

FOR ROSEATE TERN CONSERVATION

CARANTEC (France)
25-26 avril 1992

PROCEEDINGS



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Nous remercions également les départements international, de recherche et de gestion des réserves, du RSPB, grâce auxquels de nombreux participants ont pu se joindre à nous.

Localement, l'accueil par la Maison Familiale de L'Eveil (Carantec), facilité par la participation de Pierre-Jean Le Morvan a été apprécié par chacun.

En dernier lieu, nous tenons à remercier les indispensables secrétaires de séance (Marek Kerbourc'h et Gwénaél Allain), ainsi que Nonie Coulthard, Etienne Danchin et Jean-Yves Monnat pour la traduction simultanée au cours des débats ou discussions informelles.

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REUNION ANNUELLE POUR LA PROTECTION DE LA STERNE DE DOUGALL

Carantec avril 1992

En 1987, le RSPB (Royal Society for Protection of Birds) constituait un groupe informel de chercheurs, bénévoles et gardes de réserves chargés de la gestion des sites de nidification de sternes de Dougall en Europe. A partir de 1989, un contrat avec la CEE, négocié par le RSPB, a permis de financer le travail de terrain (suivis scientifiques, surveillance, gestion) sur les colonies principales de Grande-Bretagne, d'Irlande, de Bretagne et des Açores.

Avec le saison 1992, ce contrat européen arrivait à sa fin, mais pas pour autant la collaboration entre les nombreux partenaires chargés de la gestion de ces réserves. Afin de poursuivre le travail entrepris, le groupe a décidé de maintenir la réunion annuelle. En 1992, l'organisation a été confiée à la SEPNEB. Carantec, dans la baie de Morlaix, était le lieu le plus approprié, puisque située près de l'unique colonie de sternes de Dougall en France.

Le programme dense et riche de ces deux journées de travail, comprenait dans un premier temps une présentation des problèmes liés à la protection et à la gestion des réserves à sterne de Dougall en Grande-Bretagne (Nord de Pays de Galles - Angleterre - Irlande du Nord), en Irlande (deux sites sur la côte Est), au Portugal (Archipel des Açores), aux Seychelles et en Bretagne (baie de Morlaix). Dans un deuxième temps, les problèmes liés directement à la biologie de cette espèce, comme la migration et l'hivernage, ont été abordés par les représentants du Ghana et pour le Sénégal, par la LPO.

Toujours au cours de cette journée, les spécialistes de la biologie de la sterne de Dougall ont exposé les résultats des divers programmes de recherche entrepris récemment en Grande-Bretagne, en Irlande et aux Açores (écologie comparée de la nutrition de deux espèces de sternes). Avant d'entamer la discussion sur les nombreux points abordés au cours de la journée, Ian Nisbet, le spécialiste nord-américain nous a fait profiter des résultats des recherches sur les colonies américaines que 3 équipes étudient, notamment quelques aspects de la biologie de la reproduction de cette espèce.

La seconde journée a été réservée à un débat ouvert sur les deux grands thèmes : gestions de sites et suivis scientifiques.

Un plan de gestion pour la protection de l'espèce a été réalisé par le RSPB et distribué à tous les participants, même si ce document n'est applicable qu'aux réserves gérées de près ou de loin par le RSPB.

L'aspect général de gestion de sites de nidification (végétation - prédation - nichoirs) et de surveillance des sites d'hivernage concernant chaque structure ou association locale, il a été entendu que dans un premier temps l'information et l'échange d'expériences étaient le plus important à centraliser. En effet, il apparaît que les principaux sites de nidification sont suivis, gérés et protégés, par des bénévoles, des gardes et des scientifiques dont les objectifs sont semblables, même si parfois les méthodes sont différentes (interventionnisme ou pas) et les moyens financiers très inégaux.

La centralisation des informations a été confiée à trois personnes représentant les points principaux de la gestion des sites :

Contrôle de la prédation (mammifères et goélands) :
Graham HIRONS (RSPB)

Gestion de la végétation - Erosion :
Patrick WARNER (IWC - Irlande)

Nichoir et problèmes liés au parasitisme :
Adrian del NEVO (RSPB)

Suite à une demande d'aide et de conseils des représentants du Sénégal et du Ghana, Ken SMITH (RSPB) se charge des liaisons avec l'Afrique.

En matière de suivi scientifique, le RSPB a proposé une méthodologie ayant pour principal objectif de conseiller les gestionnaires de chaque site de nidification, pour d'éventuels projets de suivis.

Le guide présenté au cours de cette réunion, réalisé en collaboration avec les divers spécialistes anglais, irlandais et américain ne sera suivi d'effets qu'en mesure de la disponibilité des gestionnaires et de leur possibilité de mettre en place ce type de projet.

L'intérêt principal d'un travail scientifique commun à l'échelle européenne, étendu aux sites américains, est de comparer données et observations d'un site à l'autre.

De plus, la population européenne de sternes de Dougall, réparties entre les îles britanniques et les Açores semble avoir une unité mal connue. Mieux la connaître (par un baguage "spécial Dougall" notamment) ne peut que permettre de mieux la protéger, de mieux comprendre la diminution alarmante qu'elle accuse depuis près de 20 ans.

De nombreux bénévoles bretons (conservateurs et gardes de réserves de la SEPNE) étaient présents et ont apprécié, malgré l'usage quasi-continu de la langue anglaise, de rencontrer leurs homologues britanniques ou irlandais et d'échanger idées et projets.

Le présent rapport se compose d'articles fournis par leurs auteurs suite à leur communication au cours de cette réunion. La coordination tient donc à les remercier tous pour leur aimable participation.

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LES STERNES DE BRETAGNE

Jean-Yves MONNAT - SEPNEB

Exceptés la très ancienne monographie de L. BUREAU (1905) sur la sterne de Dougall et un travail très descriptif sur la colonie de Dougall de Méaban dans le Morbihan (1955), il n'existe pas de travail réellement scientifique sur les sternes de Bretagne.

Les recensements et les estimations de production sont les éléments les plus précis dont nous disposons.

Cet article sera donc limité à l'histoire des populations de sternes de Bretagne, c'est-à-dire, les évolutions numériques, les modifications de leur répartition géographique, et les mesures de protection prises à leur égard.

Six espèces de sternes ont historiquement niché en Bretagne, parmi lesquelles trois peuvent être considérées comme marginales :

Sterne de Hansel (*S. nilotica*) : 300 couples à Dumet en 1946

Sterne arctique (*S. paradiseae*) : présence épisodique et toujours en petit nombre

Sterne naine (*S. minuta*) : effectifs bretons toujours très réduits ne représentant que 0.5 % de la population française, et dont l'histoire est mal connue.

