duties are focused on monitoring nocturnal predator activity and implementing control measures, if necessary.

2.2.1. Tern Numbers

The number of adult Little Terns present at the colony was recorded as often as possible by the wardens, and at the end of each day the maximum number was entered into the daily log. Counts were conducted during full dreads, when the birds were flushed or when they were counted roosting at high tide along sandbars in front of the colony using a telescope during good weather; this was noted separately when it occurred.

Once chicks started to fledge, separate counts were made for fledglings to give an idea of productivity. This estimate decreases in accuracy after the first 2 weeks however, as fledglings begin to leave the colony around 2 weeks after fledging (Keogh *et al*., 2011). Therefore fledgling counts are not used to estimate the total number of fledglings produced in a breeding season, however they are a useful monitoring technique as very low fledgling counts may indicate that chicks are being heavily depredated. Survey methods for fledglings consisted of counts at high tide when the majority of the Little Terns roost together along sandbars in front of the colony. These counts were undertaken during calm and clear weather when fledglings can easily be distinguished in amongst a flock of adults.

2.2.2. Nest Locations and Observations

Binoculars and telescopes were used to monitor tern activity and locate nests within the colony. Birds observed courtship feeding, courtship displaying, aerial displaying, copulating, making nest scrapes or incubating were noted. When it became apparent a bird was incubating, an exploratory visit was made to locate the nest. Nest contents (i.e. number of eggs), approximate distance along the fence-line and approximate position in the colony were noted.

The nest substrate was categorised as either soft open sand, fine shingle (that where particle size average is less than 2cm) or coarse shingle (shingle with particle sizes average of 2cm or more in width up to the size of small rocks) The nest was marked by writing an ID code on a stone which was then placed upright 1m in front (inland) of the nest. Nests were coded as follows: Little Tern (B *n*, where *n* is the number of the nest in the order found) and Ringed Plover (RP *n*).

In addition to this, a marker stone showing the nest ID was also positioned along the electric fence. Furthermore, a crude judgment of distance of the nest from the warden's path to the seaward section of fencing, using a Close (C), Middle (M) or Far (F) denotation, was noted along with whether the nest was visible (V) from the path or not visible (NV). This allowed the nests to be coded (e.g. B48, MV), thus the approximate location of the nest could be estimated to facilitate nest check and nest observations. For nests that were not visible straight out from the path a second marker stone was placed in 1m from the nest facing an angle from which it could be viewed. Two elevated platforms were erected to facilitate monitoring this year. One was in front of the South part and the other one in front of the North part of the colony. These two towers were very useful and gave a much better view over the area to observe terns and detect predators more efficiently.

All nests were observed daily for presence or absence of an incubating bird, thus allowing identification of abandoned or depredated nests. Viewpoints were set up in the dunes and on the seaward side of the colony in locations from which multiple nests could be viewed to minimise disturbance by removing the need to view each nest individually from the electric fence. Twelve of these viewpoints were set up during the project.

When a clutch did not increase in size over three consecutive days, or when a third egg was laid, the clutch was considered complete. To minimise disturbance nests were not visited after clutch completion unless the incubating adult had not been observed incubating. Some nests were very hard to view incubating from any angle, but if its scrape was still being maintained this indicated that the nest was still active. Hatching dates were predicted where clutch completion was known, and daily nest visits were resumed at this point to check for hatching. All details were recorded on the individual nest identification sheets. In order to keep track of active nests a summary table was compiled to record daily nest visits and chicks re-trapped. The data recorded here was the number of eggs or chicks per nest, and whether any predation incidents had taken place (Table 1). These details were confirmed each evening and allowed the warden on duty to identify which nests needed to be checked without having to go through the individual nest record sheets.

2.2.3. Biometrics and Ringing

Chicks were fitted with a British Trust for Ornithology (BTO) ring (size B+) on their left leg. Baltray chicks were ringed on their left leg to distinguish them from Kilcoole chicks which were ringed on their right leg. All Little Tern chicks were ringed in or near the nest scrape meaning that their nest of origin and exact ages were known when they were subsequently re-trapped on the foreshore. Day of hatching was allocated as Day 0, such that a 1 day old chick was one that hatched on the previous day.

A green plastic darvic colour ring was fitted on the right leg of older chicks. Kilcoole Little Terns were colour ringed on their left leg. On each ring was a unique three figure alpha-numeric code. The ring was always applied so that the “I” of the code was nearest the foot. Chicks could only be colour ringed once their tarsus was long enough, so concerted efforts were made to catch chicks of over a week old. Each chick had to be assessed on an individual basis, however, to see if its tarsus was sufficiently developed.

The wing length of each chick was measured (maximum wing chord) to the nearest 0.5 mm using a stopped rule (Redfern and Clark, 2001). All chicks were weighed using a balance to the nearest 0.5g. These measurements were used to study the growth of the Little Tern chicks. Once the majority of chicks had left their nest scrapes, the area of foreshore along the colony was searched most days (weather permitting) for chicks. Re-trapped chicks were identified by ring number and measured. Re-trap data was used to create average growth curves and monitor chick development.

2.2.4. Diet Study

The aim of the dietary observations was to investigate the food types and the size of food items that were offered to Little Tern chicks of varying ages. Hatchlings through to fully fledged chicks were targeted. The date, time, chick age, food type, food item size and whether the chick accepted the proffered food were recorded for each feeding event. Each event was recorded as "food offered" whether the chick accepted it or not. By recording the time, the approximate number of feedings per hour could be estimated.

Chicks up to seven days old could be observed at or nearby the nest using a telescope. The chick age was known from its nest. Each nest/nest area was observed for one hour at a time. The food type was identifiable by eye and the food length was deduced by comparing it to the length of the bill of the adult Little Tern. Thus food size was measured in "bill-lengths", with one unit equivalent to the length of a bill. It was possible to observe several nests during one observation period.

When the chicks moved away from the nesting area, it became necessary to search the colony area by sweeps with the telescope. Once they had been located, however, observing the diet was done using the same method as with younger chicks. Chicks aged 10 to 15 days could be aged by identifying their ring number before or after the observation period. This involved re-trapping the chick due to the difficulty in reading the rings on mobile chicks. Because chicks of this age are quite mobile, only one or two sets of siblings could be observed simultaneously.

Chicks within the age bracket 15 to 20 days and bracket 20 to 28 days were identified by the progression of their juvenile plumage, particularly the growth of the black cap. These chicks were observed with the same methods as before and also remained in sibling groups. Fully fledged chicks aged 28 days or older were easily recognisable by their plumage, size, behaviour and posture. These chicks were located by sweeps with the telescope on the sandbars. They were observed in the same way as before, although observation periods were often cut short if they flew off.

2.3. Conservation Measures

2.3.1. Use of Fences

The entire site was observed for a week after the Little Terns began prospecting to see which areas they were favouring. They were using the entire shingle area, and it was decided to enclose most of it starting from close to the Boyne wall and stretching northward, to reduce the probability of breeding failure caused by mammalian predators and to protect them from human disturbance. The fencing was principally erected on May 16th and May 23rd by DH, SN and a team of volunteers. The warden (AB) fine tuned the system once in place early the following week

A string cordon was put on the outside the nesting area, enclosing an area of approximately 850m by 75m. To make the cordon pigtail stakes were used along with blue baler twine on the inland side and 8' wooden posts were used on the seaward side, as the latter could endure the tides. Coloured streamers were attached at intervals to make it more visible to the public. The string cordon went well further north than the actual nesting enclosure, this was very useful as it acted as a buffer zone so that people and dogs were well away from the nesting terns when they approached from the north side of the beach. The nesting area was divided into two zones and each zone was enclosed separately, leaving a walkway between them. These zones were created using 5’ posts and 1m high plastic mesh cable tied to the fence posts. The mesh was curved outwards and had sand shovelled onto it to partially bury it and deter burrowing predatory animals. The mesh used was mostly saved from the 2012 project, with some new mesh. The northern zone was longer (c 470m)

than the southern zone (c.330m). Both zones were c.50m wide. The walkway led almost straight out from where the caravan used as the project office was situated, facilitating wardens and volunteers in quickly reaching beach goers on the foreshore. Green plastic mesh was used on the all but the east (seaward) side of the enclosure. This made repair of storm damage easier and also allowed chicks to leave the fenced area. To prevent avian predators using the wooden posts as perches, inverted cut plastic bottles were attached on top of each post. Consequently if a bird attempted to land, the bottles would not support their weight. This worked very well as a deterrent.

Both of the enclosed zones were fenced with electric fencing, using four rows of six strand wire. Plastic electric fence posts were used and these were easily inserted into the sand immediately outside the plastic mesh. Three strands of electric fence wire were placed on the three lowest rungs of the posts and one was placed on the highest rung. The plastic posts were attached to wooden posts at intervals to strengthen them. Both of the zones had separate electrics fencer units and earthing rods and these were securely placed in waterproof boxes and buried beneath the sand. Over-ground switches were discretely wired from the fencer to wooden posts and these were used for turning them on and off. The electric fence was on at all times and checked at least once every day. If any debris was earthing the electric fence wires it was removed. The bottom electric fence wire had to be dug up and retensioned after inclement weather as sand shifted by the wind could bury it. When the voltage was seen to be dropping the warden replaced the battery.

An extension was made of green mesh fence from the southern closure to bring it to within 5m of the sea wall. This was done to protect several nests which had set up in the buffer zone to the south of the colony. The electric fence was not extended.

The spring tides damaged the fence, particularly in June (1st to 8th of June) with very strong wind on the 1st of June knocking segments of the east electric fence and causing it to become tangled in lumps of seaweed. This put the electric fence out of action for several days, leaving the colony exposed.

Between July 29th and August 4th, with the help of volunteers, began to pack up the fencing. Dominic Hartigan's assistance to the project in helping take up the fence, removing the material and storing all fencing material and the project caravan in his yard was invaluable.

2.3.2. Use of Signs

Several types of information signs were available for deployment. These included basic information signs regarding the Little Terns, protected area signs, warning signs for the electric fence and chicks on the foreshore signs. To cater for non-English speaking people, some were designed using symbols and pictures. These were erected at all entrances to the area, on the northern end of the beach and all around the nesting enclosure. Two large 1m x 1m full colour interpretative signs were erected, one at the end of Baltray village at the approach to the Haven and the second further on at the main parking area beside the locked gate. Signs were also placed on stakes by the entrance to the colony site and by the project portaloo.

As the use of the beach increased during the warm weather in July, a line of stakes with additional signs were placed along a sandbar (which protected them from the tides) to the north of the colony and at a stile by which many people access the beach. This proved very successful at cutting down on the number of people who attempted to walk along the foreshore.

2.3.3. Nest Moves

Nests in danger of being washed out by the tides were moved further inland. At least a day before a nest was moved conspicuous rubbish (discarded blue rubbers glove etc.) was placed behind and on either side of the nest to give the parents something to orientate themselves by. When the nest was moved the rubbish items were moved in relation to it. The eggs were placed in a new scrape less than one metre away from the original scrape. A picture was taken of the nest site and every effort was made to exactly mimic the arrangement of shells etc. around the nest. If a parent bird failed to relocate its newly positioned nest within 20-45 minutes (depending on the weather conditions) the nest was moved back to its original position.

2.3.4. Chick Shelters

A total of 20 chick shelters were provided this year, consisting of palettes and plastic piping half-buried in the shingle, camouflaged with pebbles, seaweed & debris. They were placed throughout the colony when the first chicks began to hatch, concentrated where clusters of nests were present. The majority of chick shelters were located on the mid-section of the beach or near the seaward fence as most chicks were moved towards the foreshore by their parents after a few days. Several chick shelters were utilised regularly by some of the older chicks from mid-June onwards, particularly during periods of inclement weather or when the mid-day sun was at its most intense.