Ne seront donc évoqués ici, que les trois autres espèces en raison de l'importance absolue ou relative de leurs effectifs.

La Bretagne est de loin, le bastion français des oiseaux marins nicheurs, puisque ses côtes hébergent environ 80 % des populations de la façade Manche-Atlantique. Si la Bretagne accueillait la quasi totalité des sternes jusqu'aux années 70, seulement 25 % des caugeks et 84 % des pierregarins s'y reproduisent en 1988. En revanche, l'ensemble de la population française de sternes de Dougall reste bretonne.

1820 - 1920 : LA PREHISTOIRE

Les premiers renseignements un tant soit peu précis concernent la sterne de Dougall, qui n'est décrite que depuis 12 ans, lorsque 124 spécimens et oeufs sont récoltés à l'île aux Dames en 1825 (Vieillot & Oudart). En fait, la majorité des traces écrites remontant au 19^{ème} siècle et au premier quart du 20^{ème} siècle, est consacrée à cette espèce. Du fait de sa rareté, les ornithologues lui ont porté une attention particulière.

Entre 1868 et 1909, L. Bureau trouve des sternes de Dougall sur 13 îlots breton, et fait état de la présence de sternes pierregarin, de sternes arctique et de sternes caugek. Malheureusement, les informations sur la taille des colonies sont vagues et on doit se contenter d'impressions qui ressortent de la bibliographie de cette époque :

- 1) les effectifs d'oiseaux de mer sont à leur plus bas niveau historique
- 2) il n'est pas impossible que les sternes soient les plus abondants oiseaux de mer
- 3) la caugek est rare !
- 4) la Dougall est peut-être la plus commune

1920 - 1950

Quelle que soit l'espèce, les renseignements sont très clairsemés au cours de cette période. On aurait en effet, moins de 10 références précises.

1950 - 1975 : GRANDEUR ET DESTABILISATION

Les années 50 sont marquées par un fort développement de l'ornithologie de terrain et par un regain d'intérêt pour les colonies d'oiseaux de mer.

Les visites répétées sur les îlots de Bretagne permettent de retrouver les sternes e.g., en particulier la sterne de Dougall, dans tous les secteurs de reproduction connus au début du siècle. On parvient également à se faire une idée du niveau d'effectifs des populations et on suit l'augmentation rapide du nombre de sterne caugek à partir de 1955.

De 1950 à 1973, les effectifs des trois espèces principales en Bretagne se maintiennent autour de 2 000 couples pour les sternes pierregarin, entre 500 et 600 couples (maximum 800 ?) pour les sternes de Dougall et fluctuent entre 300 et 4 700 couples pour les sternes caugek. Pour les sternes caugek, les oscillations se situent dans un évident contexte d'augmentation générale.

Jusqu'en 1970, l'apparente stabilité des pierregarin et des Dougall, et l'augmentation des caugek masquent la très forte instabilité géographique des sternes pendant la majeure partie de cette période, à la fois entre secteurs et au sein des secteurs.

Déplacements de la population de sterne Caugek

- * de 1946 à 1965, on la trouve entièrement en Bretagne, principalement (90 % du total) répartie entre deux îles : Méaban à l'entrée du Golfe du Morbihan et Dumet en Loire-Atlantique.
- * entre 1959 et 1965, Dumet perd plus de 90 % de son effectif, qui se retrouve à Méaban.
- * 1966 est l'année du premier essai de nidification sur le Banc d'Arguin en Gironde, où 1 200 couples s'installent, apparemment temporairement.
- * en 1968, plus de 80 % nichent sur Méaban, qui sera complètement abandonné au profit de Dumet entre 1972 et 1973

Déplacements de la population de Dougall

- * 1955 : 86 % niche en Iroise (archipel de Molène)
- * 1960 : elle est répartie entre l'Iroise et le Mor Braz (sud-est de la Bretagne)
- * 1967 : 25 % demeure dans le Mor Braz, alors que le nord-finistère en abrite 70 %. Mais on observe un déplacement de l'archipel de Molène vers les Abers.

Sur de nombreux sites historiquement connus pour la nidification des sternes, les ornithologues prennent conscience parallèlement, des effets néfastes de l'augmentation des effectifs de goélands argentés entre 1955 (6 000 couples) et 1970 (27 000 couples). L'île aux Dames (baie de Morlaix), l'archipel de Molène et l'île Dumet, vont accueillir de grosses colonies de goélands qui vont chasser les sternes ou au moins leur poser des problèmes importants.

1973 - 1974 : TOURNANT

Ces années apparaissent catastrophiques pour les sternes en Bretagne, car elles sont marquées par l'installation définitive de la moitié de la population française de caugek au Banc d'Arguin (sud-ouest de la France), et par le crash de la population de Dougall dont l'effectif passe de 500 à 100 couples (Figures 2 et 3)

1975 - 1991 : PROTECTION - GESTION

Création du réseau de réserves de la SEPNB

La SEPNB, est depuis 1959, gestionnaire de réserves, dont le nombre ne cesse de croître d'années en années. Avant d'élargir l'activité de protection à différents types de milieux (à partir de 1979 pour être exact), les

bénévoles du réseau-réserve, en majorité ornithologues, ont concentré leurs efforts à la protection de la nidification des oiseaux de mer, notamment des sternes (Figure 4).

Les objectifs admis et toujours en vigueur sont avant tout de ne pas courir après les colonies de sternes et de maintenir accueillants des sites historiques de nidification sur l'ensemble de la Bretagne.

On constate que depuis plusieurs années une forte proportion de sternes de Bretagne se reproduit dans des réserves

Proportions dans les réserves SEPNB

	1979	1998	1992
Caugek	85 %	96 %	100 %
Pierregarin	51 %	42 %	73 %
Dougall	89 %	100 %	100 %

Gestion des sites à sternes

1989	9 surveillants se sont succédés entre début mai et fin août sur Trévorc'h (29) et en baie de Morlaix (29).
1990	12 surveillants (165 jours de présence) sur 4 sites : les mêmes + La Colombe (22) et la Rivière d'Étel (56)
1991	9 surveillants (180 jours de présence) sur 4 sites

Références bibliographiques :

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BUREAU L. "Monographie de la Sterne de Dougall (Sterna Dougalli) - Proceedings of the IVth International Ornithological Congress, p. 289 à 344 - 1905.

HENRY J. et MONNAT J.Y. "Oiseaux marins de la façade atlantique française", 338 pages - SEPNB/MER - 1981.

Abstract

Scientific work does not exist about terns in France.

1820-1920

The first definite data about tern are the discovering of specimens and eggs from Ile aux Dames (Finistère) in 1824. Between 1868 and 1909, Louis BUREAU visits the main breton archipelagos and finds roseate tern colonies on 13 islets. He produced a "Monographie de la sterne de Dougal" in 1905 and described the colonies only with vague numbers and as "fine colonies...". There are absolutely no precise data, only dominant impressions from this period :

- Seabird populations are at their lowest historical level
- Terns could be the commonest seabirds, at least until 1910's
- Sandwich tern are rare
- Roseate terns the commonest ?

Between 1920's and 1940's, data on tern are scanty.

From 1950, the developpement of field ornithology has permitted to have rather good counts of tern numbers all around Brittany ant to notice a rapid growth of sandwich terns.

Until 1973, numbers seem to be stable for common tern (2 000 pairs) and roseate terns (5-600 pairs). They globally grow from 300 to more than 4 000 pairs for sandwich terns.

This global stability or growth, mask a great geographical instability at different levels (between areas and between islets in the same area). This instability is certainly due to the huge growth of gull populations at the same time

Numbers of Herring gulls in Brittany

1955 : 6 000 pairs - 1970 : 26 000 pairs - 1977-78 : 45 000 pairs.

The sudden changes from 1973-74 are marked by an emigration of the half breton population of sandwich terns to south-east of France (Banc d'Arguin), where 1 820 pairs breed in 1974. and by the crash of the roseate tern population (from 5-600 to 100 pairs)

The tern population management started with the first tern reserves in Brittany. The SEPNB's "Observatoire de sternes" is created in 1989. The management aim is to maintain a reserve network as suitable as possible to breeding terns.

Reserve creations, vegetation management, gull culling (>8000 gulls have been killed from 1981 on tern reserves) and colony wardening since 1989.

Reserve management on SEPNB reserves is possible because of volunteers. The coordination of this work helps to find money, partners and to organise the staffs od seasonal wardners.

Today tern populations seem to be more or less stable in Brittany.

Terns propotion in SEPNB reserves

	1979	1988	1992
Sandwich	85 %	96 %	100 %
Common	51%	42 %	73 %
Roseate	89 %	100 %	100 %

ROSEATE TERNS ON ANGLESEY

AN UPDATE

Alastair MORALEE - RSPB-North Wales

Roseate Terns have bred on at least 8 sites in North Wales during this century. Seven of these sites were on Anglesey.

At present, there are breeding colonies on just three of these sites - Ynys Feurig, The Skerries and Cemlyn.

1. YNYS FEURIG

This has been the main Roseate tern colony in North Wales since 1959. The colony site consists of three small islets (total c3ha), accessible from the mainland for a period of two hours either side of low tide. This is a mixed colony of Roseate, Arctic and Common terns (whith Sandwich also occasionally breeding). Historically breeding success has been threatened both by predation (e.g. rats, foxes, gulls and Peregrines) and by human disturbance (e.g. holiday-maker and egg-collectors).

The islands are very low (the highest point is approximately 7 m above Mean High Water).

Most recently threats to the colony have involved predation (by Peregrines, foxes and gulls) whilst human disturbance has been successfully reduced by full-time wardening.

The islands are too small to allow the wardens to live on them and it is, therefore, difficult to monitor disturbance and predation levels. The majority of the Roseate Terns breed on the outermost islet - around 600 m from the mainland.

The Roseate tern population appears to have remained relatively stable (between 150 and 200 pairs) for at least the period 1969-1986. Between 1986 and 1987 the population dropped from 200 pairs to around 40 pairs.

This sudden and drastic decline was almost certainly due to a combination of factors including :

- * continued and increased predation and disturbance from Peregrines,
 - * a major kill of adult terns (at least 57 adult including 12 Roseate Terns) by a fox in the third week of May,
 - * severe gales on the 6 th and 7 th June
 - * cool, wet and dull weather throughout June.
- Upto 500 adult Roseate terns were present in the middle of June although many of these had left by the end of the month.

In the four years since 1987 only 1989 was a "good" year (around 75 Roseate young fledged from around 70 pairs). In each of the remaining three years there has been a major predation problem (gulls in 1988 and 1990, Peregrine in 1991) and no young fledged from the colony in either 1990 or 1991.

Table 1. illustrates the combination of problems encountered in the past few years.

It appears that "to save" or reinstate the Roseate colony at Ynys Feurig we have to tackle at least six separate problems ; namely :

- * human disturbance and egg-collecting,
- * predation by foxes,
- * predation by rats,
- * predation by gulls,
- * predation by Peregrine,
- * bad weather during June and July.

We feel that we now have adequate mechanisms for dealing with the first three of these difficulties. There has been little problem from human disturbance since full-time wardening of the colony commenced, low-tide fox patrols are now standard procedure from early May (even if it appears that no terns are yet using the islands) and rat bait is put out on the islands each year.

Predation by Peregrines and Gulls

One of the major practical difficulties in wardening Ynys-Feurig has been monitoring activity within the colony, it is virtually impossible to watch the Roseate Tern area from anywhere other than from inside the colony. This has made it extremely difficult even to assess the impact of gull or Peregrine predation or disturbance in the past.

In 1991, two small, wooden hides were built on the Outer island to increase the opportunities for observation. These appear to have caused little or no disturbance to the terns with several pairs of Arctic terns nesting within a meter of them.

On at least 7 occasions Peregrines were scared off the islands by wardens in the hides. It is intended that far greater use of the hides will be made in future years, both to prevent, Peregrines from landing on the islands, to allow control of gulls should this prove necessary and to attempt to read ring numbers of Roseate terns.

The Weather !

Nest-boxes have been in place on Ynys Feurig since 1988. These have met with limited success. To date a total of 21 Roseate tern eggs have been laid in nest-boxes, of these 28 (90 %) have hatched. In addition chicks sheltering regularly within nest boxes appear to have survived longer in 1990 despite heavy gull predation (although all succumbed eventually).

The islands, being so low, are particularly vulnerable to South-westerly gales combined with high tides - Arctic tern clutches have been washed off the inner island in two out of the last five years - we can do little about this except hope for good weather in June and July.

2. THE SKERRIES

These are a series of small islands totalling around 16ha, 3km off the north coast of Anglesey. Arctic terns re-colonised the islands in 1979 (after an absence of 28 years) and have built up to a total of around 700 pairs in 1991. Fledging success for Arctic terns has been very good for at least the last 6 years (with the exception of 1988 when the colony deserted following Peregrine disturbance).

The islands were established as an RSPB reserve in 1982 in the hope that Roseate terns would re-colonise (they last bred in 1952).

21 pairs bred successfully in 1987.

Common terns re-colonised in 1991.

The islands have been warded full-time since 1989.

In addition to the terns upto 1 400 pairs of gulls breed on the islands (Herring Gull and Lesser Black-Backed Gull).

Conversation Action

A gull "exclusion zone" is maintained around the tern colony by removing nests/eggs.