2.3.5. Predator Management

Little Terns are very vulnerable to predators when breeding. In addition to the protection afforded by the fencing, the wardens and volunteers made every effort to scare away any potential predator away. Just the presence of humans at the colony helped keep most predators at bay. This year the predator management focused on Hooded Crows (*Corvus cornix*) and Rooks (*Corvus frigilegus*), Red Foxes (*Vulpes vulpes*) and Kestrels (*Falco tinnunculus*) for which specific preventative actions had to be taken.

Hooded Crows were major predators of Little Tern nests in 2007 (Reilly, 2007) and Red Foxes were major predators in 2011 and 2012 (Reilly, 2011; 2012), so the vicinity of the colony was closely monitored for these species. Hooded Crows or Red Foxes which were considered a danger to the colony were removed under license. Kestrels are noted predators of Little Tern chicks and have taken a large number of fledglings at Kilcoole in certain years (Hall *et al*., 2009; Keogh *et al*., 2010, Egerton & Newton, 2014). Therefore noise deterrence was used to disturb Kestrels hunting in the vicinity of the colony.

2.4. Public Awareness

2.4.1 Interaction with beach users and group talks

A daily effort was made to increase public awareness and appreciation of the Little Tern. This was carried out by talking to walkers and, when possible, showing them an incubating adult or chick through a telescope. When beach users were seen to be walking along the foreshore in front of the colony, or were in danger of entering the colony, they were approached by wardens, informed about the Little Tern colony and politely directed away from the colony.

A hiking group of 35 persons visited the site on July 4th. They were given a talk outlining the Little Tern protection scheme. This talk was well received and much appreciated by all of those who attended.

2.4.2 Media Coverage

The project was featured in a local newspaper, the 'Drogheda Leader', on June 4th and 10th (Appendix 2). It featured an outline of the project, an interview with warden Amélie Boué and an appeal for further volunteers. This was successful enough, with several people subsequently contacting the wardens about volunteering. The project also featured in the interview of Niall Keogh published in the Irish Times on the 4th of July. This included a mention of the tern colonies managed by BirdWatch Ireland (including Baltray).

2.4.3 Website & social media

A weekly blog was uploaded to the Little Tern section of the Louth Nature trust website (www.louthnaturetrust.org) to provide updates of the week's events at the project site. The site appeared to receive arounds 2500 hits in July and about 100 visits per day with peaks of around 200 in August

Figure n°4: Unique visitors to have viewed the Louth Nature Trust website during August 2015.

Louth Nature Trust (LNT) also has an active Facebook page which was used regularly to create awareness, promote support and share information about Baltray's Little tern Conservation Project. LNT's Director Cathal Johnson invited the day warden to become an administrator of the page and, this greatly facilitated weekly posting on the page and ensured that a wider audience was reached Most of the posts directed people to the blog on LNTs website. Long term volunteer Matt Byrne was very involved in taking photographs and posting them on LNT's Facebook page. He is also an administrator of the page.

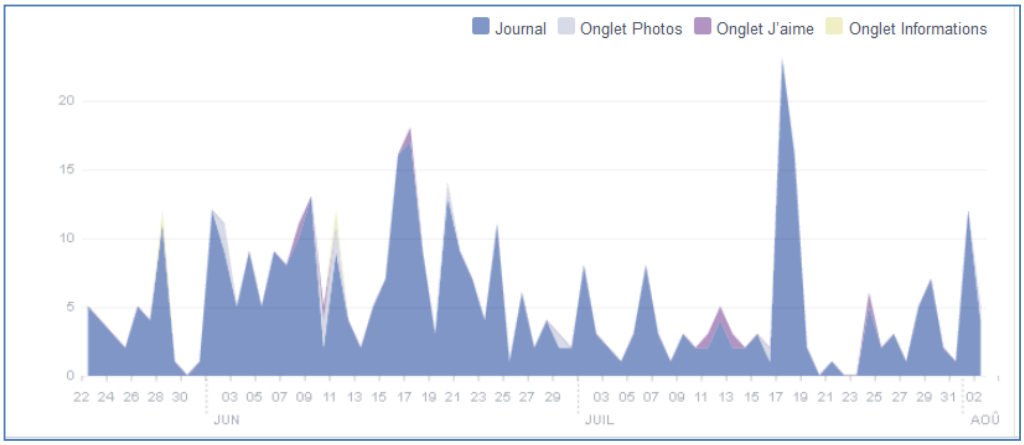


Figure n°4 :Louth Nature Trust Facebook page activity from: 22th May until 2d August 2015

Sixty new persons liked the page over the same period of time.

3. Results

3.1 Weather

A daily synopsis of the weather for this season can be found in the daily logs, available on request from BirdWatch Ireland. In brief, the weather during 2015 was relatively cold, wet and windy. The conditions were poorer than the previous years, and somewhat unfavourable for the Little Terns especially soon after their arrival.

Temperatures

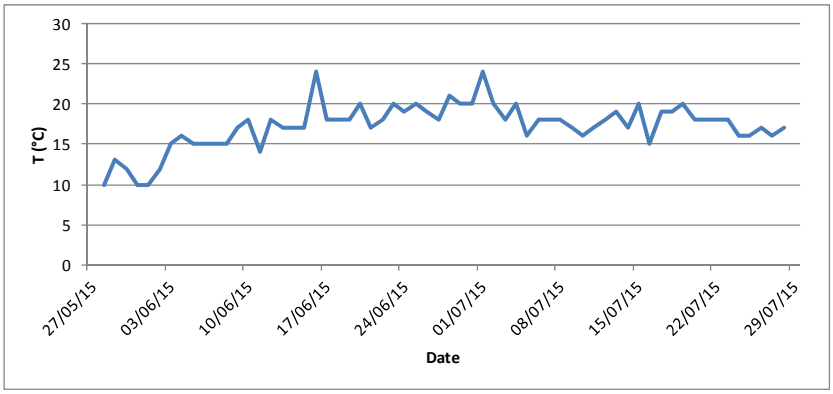


Figure n°5 : Temperatures recorded at Baltray from 28th May to 28 July 2015.

Maximal temperatures remained between 15 and 20 most of the season, with 3 dates where it reached 21 and 24 °C.

Winds

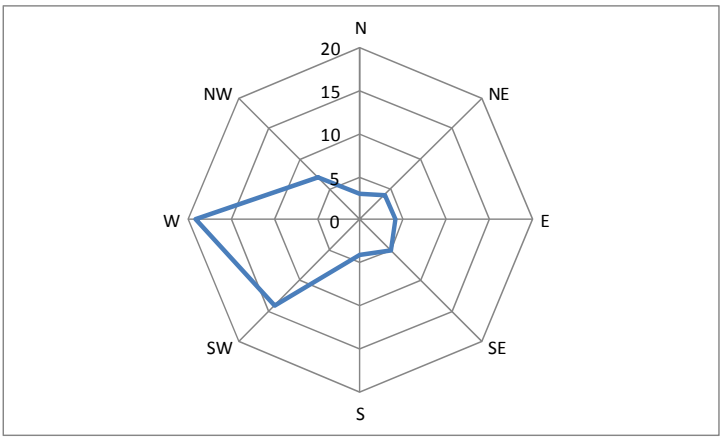


Figure n°6: Wind directions recorded at Baltray from 28th May to 28 July 2015 (in number of days).

On most of the days Western or Southwestern winds were recorded. The season was rather wet with 20 days of recorded rainfall, sea fog came in on one occasion (3rd July). Strong South/Southwest winds occurred on the 1st June, up to 80 km/h. These strong winds were coincident with high tides and badly damaged the fences.

3.2 Tern Numbers

An average count of approximately 64 adult Little Terns was recorded daily in the colony. The main method of counting was dread counts. Dreads typically consisted of 50 to 100 terns. A maximum count of 139 adult Little Terns occurred on the 19th of July. The same number of Little Tern was observed on the site around the 22nd May, when then fences were settled, 5 days before the day day wardening started.

The number of adult Terns increased in late May but then strongly decreased in June (Figure 1). It increased again in July to reach its maximum. The first egg was discovered on May 28th and the number of active nests continued to increase for the rest of May and through June (Figure 7). The first nest hatched on July 2nd. The number of active nests decreased from this date as they hatched. As chicks fledged, there was a drop in Little Tern numbers as some of the population began to move around the eastern coastline. In July, the population increased once again as large numbers of adult Little Terns began to gather in loafing flocks before migration. In mid-July, numbers decreased as Terns began migration. Less than 10 Little Terns were present by the start of August.

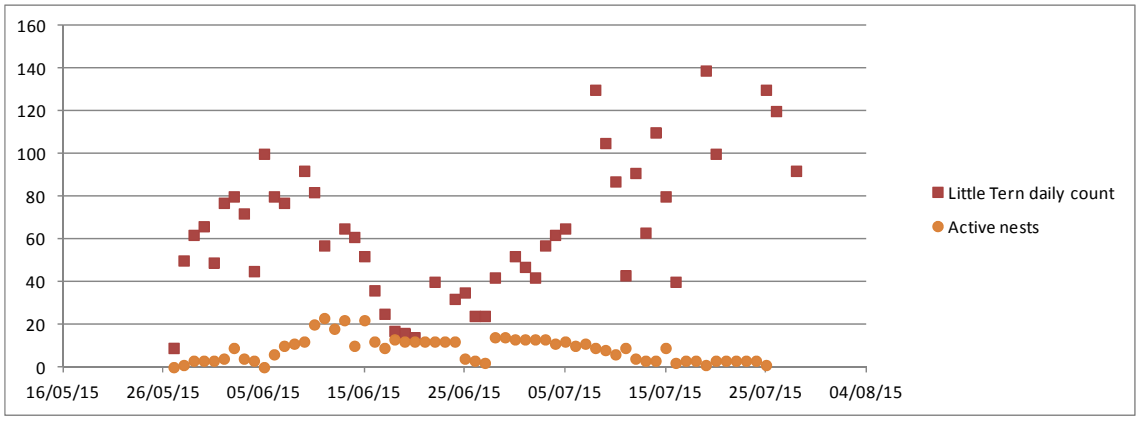


Figure n° 7: Average Little Tern flock size (red squares) and the average number of active nests (orange circles) per week at the Baltray colony from 28th May to 28th July 2015

3.3 Breeding pairs

Accurately calculating numbers of breeding pairs becomes a challenge once significant depredation or loss has occurred at the egg stage in a Little Tern colony.

The number of breeding pairs can be deduced using two formulas that take in the fact that Little Terns, on average, take 7 days to re-lay after they have lost a nest at the egg stage. So an estimate of between 24 and 26 was made (first formula: maximum number of nests on July 11th (n=23) including those depredated that day + any nest depredated 7 days previous to this (n=3) = 26 breeding pairs; second formula: maximum number of nests on July 11th (n=23) including those depredated that day + any nest depredated 4 days previous to this (n=1) + any nest gained 3 days after this (n=0) = 24 breeding pairs).

Using this estimate, the comparative number of breeding pairs in 2013 and 2014 was much higher (respectively, 102 and 111 breeding pairs).

3.4 Pattern of nesting

Scrapes occurred throughout the northern and southern enclosures, with respectively 32 and 35 nests. As was observed in 2014, both enclosures were used by the birds. Some of the nests were laid quite late and could have been re-lays.

Several nests were located outside the electric fence in the last days of May. They were all washed out by the tide on 1st June. Later, B58 was successfully moved to the inside of the fence.

Most scrapes were on the flat beachfront, but some were further up the beach into embryonic sand dunes As it was observed during the previous years, most of the nests were in fine shingle or sand substrate. A few of them were in coarse shingle or on collected shells.