Attempts are being made to establish Tree Mallow (*Lavatera arborea*) in a walled garden to provide shelter for the Roseate Terns.

Nest boxes have been provided for the past three years although none have yet been used by Roseate Terns.

Peregrines are regularly seen over the islands but appear to have been deterred from landing or roosting on the islands by the presence of the wardens.

The colony is extremely easy to monitor from the lighthouse buildings and there is great scope for detailed monitoring of breeding success and feeding rate/species composition.

3. CEMLYN

This site is wardened by the North Wales Wildlife Trust. It is a series of very small islands within a naturally formed lagoon on the north coast of Anglesey (approx. 6 km South-east of the Skerries).

Arctic, Common, Roseate and Sandwich tern nest.

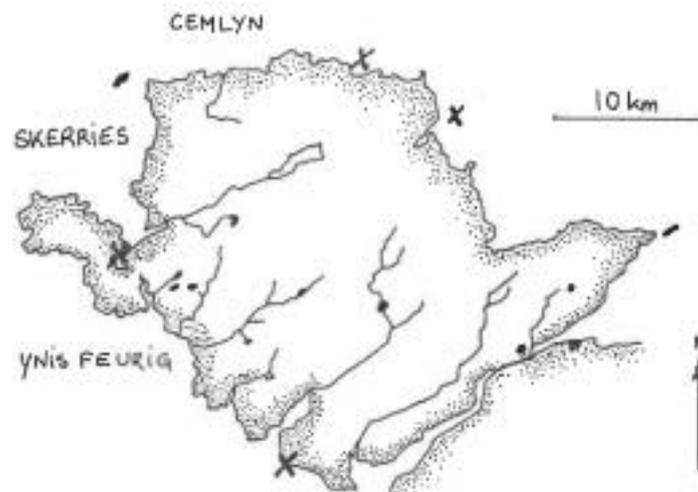
Roseate terns first bred in 1986.

Major constraints to breeding success over the past few years have included predation by gulls, jackdaws, rats and stoats and egg-collecting.

THE SKERRIES - ANGLESEY



ANGLESEY PAST AND PRESENT ROSEATE TERN COLONIES



CEMLIN BAY - NORTH WALES WILDLIFE TRUST RESERVE

TABLE 1. Pairs of breeding terns 1986 - 1991

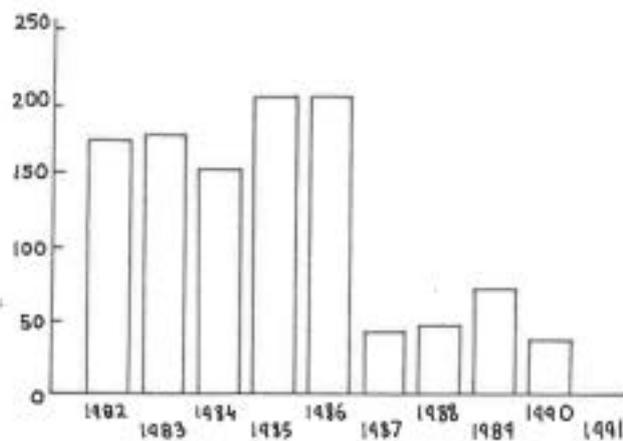
	1986	1987	1988	1989	1990	1991
COMMON TERN	c100	c100	c90	100	31	110
ARCTIC TERN	c135	c140	c180	240	150	190
SANDWICH TERN	c450	800	c1100	830	500	600
ROSEATE TERN	7-10	15-20	c15	7-12	3-4	4

THE SKERRIES

Table 2. Pairs of breeding gulls and terns 1986 - 1991

	1986	1987	1988	1989	1990	1991
ARTIC TERN	c190	260	0	380	464	700
ROSEATE TERN	0	21	0	19	7	0
COMMON TERN	0	0	0	0	0	6-7
Lsr BLACK-BACKED G.	300+	453	415	451	425	847
HERRING GULL	300+	361	382	300	348	596

BREEDING PAIRS OF ROSEATE TERNS - YNIS FEURIG - ANGLESEY 1982 - 1991



YNYS FEURIG 1985-1990 - PREDATION, WEATHER, BREEDING SUCCESS

Predators

<i>YEAR</i>	<i>FOX</i>	<i>RAT</i>	<i>GULL</i>	<i>PEREGRINE</i>
1985		+	+	+++
1986			+	+++
1987	+++		+	+++
1988			+++	++
1989			+	++
1990			+++	+
1991			+	+++

June weather

Weather Assessments are as compared with 1951-80 Average. Data from RAF Valley

<i>YEAR</i>	<i>TEMP.</i>	<i>RAIN</i>	<i>SUN</i>
1985	AV.	WET.	AV.
1986	WARM	AV.	AV.
1987	COOL	WET	DULL
1988	WARM	DRY	SUNNY
1989	WARM	AV.	DULL
1990	AV.	DRY	DULL
1991	COOL	AV.	DULL

Roseate tern breeding success

<i>YEAR</i>	<i>PAIRS</i>	<i>NO. RINGED</i>	<i>RINGED/ PAIR</i>	<i>FLEDGED</i>
1985	200	116	0.58	150
1986	200	105	0.53	?
1987	40	5	0.13	1
1988	45	15	0.33	6
1989	70	89	1.27	75
1990	35	11	0.31	0
1991	1	0	-	0

	<i>PREDATION</i>	<i>WEATHER</i>	<i>RINGED/ PAIR</i>
WORST	1987	1987	1987
BEST	1989	1988	1989

On voit régulièrement les faucons pèlerins au dessus des îlots mais il semble qu'ils soient dissuadés par la présence des gardiens.

Des bâtiments du phare , on peut facilement surveiller la colonie et l'on peut bien suivre de près le succès de la reproduction , la fréquence d'alimentation et la composition en espèces.

3. CEMLYN

La est assurée par le North Wales Wildlife Trust . Cemlyn est composé d'une série de très petits îlots qui se trouvent dans une lagune naturelle sur la face nord d'Anglesey (environ six kilomètres au sud-est des Skerries).

Les sternes arctiques, de Dougall et pierregarin y nichent.

Les sternes de Dougall se sont reproduites pour la première fois en 1986.

Les principaux problèmes qui se sont posés pendant les quelques années passées ont été la prédation par les goélands, les choucas des tours, les rats et les hermines et aussi le dérangement dû aux collectionneurs d'oeufs.

STERNES DU DOUGALL A ANGLESEY

UNE MISE A JOUR

Les Sternes de Dougall se sont reproduites sur au moins 8 sites dans le nord du pays de Galles au cours de ce siècle. Parmi ces sites, sept se trouvaient dans l'île d'Anglesey.