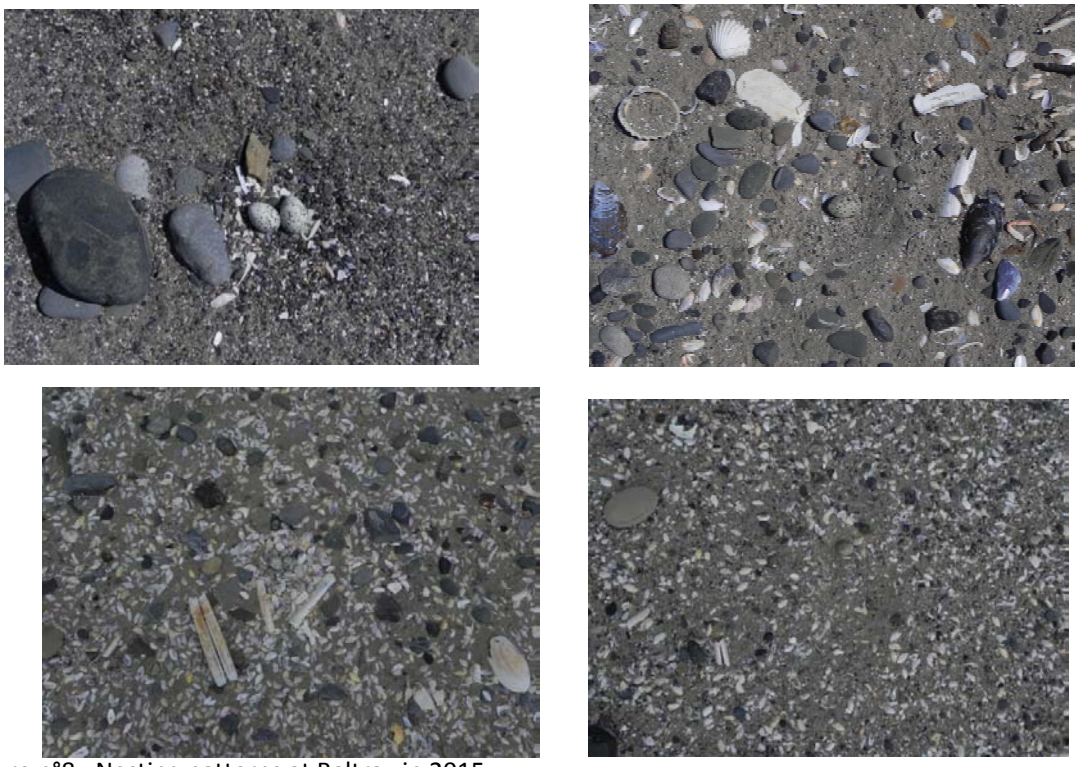


Figure n°8 : Nesting patterns at Baltray in 2015.

3.5 Clutch Size and Incubation Period

Out of 66 nesting attempts 1 had 3 eggs (1.5 %), 35 had 2 eggs (53.7 %) and 30 had 1 egg (44.8 %). The mean clutch size was 1.5 eggs per nest. The exact incubation period is known for 4 nests (Table 2). The mean incubation period was 25.25 days.

Table 2: incubation period of Baltray Little Terns in 2015 breeding season. Data only available for nests discovered before reaching full clutch. Incubation period covers time from full clutch until first chick hatches.

Nest ID	Incubation period	Incubation length
B32	10/6 →3/7	23
B36	9/6 → 6/7	27
B37	9/6→5/7	26
B52	? → 2/7	>21
B55	13/6→ 8/7	25
B58	? →4/7	>21
B63	? → 6/7	>21
B64	? → 12/7	>25
B65	? → 4/7	>16
B66	? → 11/7	>17

Mean incubation period: 25.25 days

3.6 Hatching Success

In total we recorded 102 eggs laid throughout the season, including a 1 egg count for each nest that was found already predated with fragments of shell recorded inside the scrape (4 nests). Of these eggs, 81 did not hatch due to the following causes (Figure 9): corvid depredation (37 eggs), unknown predator (25 eggs), found inside an already hatched egg shell (4 ”eggs”), washed away by spring tides (14 eggs), and abandonment (2 eggs). The remaining 20 chicks successfully hatched from 10 nests. Hatching commenced on July 2nd and continued until July 12th.

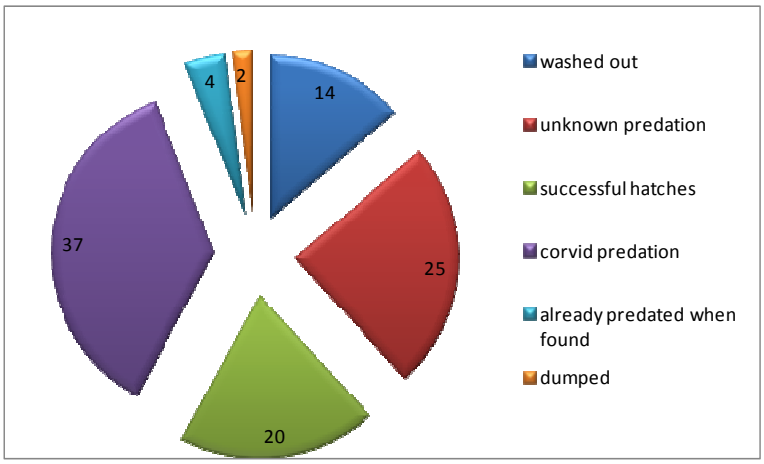


Figure n°9 : Egg outcomes and various factors that led to egg failure.

3.7 Fledging Success

The survival rate for chicks was assumed to be very high as no chick was discovered dead.

Once chicks had become fully mobile, all the individuals were observed roosting on the south part of the beach. Fledgling counts were in the range 3 to 6 birds. The birds generally roosted on a big shingle “island” in front of the fenced area. During the last days of the project, 3 chicks were observed with metal rings but no color rings, and 2 others with no ring at all, that could have been from undiscovered nests. As some of the known chicks were not observed for over than 15 days they could have died, hence these “extra” chicks are considered to compensate for this apparent loss in an estimate of productivity.

However fledgling counts only provide an indication of the survival rates of the chicks, as fledged chicks generally leave the colony within two weeks of fledging (Keogh *et al.*, 2011), a large number of older chicks could have left the colony by the time of the highest counts. Also several chicks were yet to fledge by late July and fledged chicks may roost in different areas at Baltray making counts more difficult. Because of this, any fledgling count will have been an underestimate of the total number of fledglings for 2015. However, the counts still serve as an indicator of productivity.

Thus any chick not known to have died is assumed alive. Twenty chicks were presumed alive and fledged (Figure10). This is likely an overestimate, but as the colony was observed on a close to

24 hour basis, and frequent searches were undertaken within the colony for chicks, it is thought that the majority of depredation events and other chick deaths were accounted for, so this should be close to the true figure.

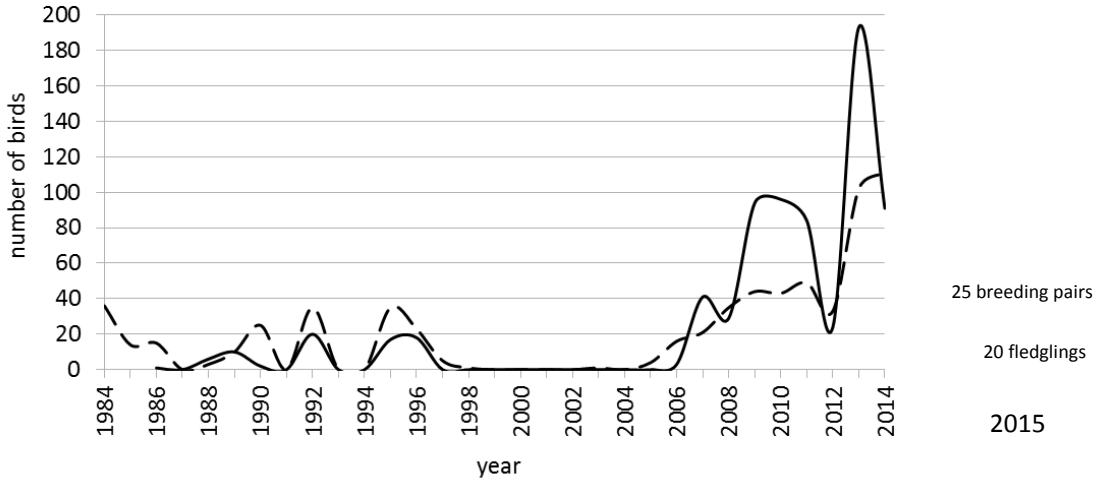


Figure n°10 the number of breeding of Little terns (- - - -) and the number of little tern chicks presumed to have fledged (------) recorded at the Haven, Baltray from 1984 to present . Data sources : Lenehan, unpublished data: 1984-2006; McKeever & Reilly, 2007-2012;Reilly: 2008-2012; Doyle & al: 2013; Egerton &Newton: 2014).

Therefore the productivity for this season is based on chicks assumed alive. As outlined above this is likely an overestimate but is thought to be the closest to the real figure. 25 pairs produced 20 fledglings, giving a productivity of 0.8 fledglings per pair. These figures are comparable to what was observed in 2012 (c.f. Figure 10).

3.8 Success of the Baltray Little Tern protection scheme

2015 season was not a successful year for the Little Tern colony, especially in comparison with 2013 and 2014.
We will try to explain that result in the Discussion (weather conditions, manpower, depredation).

The success of the 2013 and 2014 seasons was the culmination of the Little Tern protection scheme initiated in 2007 (Figure 10). Rigorous monitoring of the Little Terns at Baltray did not occur until the initiation of the Little Tern protection scheme but early attempts at monitoring the breeding success of the colony from 1984 give an indication of the health of the colony. The colony was in serious decline from the mid-1980s to the mid-1990s, with poor or no breeding success. From the mid-1990s there was zero breeding success. A notable increase in breeding pairs and numbers of fledglings occurred from 2007 onwards, when fencing and wardening of the beach during Little Tern breeding season began. Numbers had generally continued to rise since that point, with the exception of 2012 which was a very poor year overall for Little Terns on the east coast due to inclement weather in the

form of easterly storms combined with spring tides (Reilly, 2012; Keogh *et al.*, 2012). Thus, 2015 can be considered as an exception to the generally increasing trend.

3.9 Ringing and morphometric measurements

3.9.1 Ringing

Ringing commenced on July 4th, two days after the first chick hatched and the last Little Tern was ringed on July 14th. In total 20 chicks were ringed (100%), all of those known to have hatched. Fourteen were ringed on Day 1 and six on Day 2. Chicks were ringed at or near the scrape and so could all be aged and attributed to a nest. In addition 16 Ringed Plovers from at least six broods were ringed.

Six chicks were retrapped and colour ringed between July 17th and 21st . They were aged between 14 and 18 days old.

3.9.2 Ring Recoveries

Very few ringed birds were observed this year at Baltray.

At the end of July two young birds from Kilcoole were observed (green ring on the left leg) but could the inscription could not be read. They were newly fledged birds and were still fed by their parents.

A ringed adult Little Tern was also observed during the diet study, but the ring was on the ring foot, indicating that bird was probably ringed as a chick at Kilcoole.

3.9.3 Chick Biometrics

A total of 16 (80%) of the 20 ringed chicks were re-trapped at least once.

Nest	Chick ID	Number of recaptures
B52	NW45212	1
B52	NW45213	1
B32	NW45214	6
B32	NW45215	5
B37	NW45216	0
B37	NW45217	0
B58	NW45218	5
B58	NW45219	6
B65	NW45220	4
B65	NW45221	8
B36	NW45224	7
B36	NW45225	13
B63	NW45228	3
B63	NW45229	5
B55	NW45231	5

B55	NW45232	5
B66	NW45233	3
B66	NW45234	3
B64	NW45237	0
B64	NW45238	0

A total of 137 sets of biometric measurements were taken of chicks. Among them, 119 were of Little Tern chicks and the remainder Ringed Plovers.

3.9.4 Summary Statistics

Table 2: Age (days) and size and weight of Little Tern chicks on the day that a darvic ring was added to them during the 2015 breeding season in Baltray. (Colour rings I38 and I42 were broken)

BTO ring number	Green colour ring number	Nest	Age (day)	Wing (mm)	Weight (g)
NW45219	I39	B58	14	62	39.2
NW45221	I40	B65	14	81	39.5
NW45225	I41	B36	13	67	33.5
NW45218	I43	B58	17	92	NA
NW45215	I44	B32	19	105	NA
NW45214	I50	B32	19	109	NA

Table 3: minimum, maximum and mean (a) wing length and (b) weight values for Little Tern chicks age Day 0 to Day 19. n = 119.

Days	wing length (mm)			weight (g)		
	min	mean	max	min	mean	max
0 (n= 8)	9	11,50	13	7	11	11,00
1 (n=24)	10	12,16	16,5	8	14,5	14,50
2 (n=14)	11	13,50	15,5	9	13,5	13,50
3 (n=14)	12	15,11	19	10	17	17,00
4 (n=9)	17	19,44	25	15	23	23,00
5 (n=10)	18	20,90	27	16	25	25,00
6 (n=8)	24,5	28,50	34	22,5	32	32,00
7 (n=4)	32	36,00	39	30	37	37,00
8 (n=3)	33	36,33	41	31	39	39,00
9 (n=3)	36	38,67	43	34	35	35,00
10 (n=1)	60	60,00	60	58	58	58,00
11 (n=2)	49	51,50	54	32,3	52	52,00
13 (n=4)	67	70,75	74	65	72	72,00
14 (n=3)	62	72,33	81	39,2	79	79,00
15 (n=1)	76	76,00	76	NA	NA	NA
16 (n=2)	87	87,50	88	49	86	86,00
17 (n=2)	88	90,00	92	NA	NA	NA
18 (n=4)	91	96,00	99	50,5	93	93,00
19(n=3)	102	105,33	109	51	51	51,00

3.9.5 Chick wing length

Wing length increases slowly during the first few days. After day 4, the rate of wing growth increased as the chicks' flight feathers started to come through the pins (Figure 11). Chicks began to show true flight feathers from day 13. The rate of wing length increase did not appear to be slowing in the older chicks though the small sample size of older chicks makes this hard to judge. The average wing length for adult Little Terns is 176-187mm for males and 167-180mm for females (Baker, 1993), so the wing length of the chicks would be expected to continue increasing until it reaches adult size. Wing length is strongly positively correlated with age showing that any change in age is tightly linked to a change in wing length (Correlation coefficient, n =119, r = 0.98).

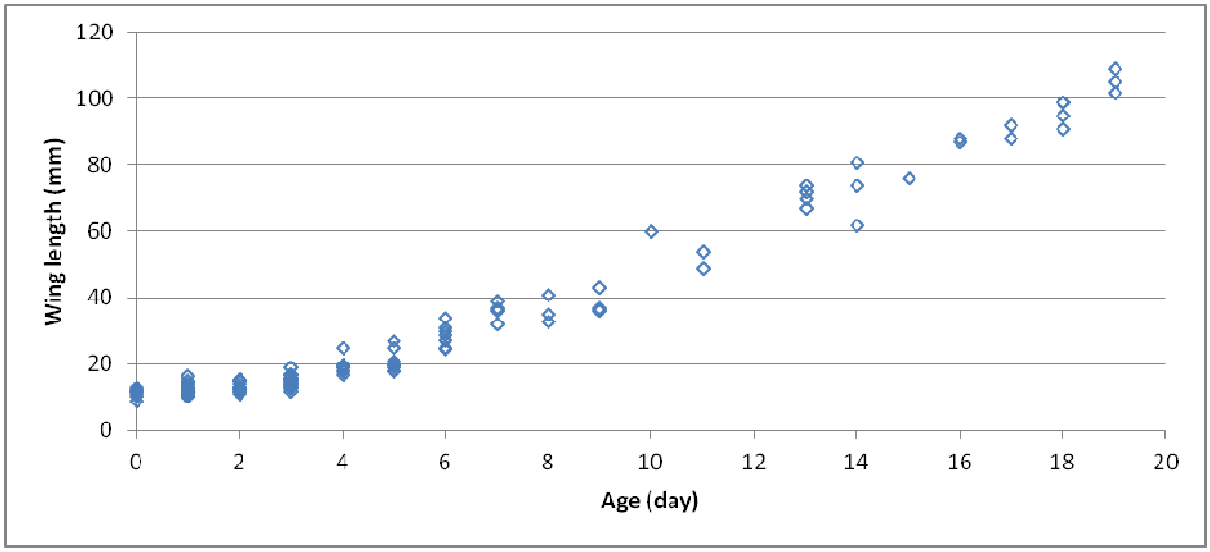


Figure n°11: Rate of increase in Little Tern chick wing length as age increases. n = 119.

3.9.6 Chick weight

Chicks rapidly increase in weight during the first few days (Figure 12). They easily double their weight or more in the first five days. At approximately day 9, the growth rate reaches an asymptote and begins to slow as the chick approachs its adult weight. The average weight for an dault Little Tern is 50g (Gochfeld and Burger, 1996), and this was reached by chicks older than 2 weeks (Table 3). Weight is strongly correlated with age (correlation coefficient, n= 112, r= 0,97).

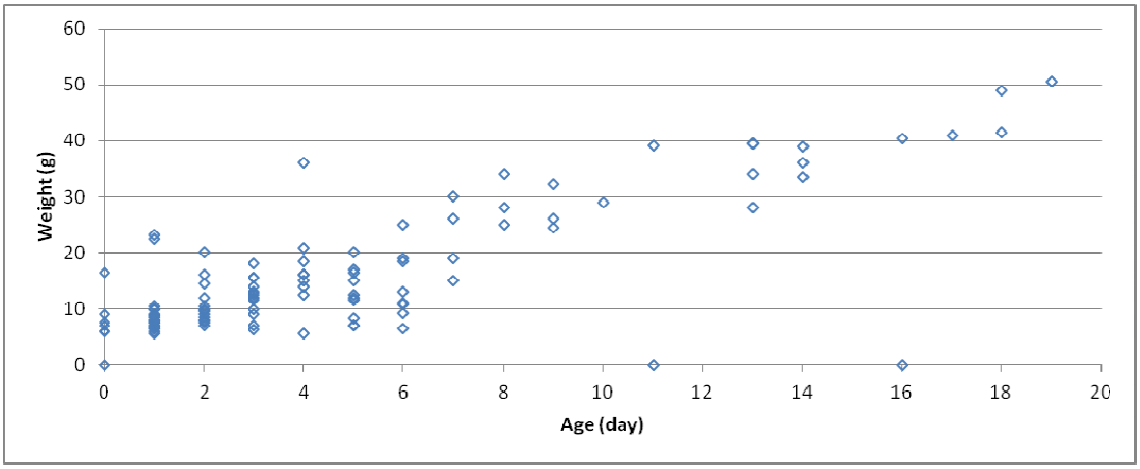


Figure n°12: Rate of increase in Little Tern chick weight as age increases. n = 119.

3.9.7 Chick wing length vs. weight

Wing length and body weight are closely linked measures of gross morphology, taken together they give a picture of the size of a bird. The wing length and age of growing Little Tern chicks were positively correlated (Correlation coefficient, n =119, r = 0.98). This shows that a change in one is closely linked to a change in the other (Figure 8). The tail of the graph begins to describe an upwards curve as older chicks (13-16 days old) begin to reach their adult weight, but continue to increase in wing length as they have not yet reached adult wing length.

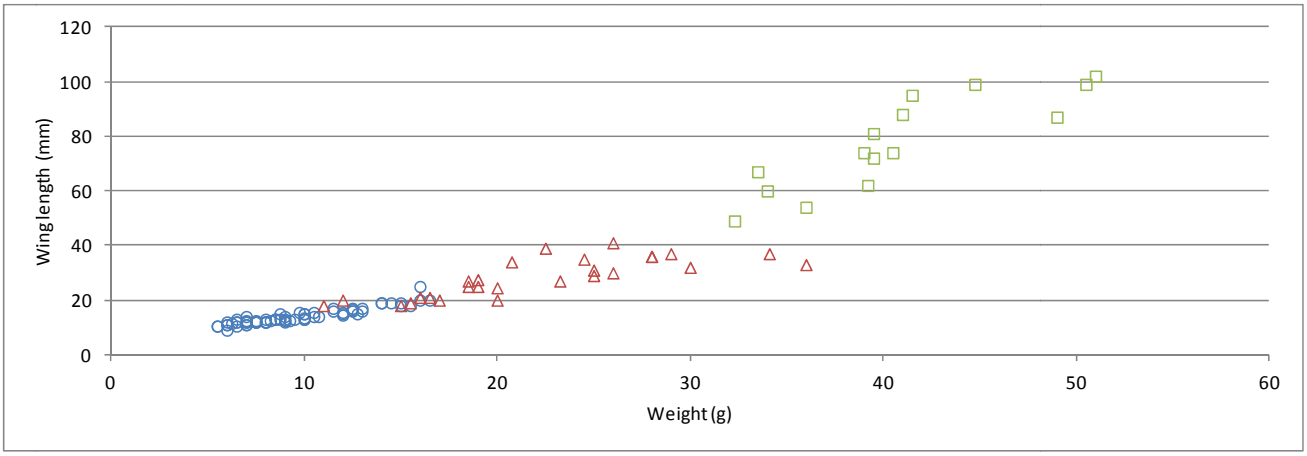


Figure n°13: Correlation between Little Tern wing length (in mm) and body weight (in grams). Age group is indicated: blue, age 0 to 4 days; red, age 5 to 9 days; and green, age > 9 days. n = 119.

3.10 Dietary observations

106 parent-feeding events were observed throughout the study. Details of chick age, fish type and length were recorded at each event using a telescope to observe a nest or chicks. Chicks were observed aged Day 0, Day 1, Day 2, Day 3, Day 5, Day 5, Day 6, Day 7, Day 9, Day 13, Day 17 and Day

18. Food size was measured in “bill-lengths”: one unit (BLS) is approximately the length of a full grown adult Little Tern’s bill.

Table 4: food substrate type and size offered to chicks of different ages (note that although the food was offered, it was not always consumed by the chick). Chick age is measured in days. Food size is measured in “bill-lengths” –one unit is the length of an adult Little Tern bill. n = 106 .

Age of chick (day)	% of Sprat	% of sandeel	% of fish fry	% of others or unknown prey	Average size of prey
0 (n=8)	14.3	14.3	57.1	14.3	0.93
1 (n=8)	14.3	71.4	7.1	7.1	1.08
2(n=8)	14.3	42.9	33.3	9.5	0.62
3(n=2)	0	100	0	0	2.75
4(n=4)	62.5	12.5	12.5	12.5	1.63
5(n=4)	33.3	25	8.33	33.33	1.18
6(n=4)	66.67	0	11.11	22.22	0.9
7(n=2)	100				1.1
9(n=2)	75	25	0	0	1.23
13(n=1)	66.67	0	0	33.33	1.35
17(n=2)	100	0	0	0	1.35
18(n=1)	100	0	0	0	1.83
? (n=5)	45.45	9.09	36.36	9.09	1.2

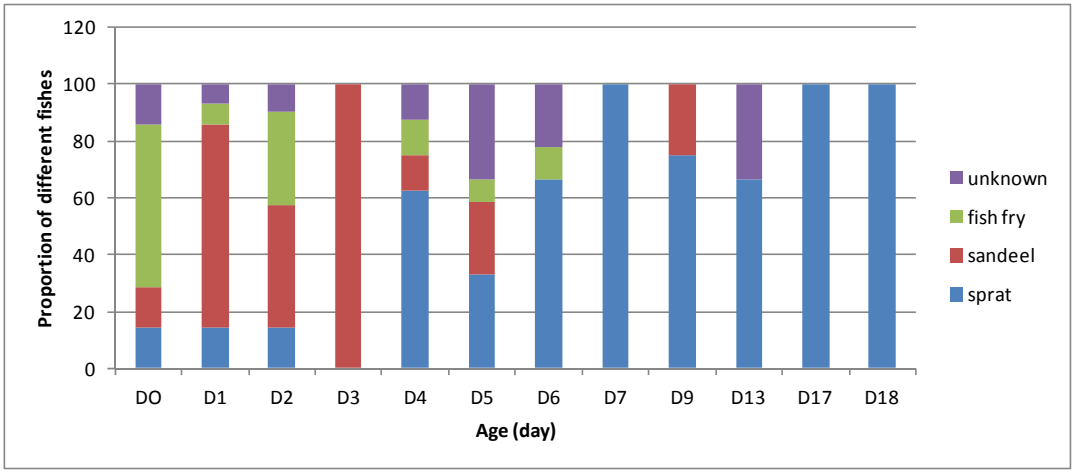


Figure n°14: Proportion of different type of fishes in the food offered by birds to their chicks.