A présent, les colonies de reproduction ne se trouvent que sur trois de ces sites - Ynys Feurig, The Skerries et Cemlyn.

1. YNYS FEURIG

Depuis 1959 Ynys Feurig est la colonie principale des sternes de Dougall. La colonie de reproduction se répartie sur trois îlots (trois hectares en total) et elle est accessible de l'île d'Anglesey deux heures avant et après la marée basse. Là on trouve des sternes de Dougall, des sternes arctique et des sterne pierregarin (les sternes caugek s'y reproduisent de temps en temps).

Historiquement, la reproduction a été menacée par des prédateurs (par exemple les rats, les renards, les goélands et les faucons pèlerins) et par le dérangement humain (par exemple le tourisme, les collectionneurs d'oeufs).

Les îlots sont très bas (le point le plus élevé se trouvent à environ sept mètres au-dessus de la myenne des marées hautes).

Plus récemment, les menaces qui pèsent sur la colonie proviennent principalement des prédateurs (surtout les faucons pèlerins, les renards et les goélands) car le dérangement a été diminué grâce l'emploi de gardiens à plein temps.

Le îlots sont trop petits pour permettre au gardien d'y habiter ; la surveillance ne permet pas de donner un idée du niveau de dérangement humain et de la prédation. La plupart des sternes de Dougall se reproduisent sur l'îlot le plus écarté de l'île d'Anglesey (à une distance d'environ six cent mètres).

La population des sternes de Dougall semble s'être stabilisée (entre 150-300 couples) au moins entre 1969 à 1986. Entre 1986 et 1987 la population a diminué de 200 couples à environ 40 couples seulement.

Ce déclin soudain et sévère s'est produit à cause d'une combinaison de plusieurs facteurs :

- * le dérangement et la prédation par les faucons pèlerins a continué et a augmenté.
- * pendant la troisième semaine de mai, un renard a tué beaucoup de sternes adultes (au moins 57 dont 12 étaient des sternes de Dougall).
- * il y eu des coups de vent sévères, le six et le sept juin.
- * pendant tout le mois de juin, il faisait frais, gris et pluvieux.

A la mi-juin, il y avait jusqu'à 500 sternes de Dougall adultes mais à la fin du mois la plupart d'entre elles sont parties.

Depuis 1987, il n'y a qu'une année, 1989 que l'on peut considérer comme bonne (environ 75 sternes de Dougall jeunes élevées par 70 couples). Durant les trois autres années, il y a eu des problèmes des prédation (les goélands en 1988 et 1990, les faucons pèlerins en 1991) et il n'y eu aucune sterne à l'envol en 1990 ou en 1991.

Le tableau 1. montre la combinaison des problèmes que l'on a rencontré pendant les quelques années passées. Il semble que, pour "sauver" ou restaurer la colonie des sternes de Dougall à Ynys Feurig, il fasse aborder aux moins six problèmes séparés, notamment :

- * le dérangement humain les collectionneurs d'oeufs,
- * la prédation par les renards,
- * la prédation par les rats,

- * la prédation par les ~~mouettes~~ ^{goélands},
- * la prédation par les faucons pèlerins,
- * le mauvais temps pendant juin et juillet.

Nous croyons avoir mis en place, les moyens pour diminuer les trois premiers problèmes. Depuis que le poste de gardien à plein temps a été créé, il y a peu de problèmes de dérangement. A marée basse les patrouilles pour les renards sont menées de façon systématique dès le début de mai (même si les sternes ne sont pas encore arrivées) et le piège à rats est laissé sur les îlots chaque année.

La prédation par les faucons Pèlerins et les goélands

L'une des difficultés pratiques majeures qui se présente au gardien à Ynys Feurig est la surveillance de l'activité de la colonie. Il est presque impossible de surveiller les sternes de Dougall sans être dans la colonie elle-même. On a donc eu bien de problèmes en essayant d'évaluer l'effet de la prédation dans le passé.

En 1991, deux affuts ont été installés sur l'îlot extérieur afin de faciliter la surveillance. Il paraît qu'ils n'ont pas du tout dérangé les sternes. Il y a même plusieurs couples de sternes arctique qui ont niché à moins d'un mètre d'eux.

Au moins sept fois les faucons pèlerins ont fui par peur des gardiens qui surveillaient la colonie, de leurs affuts. A l'avenir, on projette de s'en servir plus fréquemment pour empêcher les faucons pèlerins de se poser sur les îlots, pour permettre au gardien de contrôler la population des goélands si c'est nécessaire et pour essayer de lire les bagues que portent certaines sternes de Dougall.

Le temps !

Depuis 1988, des nichoirs sont installés à Ynys Feurig. Le succès a été limité. A ce jour, 31 oeufs des sternes de Dougall ont été pondus dans les nichoirs, dont 28 (90 %) ont éclos. De plus, il semble que les oisillons qui se mettent régulièrement à l'abri des nichoirs ont survécu plus longtemps, pendant 1990 malgré une prédation lourde par les goélands (finalement, il sont tous morts).

Du fait de leur faible altitude, les îlots sont vulnérables aux vents forts du sud-ouest additionnés aux marées hautes - il y a des couvées de sternes arctiques qui ont été emportées pendant deux des dernières années. Nous n'y pouvons pas grand chose, seulement espérer du beau temps pendant juin et juillet !

2. THE SKERRIES

Les Skerries sont une série de petits îlots dont la superficie totale est de 16 hectares, et qui se trouve à trois kilomètres du côté nord de l'île d'Anglesey. En 1979, les sternes arctiques ont recommencé à s'y reproduire. Pendant les six dernières années les sternes arctiques ont réussi en élevant les poussins (sauf en 1988 quand la colonie a été désertée suite au dérangement par des faucons pèlerins).

En 1982, les îlots sont devenus une réserve de la RSPB. On espérait que les sternes de Dougall reviendraient. (la dernière reproduction avait eu lieu en 1952).

En 1987, 21 couples ont réussi à se reproduire.

Les sternes pierregarin sont revenues en 1991.

Il y a un gardien à plein temps depuis 1989.

En plus des sternes, jusqu'à 1 400 couples de goélands se reproduisent sur les îlots (goéland argenté et goéland brun).

On maintient une "zone d'exclusion" contre les goélands autour de la colonie des sternes (prélèvement des oeufs et destruction des nids. On essaie de faire se développer la mauve (lavatera arborea) dans un jardin afin de fournir de l'abri aux sternes de Dougall.

Des nichoirs ont été installés pendant les trois dernières années quoique les sternes de Dougall ne s'en soient pas encore servies.

On voit régulièrement les faucons pèlerins au dessus des îlots mais il semble qu'ils soient dissuadés par la présence des gardiens.