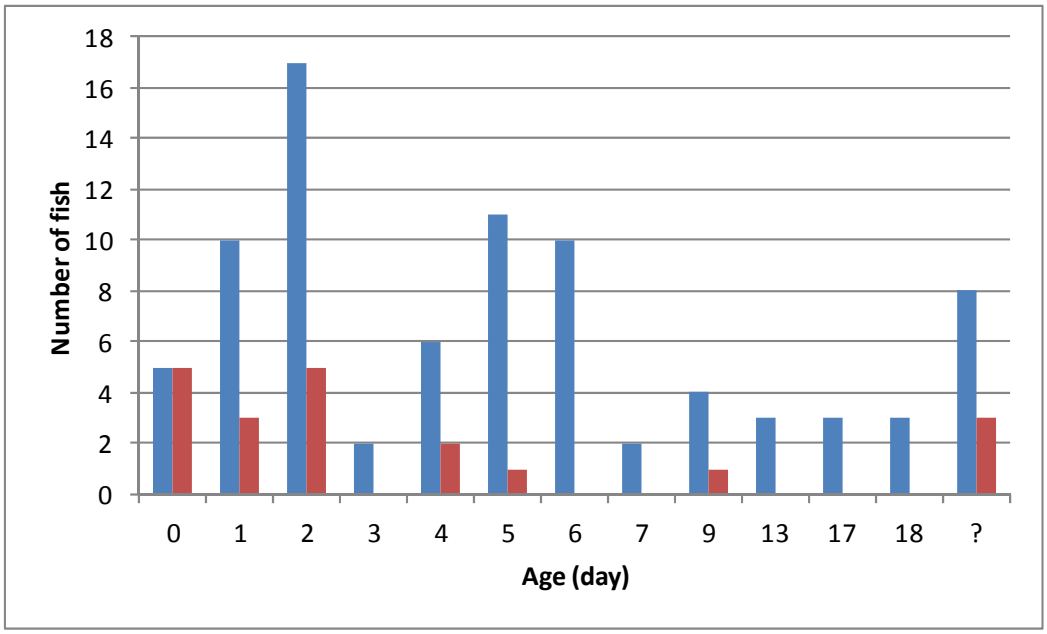


Figure n°15: Number of fishes accepted (blue) and refused (red) by Little Tern chicks at Baltray in 2015, as a function of increasing age.

On day 0 (4 observation sessions, 10 feeding events), half the feeding events were unsuccessful. Then the number of unsuccessful events decrease and almost disappear from day 5 to day 18 (only 2 unsuccessful events out of 36 feeding events). Occasionally, the parent bird consumed the food if the chick refused it.

The average size of the prey increases as age increases (c.f. Table 4), except for Day 3-4 where a particularly large size was recorded.

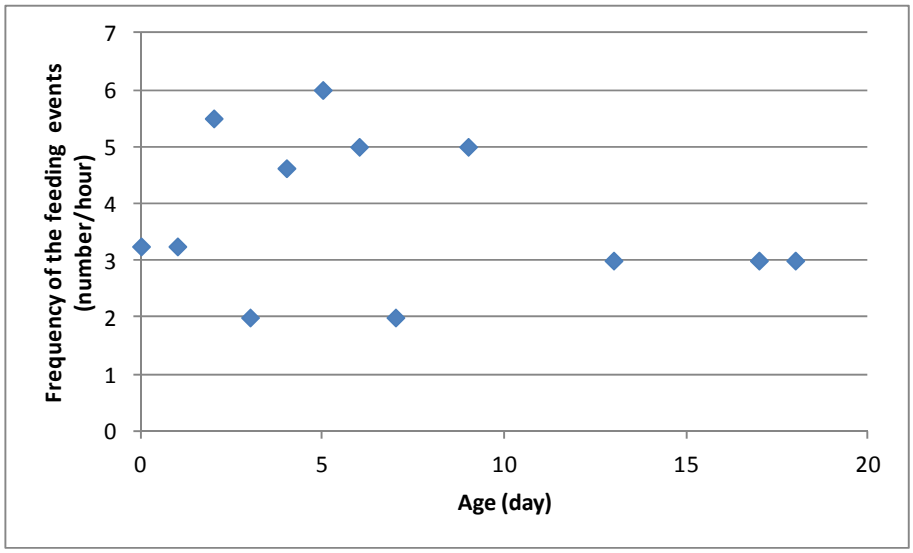


Figure n°16: Trend in the frequency of the feeding events as chicks develop.

At most, day 2 chicks were fed between 5 and 6 times per hour (for 2 chicks). It is known that a frequency of 4 fishes per hour per chick is a good average and means that the chick is well nourished. The observed frequency is reduced from day 10 but most of the chick were observed alone at this stage so that the average frequency per chick remains around 3 fishes per hour.

Small sample sizes make it difficult to draw any firm conclusions from the feeding observations; however, some general trends are apparent, though with some inconsistencies.

3.11 Nest moves

Two nests were moved at the end of June.
The first one (B58) was moved successfully in order to be included in the protected area. Both eggs hatched a few days later.
The other one (B67) was moved successfully to be protected from the tide. Unfortunately this nest was depredated at a later date.

3.12 Predators and disturbance

Terrestrial: No depredation from terrestrial predators was observed this season. This is likely to be due to the presence of night wardens. A Red Fox was present in the surrounding area and was seen in the vicinity of the colony on multiple occasions in June and July. It could not be removed but was scared by the night warden each time it was seen.
A Badger (*Meles meles*) was observed on several occasions inside the north colony and was scared by the night warden.
Otter's footprints (*Lutra lutra)* were observed on the extreme South of the colony, but the animal was not directly observed.

Avian: Several potential avian predators posing a danger to fledged Little Terns and adults were observed in the area. A pair of Kestrels raised a brood in the vicinity (in conifers near the Golf Club entrance) and regularly hunted around the colony, mainly in July. They were occasionally observed over the fenced area. In an attempt to deter the Kestrels wardens would shout, bang metal objects together and use a siren on a megaphone provided by Louth Nature Trust.
Walking out beneath hovering individuals, where they hunted, seemed to perturb them but they would usually just fly to the opposite end of the colony to the warden and resume hunting. Also, the Kestrels would often fly in very low, thus avoiding detection until the terns were disturbed.
Despite the presence of at least one pair nesting in the vicinity of the colony, the impact of the Kestrel was minor this year, as no chick was seen to be taken by a Kestrel.

Several other birds of prey were observed hunting Little Terns, a Sparrowhawk (*Accipiter nisus*) was observed hunting several times around and inside the colony and a Peregrine Falcon (*Falco peregrinus*) was recorded hunting in colony May 31th. There is no evidence of depredation by these two species. A Short-eared Owl (*Asio flammeus*) was sighted on several occasions in June but it did not take any interest in the Little Tern colony.

Hooded Crows and Rooks were present in very large numbers as the wardening started and often landed on the beachfront, in the dunes or close to the colony.

Therefore, a decision was taken to remove some of the local population. Three Hooded Crows were trapped between late May and mid June. A small trap was set in early June in the dunes next to the colony, but remained unsuccessful. A ladder trap was set around mid July.

One breeding pair of crows remained throughout the season. They were exceptionally wary of humans and hid amongst the rocks by the sea wall. They were known to land on the foreshore and then walk up the beach into the colony. It is thought they were responsible for depredating four eggs from two nests (B20 and B53). They were not observed depredating the nests but the depredation matched that of corvid behaviour, as the whole eggs were carried away leaving no fragments, and the nests were in the vicinity of the sea wall were the crows were often seen.

Rooks (*Corvus frugilegus*) were present throughout and in many occasions. They were observed several times depredating eggs. Jackdaws (*Corvus monedula*) were present with Rooks and Hooded Crows in early June, though they didi not appear to cause any problems.

Several seabirds, which presented a potential threat to Little Tern chicks and eggs were present throughout the season: the Lesser Black-backed Gull (*Larus fuscus*), Great Black-backed Gull (*Larus marinus*), Herring Gull (*Larus argentatus*), Black-headed Gull (*Chroicocephalus ridibundus*), and Grey Heron (*Ardea cinerea*).

Gulls were thought to have been responsible for heavy predation of Little Tern eggs in 2008 (Reilly, 2008) and any gull species flying over the colony was relentlessly mobbed by the Little Terns. A Great Black-backed gull was observed in mid July depredating a chick, but it could not be determined if it was a Little Tern or a Ringed Plover chick.

Flocks of up to 100 Starlings (*Sturnus vulgaris*) were observed throughout the season. They were considered a potential threat to the Little Tern eggs as they are thought to have depredated two nests in 2011 (Reilly, 2011). They were chased away whenever they entered the enclosure and a megaphone provided by Louth Nature Trust which had a function which played a starling alarm call was used with some success.

Human: The particularly bad weather this summer is likely to have reduced the number of visitors to the beach compared to previous years. The visitors did not stay long on the beach, mainly walking to the seawall before returning north.

Despite the small numbers of people visiting the beach, dogs entered the colony on at least two occasions. Each time it was eventually chased out of the colony by the wardens and no nests were damaged. The owners were apologetic when approached and put their dogs on leads.

It appears that none of these activities led to the damage of Little Tern eggs or chicks, in part due to quick reactions by the wardens.

On the 23rd July, two visitors were approached by the warden because they were walking on the beach exactly where the chicks were known to be roosting. The visitors agreed to leave the beach quickly and went away but they found a chick on their way out, caught it and brought it back inside the fence. The warden went back to them to give more information about the protected status of the species and appropriate behaviour should they find a wild bird on another occasion.

A Coastguard rescue helicopter flew above the colony in several occasions at very low altitude and caused considerable disturbance for all the birds present on the beach, including Little Terns.

Jet skis regularly coursed the river and estuary. These may cause disturbance to foraging Little Terns.

4. Discussion

The success of any breeding season at a Little Tern colony can be primarily judged by the number of pairs that attempt to breed in that year and how many chicks are fledged from these nesting attempts. Around 25 breeding pairs produced 20 chicks which are presumed to have fledged in the 2015 breeding season at Baltray (productivity= 0.80).

This is the same productivity that was observed last year (91 fledglings from 111 breeding pairs giving 0.82) but with significantly different numbers of breeding pairs and consequently of chicks. These figures are much lower than the number of breeding pairs and chicks presumed to have fledged during the 2013 season, (193 fledglings from 102 nests). They are closer to numbers recorded in 2012, when weather and tides were destructive across the east of Ireland. For the record, 43 pairs fledged 96 chicks in 2010 (Reilly, 2010).

Productivity this year was low with 0.80 fledglings per pair (average estimate, see results). This is a much lower productivity that in 2010 (2.23 fledglings per pair), 2009 (2.18), 2011(1.73) and 2007 (1.95) and it was more or less the same productivity as 2014 (0.82), 2012 (0.73), and 2008 (0.82) (Doyle et al, 2013; Egerton et al, 2014; McKeever and Reilly 2007; Reilly, 2008; 2009; 2010; 2011; 2012). The productivity of pairs of Little Terns at Baltray is in general very high (especially when 24 hour wardening is in place) underlining the suitability of this site for Little Tern breeding.

This result highlights the relative lack of funds to pay wardens compared to the previous two years. In 2015 the resources were not sufficient to implement 24/7 wardening. From May 26th (start of the project) to the June 9th, there was only one warden on the site, and the period of working time was 5 hours a day (compared to 24/7 at Kilcoole). After June 9th, a second warden was present 3 days a week for 8 to 10 hours a day. Nightshifts were settled by mid June and lasted until July 23rd.

It was impossible to implement 24 hours wardening per day. This probably explains why low numbers settled at the colony and the resulting poor productivity at the Baltray colony in 2015.

This year the first Little Tern eggs were found on 28th May, 3 days later than the average for previous years, May 25th (McKeever and Reilly 2007; Reilly, 2008; 2009; 2010; 2011; 2012; Doyle et al, 2013). The last nest, was found on June 28th, much earlier than what was observed in 2013 (July 18th) or in 2014 (July 7th). It was subsequently depredated. Hatching began on the 2nd July and continued until July 12th. The commencement of hatching was 16 days later than the average of previous years, June 16th.

The late start to nesting and hatching reflected the effect of:

- the prolonged cold, wet and windy conditions all through May, June and July
- the influx of corvids early on, picking off first laid eggs, and preventing significant numbers of Little Terns from settling at the colony and thereby reducing the mobbing response needed to protect from such predators.

The modal incubation length was 25.25 days, much longer than the 18-22 day range cited by Cramp (1985), indicating unfavourable conditions (temperature and disturbance from corvids).

4.1 Egg losses

The productivity was relatively low in 2015, primarily because of very high depredation levels on eggs. Eggs were also lost to spring high tides, and abandonment.

No eggs were deemed infertile this year, as all those incubated eggs hatched chicks.
Only 2 eggs were abandoned after the other egg from the nest was depredated (B28 and B44), presumably by a corvid. It is regularly reported elsewhere that pairs abandon a partially depredated nest. No nest was abandoned with 2 eggs.

Fourteen eggs from 11 nests were lost to spring tides, 10 from 9 nests in June and 4 from 2 nests in July. This was a high number of eggs lost to tides in comparison to previous years (6 eggs in 2014, 8 eggs in 2013).This result was mainly due to unfavourable tides coinciding with strong winds (low pressure, in June). While the July spring tide was not as high as the previous month's, 2 nests were flooded even though they were judged to be safe. Overall, the nest moves were successful: 1 nest which would have otherwise been washed out successfully hatched. The other one was unfortunately depredated before hatching.

The strong action of the spring tides on June 1st and 3rd caused dramatic changes to the beach morphology during the season. The existing sandbar to the north of the colony was strengthened with further deposits of sand and shingle. This was an important roosting spot for waders but suffered from high disturbance due to being north of the fenced area. The shingle "island" became bigger in front of the southern enclosure by the first spring tide. This provided protection from later tides as well as being an important high tide roost for Little Terns, and later in the season for loafing flocks of the other four species of tern that breed in Ireland, the Common Tern (*Sterna hirundo*), Roseate Tern (*Sterna dougallii*), Arctic Tern (*Sterna paradisaea*) and Sandwich Tern (*Thalasseus sandvicenis*).

Egg depredation this year was very high. The combination of the protective electric fence and the day wardening could not prevent avian predators entering the fenced enclosure and having a major impact on the Little Tern.

37 Little Tern eggs from nests were taken by corvids, primarily Rooks and Hooded Crows which were very active in the area. Between them, the Rooks caused the major impact and were seen taking eggs on several occasions. A single Rook is believed to have caused the loss of several eggs on the 15th and the 16th June. The situation this year was completely different to last year when only 4 eggs were depredated by corvids. In 2015 the number of corvids was much higher inside and around the colony (O'Donoghue, pers. comm.) than in 2014 and several hundreds of corvids were nesting close to the beach, along the River Boyne. The ladder trap gave good results (8 birds trapped in 2 weeks) but was established too late in the season.

It seems that the small numbers of nesting birds on the site has facilitated the encroachment of corvids, as the few terns were not aggressive enough to chase off the crows.

The wardens chased the Rooks each time they observed them flying towards the colony, but they would attack in several places simultaneously, and as the site was very large (between 800 and 900 m long), it was not always possible to protect all the nests all day long.

4.2 Biometrics and Chick ringing

A total of 20 (100%) Little Tern chicks were ringed this year, all of them in or close to the nest scrape within 3 days of hatching. These were ringed on the left leg to distinguish them from those ringed at Kilcoole which were ringed on the right leg. Re-trapping was carried out as often as

possible in order to collect data on growth rates. 16 chicks (80%) were re-trapped at least once. This data was used to construct growth curves. Across years, these could be used as an indicator of feeding rates, and hence the availability of prey to Little Terns at Baltray. As the data set grows in future years, it will also permit a greater insight into the growth of older chicks near fledging. It appears that Little Tern chicks are approaching their final adult weight at about 2 weeks of age, but their wing length continues to increase, though further data will be needed to get a clearer picture of this.

4.3 Feeding Study

The feeding ecology of the Little Tern chicks at Baltray was also studied for the second time. This gave an insight into the diet of the chicks and how it changes, with similar results to those obtained in 2014. A general switch from fish fry to sandeel was observed after about Day 3 and then to Sprat from Day 4 to 18. It also showed the importance of Sprat throughout the early life of the chicks. However, further data collection will have to be carried out in future years before any more firm conclusions can be drawn. It does show however that a variety of fish species are important in the feeding ecology of Little Terns.

4.4 Baltray success and link with Kilcoole

The initiation of the Little Tern Protection Scheme at Baltray has seen a dramatic recovery of the colony at Baltray and the poor results in 2015 are evidence that a complete 24/7 scheme is required in order to provide effective protection.

Between 1984 and 2006 even the most optimistic estimates showed that less than 80 chicks had fledged from the Baltray colony, with almost zero breeding success since the mid-1990s (Larry Lenehan, unpublished data). In the seven breeding seasons since this project began 562 chicks are presumed to have fledged (McKeever and Reilly 2007; Reilly, 2008; 2009; 2010; 2011; 2012). There had been an increase in breeding pairs of Little Terns every year since the project was initiated (Figure 5) . The only exception to this was the 2012 season when the number of breeding pairs dropped to 33, however 2012 was an exceptionally poor breeding season for Little Terns along the east coast due to exceptionally inclement easterly dominated weather (Keogh *et al*., 2012; Reilly, 2012), and the fact that Baltray was the only major breeding site to fledge any chicks on the east coast in 2012 underlines the success of the project.

2015 was another exception, with very poor weather conditions, very high daytime depredation and reduced wardening on the ground.

There also had been a general increase in number of fledged young produced per year, though this has been more variable, reflecting the vulnerability of this species to being washed out by tides (2012) and heavy predation by corvids (2007), gulls (2008) and foxes (2011 and 2012) (McKeever and Reilly 2007; Reilly, 2008; 2011; 2012). Foxes are a particularly serious risk as they can wipe out an entire colony in one night, emphasising the importance of protective fencing. The importance of 24 hour wardening is shown by the three peak years, 2009, 2010 and 2013, having 24 hour wardening. It was illustrated this year by the suspected depredation of the first three Ringed Plover nests by a fox early in the season before the fence was completed and 24 hour wardening had

commenced. No Little Tern or Ringed Plover eggs were lost to mammalian depredation after the fence was completed and regular wardening initiated. In 2015, it cannot be excluded that mammalian predation occurred, as a fox was observed quite often around the colony, footprints were detected and the possibility exists that it got inside the enclosures.

The growth in the number of breeding pairs of Little Terns at Baltray in 2013 and 2014 was astounding. In comparison, settlement was very low in 2015.

The movement of birds from Kilcoole to Baltray has been known for several years (Maljkovíc *et al*., 2003; Veldman *et al*., 2004; Stringer *et al*., 2005; Lynch *et al*., 2006; O'Connell *et al.*, 2007; Cockram *et al.*, 2008; Hall *et al.*, 2009; Keogh *et al.*, 2010; Keogh *et al.*, 2011; Keogh *et al.*, 2012). Since the Baltray protection scheme began in 2007 the average number of breeding pairs has dropped at Kilcoole from the numbers present between 2003 and 2006. This year Kilcoole had exceptional numbers of birds, which indicates that the birds that could not settle at Baltray, because of predator activity and poor conditions, relocated to nest in Kilcoole.

Though this may just be a natural fluctuation it seems probable that some of the birds hatched in Kilcoole are recruiting to Baltray to breed. The discovery in 2013 at Baltray of a dead adult Little Tern ringed at Kilcoole in 2010 proves that this movement is occurring.

It is likely that the east coast population of Little Terns acts as a single metapopulation, with individuals moving between sites assessing which site is the most suitable for breeding in any given year. Kilcoole birds have also been trapped at Rue Point, on the Isle of Man (Keogh *et al*., 2012), indicating that dispersal may extend even further afield. The colour ringing scheme was continued in 2015 and 6 chicks were ringed. It will be extremely useful if this permits inter-colony movements to be monitored in the coming years.

Overall, 2015 was a mixed year for Little Terns breeding colonies along the east coast of Ireland.

5. Recommendations

5.1 Human resources

It is very important to provide 2 full time day wardens on Baltray site. The site is very long and it is not possible to assure full monitoring and complete protection from disturbances and predators with part-time wardens. The wardens should be on the site prior to mid May so that they could participate in the erection of fences and observation platforms, and meet the volunteers who help with this task.

Ideally, it would be good to recruit one or more interns, who could help the wardens in their different tasks.

5.2 Predator management

The main predators were corvids this year. It is critical to control the corvid population early in the season, as was done in 2014. The loan, installation and operation of the ladder trap needs to be commenced prior to the arrival of terns

Kestrel depredation was not a big issue in 2015, but it is probably a reflection of the low number of terns present on the site.

5.1 Kestrel supplementary feeding project

A first attempt at supplementary feeding was conducted at Baltray by volunteer, Maurice O'Conaugh. Such projects had been successfully set up in Norfolk and Chesil Beach in England and have helped to mitigate this predation problem using non-lethal measures.

Once the chicks fledged, dead mice and hen chicks were provided to the Kestrels on a perch that had been erected near the golf course (ca. 500m from the colony). The birds were observed feeding on this food.

The efficiency was not properly monitored, but the low impact of Kestrels on the colony could be linked with this food supplementation. Thus, this should be conducted again in 2016 with a more detailed monitoring scheme (perhaps through an internship).

5.2 Trapping Adults

In 2014 the colony at Baltray was considered large and stable enough so that the trapping of adults using nest traps should be considered, especially as no adults which hatched at Baltray would have been ringed as chicks. This activity is carried out by the Manx Ringing Group (Scott, 2011), and others in Britain, with great success. If human means are sufficient, it is likely that the trapping of adults should be considered if nesting numbers rise to former levels and the colony is able to protect itself by mobbing predators.

5.3 Observation Platform location

Much of the nesting area is not visible from the inland side of the protective fence. This made watching for new nests and carrying out incubation checks more difficult. Often nests in non visible areas could only be found by entering the colony and searching for nests, which was not ideal.

Basic scaffold platforms were erected in 2015, one in front of the south enclosure and the other in front of the north enclosure. These platforms are useful but should be settled once the day wardens are on duty so that the location can be optimized (not too close to the fence, adapted to the site new topography). Also, the nesting site is now so large at Baltray that at least a third or a fourth platform would be useful to cover all non-visible areas.