Des bâtiments du phare , on peut facilement surveiller la colonie et l'on peut bien suivre de près le succès de la reproduction , la fréquence d'alimentation et la composition en espèces.

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ROSEATE TERNS IN ENGLAND

JANE BROOKHOUSE - RSPB

Roseate tern breeding sites in England occur around the coast, are few and scattered (Map 1). Typically, the sites are small off-shore islands, with one or two exceptions. Some of these sites are reserves managed by RSPB, some are managed by other conservation organisations eg. National Trust.

Although the Roseate have not necessarily always been counted or monitored well in the past, it is apparent that, as elsewhere, the numbers of breeding terns in England have declined rapidly in recent years. There was a serious decline in the 1980s at all the English sites (Table 1).

The known breeding sites are as follows :

Hodbarrow - RSPB reserve on the south Cumbria coast, comprising lagoons and old mine workings. Here the colony used to exist some 20 years ago on slag islands in the lagoon, but the islands on which the bird nested were eventually bulldozed. Only a single bird have been seen in the last six years. The reserve is now largely managed for little terns.

Dungeness - another RSPB reserve is a complex of shingle and wetlands where a few pairs of Roseate terns have nested on man-made islands over the past 15 years or so. There was a minimum of four pairs in 1981, but usually only one pair. In 1990 one pair bred for the first time since 1984, and in 1991 three birds were seen in June, but there was no breeding.

Scilly Isles - Lying off the south west coast of Cornwall, a group of islands in various ownerships, with Roseate terns moving between various sites. The maximum total was 20 pairs in 1969, but since this, there were only eight or nine pairs until 1987, where there were only five pairs.

The only sites in England where Roseate terns successfully bred last year (1990), were off the north east coast, on the Farnes Islands and Coquet Island.

Farnes Islands - owned by the National Trust, a group of rocky, flat-topped islands with steep cliffs. Thousands of other sea birds including Common, Sandwich and Arctic terns also breed there. Roseate terns have been recorded first in 1831 with highest number in 1950s and 1960s (Table 1). There was a maximum of 94 pairs in 1961, which has dropped to only three pairs in 1991. The birds nest in the sea campion (*Silene maritima*) and dock (*Rumex* sp) on the top of the islands. The birds have moved around between the islands with the changes in the vegetation. The fledging success on the Farnes Islands is not well documented (Table 2). Predation of eggs and chicks by herring and lesser-black-backed gulls seems to have been a problem. More accurate records will be kept in future.

Coquet Island - RSPB reserve lying several miles to the south of the Farnes Islands. It is a low flat-topped island lying about 1.5 km off-shore. The cliffs are much lower than the Farnes but similarly, the islands support thousands of other seabirds, eg : Eider - 350 pairs, Puffins - 1500 pairs, Sandwich terns - 1736 pairs, Arctic terns - 439 pairs and Common terns - 578 pairs. The highest numbers of Roseate terns occurred during the early 1970s (Table 3).

The vegetation is also very different from Farnes, being mostly nettles (*Urtica dioica*) and Yorkshire fog grass (*Holcus lanatus*). Plots are kept open in the nettle beds and it is here that the Common and Arctic terns nest. The Sandwich terns nest in the same area every year which is close to the lighthouse. The Roseate terns tend to nest around the edges of the islands (Fig.1) away from the main tern colony, so are not so easily confused with other tern species, ie. they are easier to count and monitor. They tend to nest in small nettle clumps or in old puffin burrows, so are fairly sheltered.

There is a summer warden every year on the island during the breeding season who carries out the counting. However, because the wardens changes every year, there a possibility of inconsistency in expertise and methodology. The Roseate tern chicks are ringed every year, and fledging success monitored. As there is no public access to the island, disturbance is kept to a minimum. There has been a problem of predation by Herring

and Lesser-Black-Backed gulls in the past, from time to time, these large gull species are culled to maintain low numbers so as to reduce the predation. However, the number of Black-headed gulls nesting on Coquet Island has risen dramatically over the last few years, and it is suspected that these are now much more of a threat to breeding tern, both from predation and competition for nest space. This will be carefully monitored in the future. Artificial nest boxes are not used on either Coquet Island and the Farne Islands.

It is thought there may well be some interchange or Roseate terns between Coquet and the Farne Islands, but again this has not been closely monitored to date.

Table 1. Numbers of Roseate Terns breeding in Britain and Ireland 1969-1987

Number of pairs	1985-87	1969-70
Orkney Islands	-	3
Angus	-	1
Dunfermline	2	5
East Lothian	20	107
Western Isles	1	-
Argyll and Bute	-	3
Kyle and Carrick	-	15
<u>Scotland total</u>	23	134
Northumberland	35	332
Hampshire	-	2
Isles of Scilly	6	20
Cumbria	-	1
<u>England total</u>	41	355
Gwynedd	69 ^a	202
<u>Wales total</u>	69 ^a	202
Antrim	25	- (20 birds)
Down	44	251
Dublin	250 ^b	60
Wexford	8	1352
Cork	-	10
Kerry	1	1
Galway	6	-
Donegal	3	6
<u>Ireland total</u>	337	1701
<u>Britain and Ireland total</u>	470	2392

^a Reduced to 45 pairs in 1988

^b Increased to 306-332 pairs in 1988. 1988 total for Britain and Ireland was at least 490 pairs.

3

Table 2. Roseate terns on the Farne Islands

Year	Browsman	Inner Farne	Longstone End	Longstone Main	"Others"	Total
1946	1-2					1-2
1947	"few"					"few"
1948	13					13
1949	8		15			23
1950	6	4	12		10	32
1951			29			29
1952	3	3	9	1	15	31
1953	3	2	93			98
1954	2	3	40			45
1955		10-20	50		10-15	70-85
1956	4	5-10	40-50		12	61-76
1957	1	5	60-70			66-76
1958		12	30-40			42-52
1959	12	11	10-12			33-35
1960	46	12				58
1961	60	34				94
1962	20	12				32
1963	35-38	30-40				65-78
1964	39-51	30				69-81
1965	37	20				57
1966	22-24	?				24+
1967	24-25	?				25+
1968	49	30				79
1969	No details available for this year					-
1970	24	40				64
1971		15				15
1972	1	10				11
1973	6	23-25				29-31
1974	7	7				14
1975	9	3				12
1976	11	6				17
1977	3	6				9
1978	14	3				17
1979	27-33	1				28-34
1980	21	1				22
1981	14	1				15 (18*)
1982	11	2				13 (11*)
1983	2	1				3
1984	9					9
1985	10					10
1986	9					9
1987	14					14
1988	21					21
1989	11	1				12
1990	2	2				4
1991	1	2				3 (2*)

* : number of young fledged

The three main islands for nesting Roseate terns are/were Brownsman, Inner Farne and Longstone End - Longstone Main being used on only one occasion. "Others" include Northern Hares (10 pairs in 1950, 15 in 1952) and West Wideopens (10-15 pairs in 1955, 12 in 1956).

Table 3. Roseate tern numbers on Coquet Island

Year	Breeding pairs	Young fledged
1970		
1971	50+	-
1972	75	-
1973	-	-
1974	61	-
1975	60	-
1976	26	-
1977	16	-
1978	28	-
1979	36	-
1980	20	-
1981	19	-
1982	29	30
1983	25	15+
1984	18	16
1985	18	17
1986	20	18
1987	17	16
1988	21	22
1989	25	21
1990	23	19
1991	20	15
1992*	29	35

* 1992 figures for interest/information



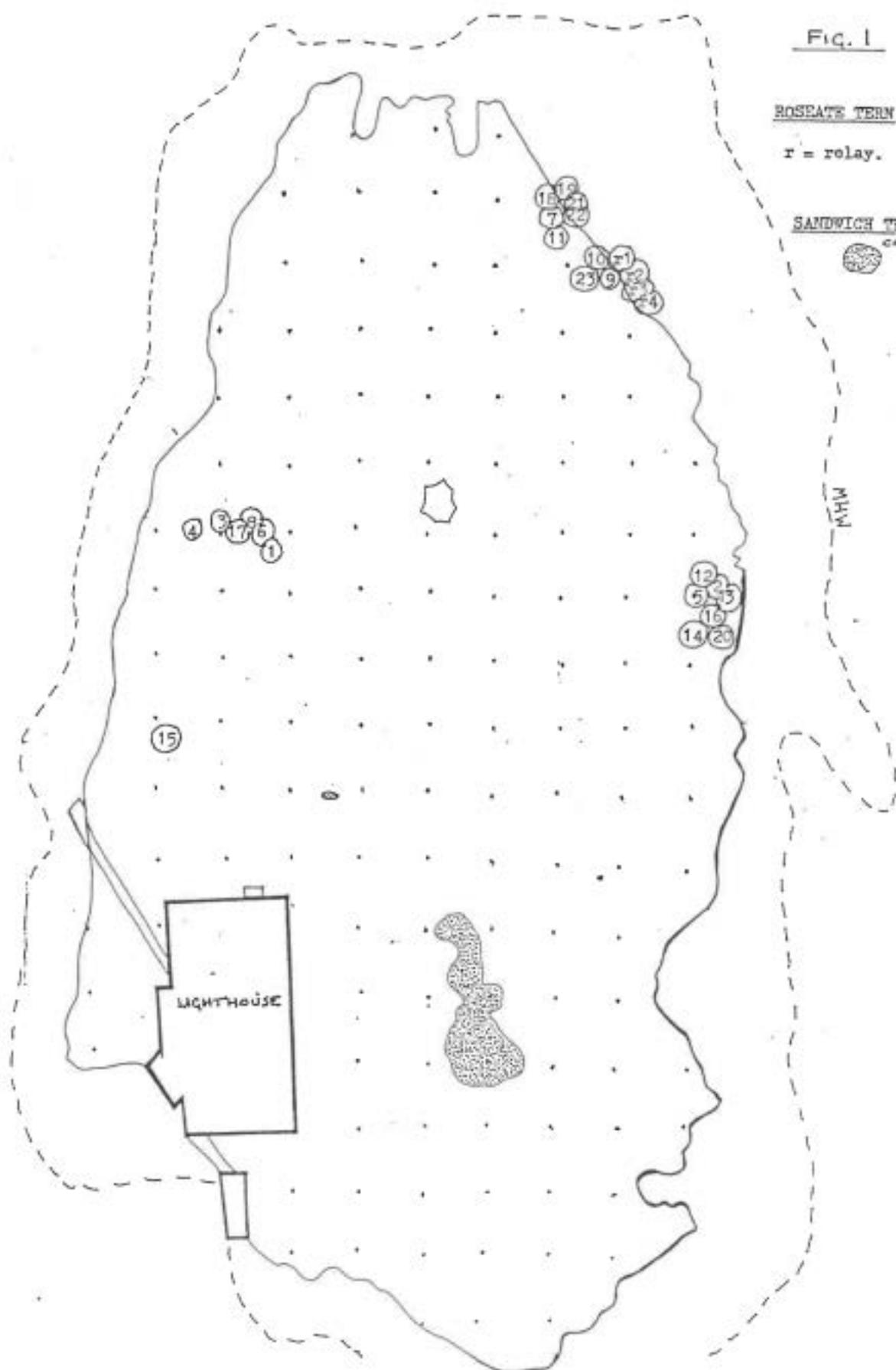
Map 1

FIG. 1

ROSEATE TERN (1991)

r = relay.

SANDWICH TERN COLONY



CONSERVATION OF ROSEATE TERNS AT ROCKABILL ISLAND 1989-1991

Michael O'BRIAIN (1), Liam RYAN (1)
Oscar MERNE (2), Patrick WARNER (2)

(1) - IWC, Dublin
(2) - NPWS, Dublin

A protection scheme for Roseate Terns has operated at their principal north-west European breeding site, Rockabill Island. Co. Dublin, since 1989, Wardening of the colony has ensured that human disturbance has been kept to a minimum. Gull control measures have been introduced to reduce predation of terns. Habitat management has included extending the area of Tree Mallow, the favoured nesting vegetation and the provision of nest boxes in more exposed areas of the colony. The number of breeding pairs of Roseate Terns at Rockabill has increased from 189 in 1989 to 366 in 1991, with high productivity and fledging success in each season. Reading of leg rings on adult roseate terns has shown that a significant number of terns using Rocabill originate from other colonies in the Irish Sea. The continued success of Rockabill is probably central to any recovery of this population.

Un schéma de protection pour la sterne de Dougall a été établi sur leur principal site de nidification au nord-ouest de l'Europe, Rockabill Island. C.o. Dublin, depuis 1989. La surveillance de la colonie a assuré un dérangement humain minimum. Des mesures de contrôles des goélands ont été mises en place pour réduire la prédation sur les sternes. La gestion des sites comprenait l'extension de la lavataire arborescente, de la végétation favorable à la nidification et l'installation de nichoirs dans les endroits les plus exposés de la colonie. Le nombre des couples nicheurs de sternes de Dougall à Rockabil est passé de 189 en 1989 à 366 en 1991, avec un succès de production et d'envol élevé à chaque saison. La lecture des bagues sur les sternes de Dougall adultes a montré qu'un nombre significatif des sternes utilisant Rockabill sont originaires d'autres colonies de la mer d'Irlande. La pérennisation du succès sur Rockabill est probablement majeure pour le rétablissement de la population de l'espèce.