5.4 Fencing

The fenced areas were extended in 2015 so that almost all the Little Terns nest were found inside the enclosure. This was very positive and almost all the nests were protected in 2015, or could be moved inside. The negative side of this was that the site was very hard to coverwith only 1 or 2 people.

5.5 Signs

Signs asking people not to walk along the area in front of the colony and informing them that chicks are present on the foreshore once hatching begins would be helpful. Many people seemed to be under the impression that the Little Terns did not leave the fenced off area and would walk along the string fence, endangering chicks.

5.6 Project Website

The blog informing the public of the progress of the Little Terns breeding at Baltray should be added to the website set up in 2011 to house the Kilcoole blog (www.little ternconservation.blogsot.com). This would greatly aid the dissemination of information about the project as this site is the number one result found by a Google search for "Little Tern". This was made evident by the fact that more visitors to the site had heard about the project through posts on the Kilcoole blog than through the Baltray blog. A Baltray page could be added to this website, allowing the public to follow the progress of the Baltray and Kilcoole sites from the same site, giving people a better idea of the progress of the Little Tern on a national level.

5.7 Education

An attempt should be made to invite local school groups to visit the site. This would help increase community involvement in the project in future years.

5.8 Communication tools

A blackboard and whiteboard were provided in the site portacabin and next to the portaloo during the project. They were used to give up to date figures for numbers of nests and chicks, and inform people of the other species which can be seen at the site. Using more colours could be more attractive for the general public. It would also be useful to find a way to give more information about the project at the office caravan (permanent exhibition during the project season).

5.9 Water Pipe

If a water pipe could be extended from the field adjacent to the site this would remove the need for wardens to ferry water from Dominic Hartigan's yard, reducing wear on the track down to the site, which is needed for removing project equipment.

5.10 Emergency Phone Numbers

A series of special emergency contact numbers and protocols for dealing with incidents should be established for future projects.

5.12 Two-way Radios

A set of two-way radios for the project wardens would be a great advantage, making quick communication possible in the event of an emergency.

5.13 Relief Warden

The creation of a paid relief warden position would greatly aid the running of the project in future. This year the only way one of the wardens could get a day off was if the other warden worked a double shift. The relief warden could be hired on a part-time basis to cover one or two days a week. Alternatively a full-time relief warden position could be created to cover all of the wardened tern sites, so that the relief warden would cover days in Baltray, Kilcoole and possibly Rockabill. This would be more challenging logistically, but full-time hours may make the position more attractive and the cost would be split between projects.

References

Baker, K. (1993) *Identification guide to European non-passerines: BTO guide 24*. British Trust for Ornithology, Thetford.

Cockram, J., Micklos, M., Carroll, D., Macey, C. and Newton, S. (2008). Kilcoole Little Tern Report 2008. BirdWatch Ireland Conservation Report.

Coveney, J., Merne, O.J., Wilson, D., Allen, D. and Thomas, G. (1993). A conservation strategy for birds in Ireland. Unpublished Report, IWC, Monkstown, Co. Dublin.

Cramp, S. (Ed.) (1985). *Handbook of the birds of Europe, the Middle East and North Africa: the birds of the Western Palaearctic. Volume 4: Terns to Woodpeckers*. Oxford University Press, Oxford.

Doyle, S. and O'Connell , A. (2013) Baltray Little Tern Report 2013.BirdWatch Ireland Conservation Report.

Egerton, S. and Nexton, S. (2014) Baltray Little Tern Report 201'.BirdWatch Ireland Conservation Report.

Farrelly, P. (1993). Irish East Coast Little Tern survey 1992 and 1993. Irish East Coast Bird Report 1992: 60-64. IWC, Dublin.

Fasola, M., Sanchez, J.M., Roselaar, C. S. (2002). Little Tern, Sterna albifrons. BWP Update, 4: 89-114.
Gochfeld, M. and Burger, J. (1996) Family Sternidae (Terns). In del Hoyo, J., Elliot, A. and Sargatal, J. (Eds.), Handbook of the birds of the world. Volume 3: Hoatzin to Auks. Lynx Edicions, Barcelona, pp. 624-667.

Hall, M.E., Murgatroyd, S.M. and Newton, S.F. (2009) Kilcoole Little Tern Report 2009. BirdWatch Ireland Conservation Report.

Hannon, C., Berrow, S.D. and Newton, S.F. (1997). The status of breeding Sandwich Sterna sandvicensis, Roseate S. dougallii, Common S. hirundo, Arctic S. paradisaea and Little Terns S. albiforns in Ireland in 1995. Irish Birds, 6: 1-22.

Keogh, N.T., Macey, C., McAvoy, S., McGuirk, J. and Newton, S.F. (2010) Kilcoole Little Tern Report 2010. BirdWatch Ireland Conservation Report.

Keogh, N.T., Macey, C., McGuirk, J. and Newton, S.F. (2011) Kilcoole Little Tern Report 2011. BirdWatch Ireland Conservation Report.

Keogh, N.T., Macey, C., Nuttall, L. and Newton, S.F. (2012) Kilcoole Little Tern Report 2012. BirdWatch Ireland Conservation Report.

Keogh, N.T., Macey, C., Power, A. and Newton, S.F. (2013) Kilcoole Little Tern Report 2013. BirdWatch Ireland Conservation Report.

Lloyd, C.S. Bibby, C.J. and Everett M.J. (1975). Breeding terns in Britain and Ireland in 1969-74. British Birds, 68: 22-37.

Lynas, P., Newton, S.F. and Robinson, J.A. (2007). The status of birds in Ireland: an analysis of conservation concern 2008–2013. Irish Birds, 8: 149–166.

Lynch, Á., Fermer, J., Prinz, K. and Newton, S. (2006) The Little Tern Protection Scheme at Kilcoole/Newcastle, Co. Wicklow. Unpublished BirdWatch Ireland Conservation Report No. 06/4.

Maljkovíc, A., Durnin, P.J., Boland, H. and Newton, S. (2003). The Little Tern Protection Scheme Report. Unpublished BirdWatch Ireland Conservation Report No. 03/1.

McKeever, S. and Reilly, M. (2007) 2007 Report for the Little Tern Conservation Project at Baltray, Co. Louth. Unpublished Louth Nature Trust Report.

Medeiros, R., Ramos, J.A., Paiva, V. H., Almeida, A., Pedro, P., and Antunes, S. (2007). Signage reduces the impact of human disturbance on Little Tern nesting success in Portugal. Biological Conservation, 135: 99-106.

Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (2004). Seabird Populations of Britain and Ireland. Poyser, London.

O'Briain, M. and Farrelly, P. (1990). Breeding biology of Little Terns at Newcastle, Co. Wicklow and the impact of conservation action, 1985-1990. Irish Birds, 4: 149-168.

O'Clery, M. (2007). Breeding seabirds of the Magharees and related islands, County Kerry, 2006/2007. Irish Birds, 8: 179-188.

O'Connell, B. Miklos, M. Struk, R. and Newton, S. (2007). Kilcoole Little Tern Report 2007. Unpublished Birdwatch Ireland Conservation Report.

Ratcliffe, N., Schmitt, S., Mayo, A., Tratalos, J., and Drewitt, A. (2008) Colony habitat selection by Little Terns Sternula albifrons in East Anglia: implications for coastal management. Seabird, 21: 55-63.

Reilly, M. (2008) 2008 Report for the Little Tern Conservation Project at Baltray, Co. Louth. Unpublished Louth Nature Trust Report.

Reilly, M. (2009) 2009 Report for the Little Tern Conservation Project at Baltray, Co. Louth. Unpublished Louth Nature Trust Report.

Reilly, M. (2010) 2010 Report for the Little Tern Conservation Project at Baltray, Co. Louth. Unpublished Louth Nature Trust Report.

Reilly, M. (2011) 2011 Report for the Little Tern Conservation Project at Baltray, Co. Louth. Unpublished Louth Nature Trust Report.

Reilly, M. (2012) 2012 Report for the Little Tern Conservation Project at Baltray, Co. Louth. Unpublished Louth Nature Trust Report.

Redfern, C.P.F., & Clark, J.A. (2001). Ringer's Manual. Fourth edition, British Trust for Ornithology, Thetford.

Scott, K. (2011). Manx Ringing Group annual report 2011. Unpublished Manx Ringing Group Report.

Smart, J & Ratcliffe, N, Bolton, M, Lewis, S,Cliffe, C. (2009) Diversionary feeding: is it effective at reducing kestrel predation? Raptor Research Foundation Conference.

Smart, J & Ratcliffe, N. (2000) Monitoring the effectiveness of supplementary feeding as a means of reducing Kestrel (Falco tinnunculus) predation of little Tern chicks at the Great Yarmouth colony. Royal Society for the protection of Birds, Sandy, UK.

Stringer, A, Durrant, J., White, M and Newton, S. (2005° Kilcoole Little Tern Report 2005. BirdWatch Ireland Conservation Report 05/6.

Suddaby, D. (2012) Ornithological Research and Scientific Monitoring on Breeding waders and terns on the Iniskea Islands, Co.Mayo in 2012. BWI Mayo Office report to NPWS, 19pp.

Tucker, M. and Heath, M.F. (1994). Birds in Europe:their conservation status. BirdLife International, Cambridge.

Valle, R. and Scarton, F. (1999). Habitat Selection and Nesting Association in Four Species of Charadriiformes in the Po Delta (Italy). Ardeola 46: 1-12.

Veldma,, J., McMahon, J., Corbishley, H. and Newton, S. (2004). Kilcoole Little Tern Report 2004. Unpublished BirdWatch Ireland Conservation Report No 04/4

Whilde, A. (1993) Threatened mammals, birds, amphibians and fish in Ireland. Ireish Red Data Book 2: vertebrates, HMSO, Belfast.

Appendices

Table 5: Baltray Little Tern and Ringed plover Chick ringing and morphometric data 2015 (Bxx= Little tern nest; RPxx = Ringed Plover nest)

Event	Ring Number	Darvic code	Nest No.	A-,B- or C-chick	Age (day)	Date	Time	Wing (mm)	Corrected weight (g)
First check			B52		0	02/07/15	13:21:00	12	6
First check			B52		0	02/07/15	13:26:00	13	6,5
Ringing	NW45212		B52		1	03/07/15	13:22:00	13	8,5
Ringing	NW45213		B52		1	03/07/15	13:38:00	12	8
First check			B32		1	04/07/15	12:10:00	12	7,5
First check			B32		1	04/07/15	12:13:00	12	7,5
Control	NW45212		B52		2	04/07/15	14:28:00	15	12
Control	NW45213		B52		2	04/07/15	14:31:00	14	10,5
Ringing	NW45214		B32		2	04/07/15	17:25:00	13	9,5
Ringing	NW45215		B32		2	04/07/15	17:29:00	13	9
First check			B58		0	04/07/15	17:39:00	9	6
First check			B37		0	04/07/15	19:13:00	12	7
First check			B37		0	04/07/15	19:15:00	12	7
First check			B37		1	05/07/15	12:46:00	12	8
First check			B37		1	05/07/15	12:49:00	13	8
First check			B65	A	1	05/07/15	13:01:00	11	6
First check			B65	B	1	05/07/15	13:03:00	11,5	6,25
Control	NW45214		B32		3	05/07/15	13:26:00	15,5	12
Control	NW45215		B32		3	05/07/15	13:35:00	13,5	10
Ringing	NW45216		B37		1	05/07/15	17:00:00	13	8,5
Ringing	NW45217		B37		1	05/07/15	17:05:00	13	8,75
Ringing	NW45218		B58		1	05/07/15	17:15:00	12,5	7,5
Ringing	NW45219		B58		1	05/07/15	17:20:00	12	7,5
First check			B63	A	0	06/07/15	17:26:00	11	6
First check			B63	B	0	06/07/15	17:28:00	10,5	5,5
Control	NW45214		B32		4	06/07/15	17:37:00	19	15
Control	NW45215		B32		4	06/07/15	17:40:00	19	14,5
Ringing	NW45220		B65		2	06/07/15	17:45:00	15,5	9,75
Ringing	NW45221		B65		2	06/07/15	17:48:00	15	8,75
Ringing	NW45222		RP5		1	07/07/15	08:20:00	12	9,5
Ringing	NW45223		RP5		1	07/07/15	08:25:00	13	9,75
Ringing	NW45224		B36		1	07/07/15	08:57:00	12	6,5
Ringing	NW45225		B36		1	07/07/15	09:01:00	10,5	5,5
Ringing	NW45226		RP17		1	07/07/15	09:55:00	10,5	7,25
Ringing	NW45227		RP17		1	07/07/15	10:00:00	10	6,5
Ringing	NW45228		B63		1	07/07/15	13:38:00	12	6,5
Ringing	NW45229		B63		1	07/07/15	13:42:00	12,5	7
Control	NW45219		B58		3	07/07/15	16:21:00	15	12,75
Control	NW45218		B58		3	07/07/15	16:24:00	16	12,5
Control	NW45214		B32		5	07/07/15	16:50:00	21	18
Control	NW45221		B65		3	07/07/15	17:07:00	17	11,5
Control	NW45220		B65		3	07/07/15	17:09:00	16	11,5
Ringing	NW45230		RP5		1	07/07/15	17:35:00	12	9
Control	NW45215		B32		5	07/07/15	18:20:00	20	16,5
Control	NW45226		RP17		1	08/07/15	11:18:00	10,5	6,5
Control	NW45219		B58		5	08/07/15	11:00:00	18	12
Control	NW45218		B58		5	08/07/15	11:05:00	18	11
Control	NW45215		B32		6	08/07/15	12:28:00	24,5	18,5
Control	NW45214		B32		6	08/07/15	12:32:00	27,5	20
Control	NW45228		B63		2	08/07/15	12:51:00	12	8
Control	NW45229		B63		2	08/07/15	12:54:00	12,5	9
Control	NW45224		B36		2	08/07/15	12:57:00	12	8
Control	NW45225		B36		2	08/07/15	13:00:00	11	7
Control	NW45221		B65		5	09/07/15	08:30:00	19	15
Control	NW45220		B65		5	09/07/15	08:35:00	20	15,5
Control	NW45228		B63		3	09/07/15	11:30:00	13	10
Control	NW45229		B63		3	09/07/15	11:35:00	14,5	12
Control	NW45225		B36		3	09/07/15	11:45:00	12	9
Control	NW45224		B36		3	09/07/15	11:49:00	13	10
First check			B55		1	09/07/15	14:10:00	11	7
First check			B55		1	09/07/15	14:12:00	12	7
Control	NW45219		B58		5	09/07/15	14:30:00	21	17
Control	NW45218		B58		5	09/07/15	14:35:00	20	16
Ringing	NW45231		B55		2	10/07/15	09:00:00	13	8,5
Ringing	NW45232		B55		2	10/07/15	09:05:00	12,5	9,25
Control	NW45220		B65		6	10/07/15	11:25:00	25	19
Control	NW45221		B65		6	10/07/15	11:30:00	27	18,5
Control	NW45228		B63		4	10/07/15	13:30:00	19	14
Control	NW45229		B63		4	10/07/15	13:34:00	25	16
Control	NW45225		B36		4	10/07/15	13:40:00	17	12,5
Control	NW45224		B36		4	10/07/15	13:45:00	18	15,5

Control	NW45232		B55		3	11/07/15	08:45:00	16	13
Control	NW45231		B55		3	11/07/15	08:50:00	14	10,75
Control	NW45229		B63		6	12/07/15	09:15:00	34	23,25
Ringing	NW45233		B66		1	12/07/15	09:34:00	12	7,5
Ringing	NW45234		B66		1	12/07/15	09:38:00	10,5	6,5
Control	NW45224		B36		6	12/07/15	11:20:00	29	20,75
Control	NW45232		B55		4	12/07/18	13:10:00	20	16,5
First check			B64		0	12/07/15	18:04:00	12,5	8,25
Control	NW45231		B55		5	13/07/15	13:45:00	25	20
Control	NW45232		B55		5	13/07/15	13:50:00	27	19
Ringing	NW45235		RP14		1	13/07/15	14:30:00	10	8,5
Control	NW45224		B36		7	13/07/15	16:20:00	39	26
Control	NW45225		B36		7	13/07/15	16:30:00	32	22,5
Ringing	NW45236		RP ?		?	13/07/15	16:40:00	13	9
First check			B64	A	1	13/07/15	17:00:00	15	10
First check			B64	B	1	13/07/15	17:05:00	14	7
Control	NW45233		B66		2	13/07/15	17:20:00	15	10
Control	NW45234		B66		2	13/07/15	17:25:00	15,5	10,5
Ringing	NW45237		B64	B	1	14/07/15	08:30:00	14	9
Ringing	NW45238		B64	A	1	14/07/15	08:35:00	16,5	12,5
Control	NW45233		B66		3	14/07/15	14:09:00	19	14
Control	NW45234		B66		3	14/07/15	14:11:00	17	13
Control	NW45232		B55		6	14/07/15	18:20:00	31	25
Control	NW45231		B55		6	14/07/15	18:25:00	30	25
Control	NW45224		B36		8	14/07/15	18:40:00	35	28
Control	NW45225		B36		8	14/07/15	18:50:00	33	24,5
Control	NW45225		B36		9	15/07/15	10:30:00	36	26
Control	NW45224		B36		9	15/07/15	10:30:00	37	28
Control	NW45214		B32		13	15/07/15	11:30:00	70	NA
Control	NW45221		B65		11	15/07/15	15:30:00	54	36
Control	NW45233		B66		4	15/07/15	16:40:00	20	16
Control	NW45234		B66		4	15/07/15	16:45:00	18	15
Control	NW45232		B55		7	15/07/15	19:20:00	37	30
Control	NW45231		B55		7	15/07/15	19:25:00	36	29
Control	NW45229		B63		10	16/07/15	10:00:00	60	34
Control	NW45232		B55		8	16/07/15	12:30:00	41	36
Control	NW45219	G139	B58		14	17/07/15	10:35:00	62	39,2
Control	NW45225		B36		11	17/07/15	13:30:00	49	32,3
Control	NW45231		B55		9	17/07/15	14:30:00	43	34,1
Control	NW45230		RP ?		11	17/07/15	15:00:00		
Control	NW45220		B65		13	17/07/15	17:40:00	72	39,5
Control	NW45221		B65		13	17/07/15	17:45:00	74	39
Control	NW45221	G140	B65		14	18/07/15	16:00:00	81	39,5
Control	NW45225	G141	B36		13	19/07/15	11:00:00	67	33,5
Ringing	NW45239		?		?	19/07/15	16:45:00		-2
Control	NW45225	**G141**	B36		14	20/07/15	15:10:00	74	40,5
Control	NW45221	G140	B65		16	20/07/15	15:50:00	88	41
Control	NW45218	G143	B58		17	20/07/15	16:15:00	92	
Control	NW45219	G139	B58		17	20/07/15	16:25:00	88	
Control	NW45225	G141	B36		15	21/07/15	10:15:00	76	
Ringing	NW45300		?			21/07/15	10:25:00		
Ringing	NW45240		RP26			21/07/15	11:20:00		
Ringing	NW45241		RP26			21/07/15	11:25:00		
Control	NW45215	G144	B32		19	21/07/15	11:50:00	105	
Control	NW45214	G150	B32		19	21/07/15	12:40:00	109	
Control	NW45219	G139	B58		18	21/07/15	16:30:00	91	
Control	NW45218	G143	B58		18	21/07/15	18:00:00	95	41,5
Ringing	NW45242		RP26			21/07/15	18:15:00		
Control	NW45221	G140	B65		18	22/07/15	10:00:00	99	44.75
Control	NW45225	G141	B36		16	23/07/15	13:00:00	87	49
Ringing	NW45243		P16			23/07/15	16:00:00		
Control	NW45225	G141	B36		18	24/07/15	15:00:00	99	50,5
Ringing	NW45244		RP ?			24/07/15	16:40:00		
Control	NW45225	G141	B36		19	25/07/15	10:40:00	102	51
Ringing	NW45245		RP ?			26/07/15	19:00:00		
Ringing	NW45246		RP ?			31/07/15	11:00:00		

Appendix 2: Project publicity

Drogheda Leader, published on June 10th.

JUST a minute

Amélie Boue
of the Little Terns Project in Baltray.
Find out more at
www.louthnaturetrust.org

What is your occupation?
I am a Hatcher and chick feeder with the Little Terns Project in Baltray.

What is the funniest Drogheda saying you have heard?
It's for the birds!

Who would your dream date be?
John "Eagle" ton!

What makes you angry?
Foxes and crows eating my eggs.

If you could buy any car in the world what would it be?
We don't need cars!

What is the first thing you would do if you won the lotto?
Build a nature school, buy a first class flight to West Africa
and give a big donation to Louth Nature Trust.org

Where is the first place in Drogheda you would bring a tourist to see?
The beach at Baltray of course!

If you could change one thing in the town what would it be?
Just nothing. Don't change a beautiful town!

What do you think the town will be like in a 100 years?
Part of Dublin city and further from the sea!

What is your favourite memory from your childhood?
Ghana where we spent our winter. It's very hot and sunny! Fish and dips!

Are you well-known in the local community? Would you like to take part in our Just a Minute? Phone us on 041-9836100 or text 086 - 8053534

Flying ahead

Little Terns Project in Baltray off to a great start but funding needed

By Ian Watters

THE Little Tern Project in Baltray is off to a flying start this year already, with over 20 volunteers from all walks of life playing their part in helping to protect the birds.

However, despite fundraising and significant donations there is still a shortfall in money to run the project and the Louth Nature Trust will need to replenish funds before the end of the year.

The zone protection work began on Saturday 16th May, with the volunteers marking out and fencing off the nesting area that is to be protected this year.

"The volunteers braved the showers and wind to help prepare for an influx of tourists from Africa. The tourists, Little Terns who have spent the winter in East Africa, will be hoping for better weather when they arrive any day now to make their nests and breed at Baltray Beach in Louth. And although we cannot guarantee the weather, thanks to the hard work of the dedicated volunteers, we can be sure their nesting area will be protected from predators as over 2 km of flexi-netting and electric fencing has been erected around the colony site, the biggest on the East coast," it was explained.

Little Terns, sometimes known as swallows of the sea, due to their acrobatic flight and forked tails have been breeding at Baltray for centuries but during the 1980's numbers declined and the breeding population was almost wiped out. Then a group of volunteers stepped in to help protect the birds by wardening the beach. These volunteers became the core of the Louth Nature Trust that has overseen the rise of numbers of breeding terns from complete failures in the 1990s to almost 100 breeding pairs now.

Dominic Hartigan and Gerard Murray setting up the viewing tower at the Little Tern Project Baltray

Volunteers at the Little Tern Project Baltray setting up the fencing.

"Every year the birds face the twin problems of predators developing a taste for baby terns and having their nests washed away by high tides. The electric fencing will help to prevent the predators and Louth Nature Trust, with funding from Louth County Council Heritage Office and donations from local businesses such as Premier Periclase and the Drogheda Port company, will employ night time wardens, support an ecological team to relocate nests out of harm's way and organise a rota of volunteers to help inform dog-walkers and beach users about the delicate nests hidden in the stones," it was added.

Anyone wishing to donate either equipment, time, expertise or funds should contact Breffni martin bmartin@regintel.com or the site hotline on 086-2434874

Drogheda Leader, published on June 4th.