TALK : John COVENEY

PRODUCTIVITY OF ROSEATE TERNS (*Sterna dougallii*) BREEDING ON ROCKABILL-IRELAND

David CABOT

Productivity studies of the roseate tern at Rockabill, Co. Dublin, commenced in 1975 when 100 pairs or 7,5 % of the NW European population attempted to breed. Breeding failure occurred in years 1975 to 1978 inclusive due to habitat destruction and predator (*Larus* spp.) impact. Since then breeding numbers have increased from 40 pairs in 1979 to 366 pairs in 1991 when the Rockabill colony held 65 % of the NW European population. Productivity (number of fledged chicks per breeding pair) is calculated from complete breeding censuses and saturation ringing of pulli. Data on the success of capturing all available pulli is obtained by monitoring freshly fledged pulli on Rockabill. Additional productivity information is available from the ratio of juvenile to adult bird some 4-6 weeks after fledging at pre-migration roosts in Dublin Bay. Productivity 1979-1991 has been consistently high, ranging from 0.57 to 1.55 fledged chicks per breeding pair. The average over the period was 1.28. This compares with 1.19 obtained in Co. Wexford (1975-78), 1.21 from Coquet Island, Northumberland, England (1965-70) and 1.33 from Massachusetts, USA (1970-80).

As a result of intensified field work on Rockabill, the average productivity was 1.46 in the period 1988-1991. Post-fledging mortality must be high as recruitment of birds into the breeding population as shown by total population size is low. Recruitment and mortality studies are now in progress based on the data base of 2,953 pulli ringed on Rockabill.

Des études sur la réussite de la reproduction de la sterne de Dougall à Rockabill, Co. Dublin, ont commencé en 1975 quand 100 couples soit 7,5 % de la population du Nord-Ouest de l'Europe ont essayé de s'y reproduire. De 1975 à 1978 inclus, l'échec de la reproduction a été dû à la destruction du site et à l'impact des prédateurs (*Larus* sp.). Depuis lors, le nombre de couples reproducteurs a augmenté de 40 en 1979 à 366 en 1991 quand la colonie de Rockabill atteignait 65 % de la population NW européenne. Le taux de réussite (nombre de poussins à l'envol par couple nicheur) est calculé à partir des recensement complets des reproducteurs et du baguage en masse des poussins.

Les données sur le succès de la capture de tous les poussins disponibles est obtenu en contrôlant tous les poussins à l'envol sur Rockabill. Une information complémentaire de la production est obtenu à partir du ratio entre juvéniles et adultes 4 à 6 semaines après l'envol sur les reposoirs d'avant la migration dans la Baie de Dublin. Le nombre de jeunes à l'envol entre 1979 et 1991 a été régulièrement fort, oscillant de 0,57 à 1,55 par couple. La moyenne de la période a été de 1,28. Ceci est à comparer avec 1,19 (Co. Wexford en 1976-78), 1,21 à Coquet-island, (1965-70) et 1,33, Massachusetts (USA - 1970-80).

Le résultat du travail sur Rockabill fait apparaître une moyenne de production de 1,46 pour la période 1988-1991. Le chiffre total de population et le faible recrutement dans la population nicheuse montre que la mortalité après envol doit être élevée.

Les études de recrutement et de mortalité sont actuellement en cours s'appuyant sur la base de données de 2 953 poussins bagués à Rockabill.

LADY'S ISLAND LAKE, Co WEXFORD

Eugene WALLACE

Wildlife Service, Co Wexford

Work on the 1991 season started in February with a check for mink and foxes. Five foxes were shot in the vicinity of the island. On March 25th, the lake was partially drained allowing possible ground predator access to the Roseate tern nesting area. In April an electric fence was constructed to separate the colony area from the rest of the island. Rat bait was laid on the rest of the island. "Roundup" 3 E was sprayed in 15 cm. wide strips. Nest-boxes were sited along these strips and in other likely sites. Shingle was transported on to the island to provide suitable Little Tern habitat, the habitat measured 6 x 10 metres.

In late April the Sandwich tern numbers began to build up at the evening roost (525 on the 24 th), then the numbers began to drop each evening to 300 on May 1st. Intensive watches were kept to identify the problem. Great Black-backed Gulls were harassing the prospecting terns which included 35 Common/Arctic and 10 Roseate terns by May 10th. Alpha-chlorolose was laid for these Great Black-backs. One was found dead, the harassing stopped. The build up of terns continued, by 30 May 50 Roseate and c. 400 Common/arctic terns were prospecting. It is felt that the Great Black-back's harassment delayed the build up by Roseate, Common and Arctic terns and may have actually moved some birds on to other colonies.

Nest census is felt to be extremely accurate as the colony is divided into 2-3 metre strips which are then censused. A total of 132 nest-boxes were provided and 32 were used last year by Roseate terns.

The 1991 censusing revealed :

	Sandwich	Roseate	Common	Arctic
Total nests	1469	60	360	
Mean clutch	1.32	1.83	2.57	
Chicks ringed	579	45	87	38
Chicks per pair	c.o.7	c.o.75	c.o.7	

Tern Numbers Pairs 1983 - 1991

	Sandwich	Roseate	Common	Arctic
1983	4	1	-	3
1984	191	35	-	30
1985	291	0	-	3
1986	524	0	-	31
1987	708	8	-	216
1988	412	8	-	195
1989	1317	76	291	125
1990	1395	60	261	153
1991	1469	60	250	111

ROSEATE TERNS IN NORTHERN IRELAND

A REVIEW OF KNOWN NESTING SITES

Robert A. BROWN
RSPB - NORTHERN IRELAND

Introduction

Roseate terns were first recorded as nesting in Northern Ireland on New Island (Copeland Islands, Co Down) in the early 19th century. By the 1880's it had virtually disappeared, but breeding was rediscovered in 1906, and was recorded as breeding on Strangford Lough in 1908 (Marples & Marples, 1934). Numbers increased in Ireland through the 20th century until the 1960's when they began to decline once more (Hutchinson, 1989). Since then eleven sites, all in Co Antrim and Co Down, are known to have been used by roseate terns, but the record of nesting was patchy until 1969 when regular nest counts commenced in Strangford Lough (Brown and McAvoey, 1985). Although intermittent counts were conducted at other locations in former years, it was not until 1980 that regular accurate monitoring of all known sites was achieved, and this has since been maintained.

The trend of nesting roseate terns in Northern Ireland reflects the more general decline of north west Europe; between 1969/70 and 1984 the total breeding population in Ireland as a whole is thought to have fallen by 85% (Whilde, 1985). Numbers on Strangford Lough sites reached a peak of 156 nests in 1978, and it may be inferred that the other sites in the Province may also have contained significant numbers at that time. In 1984 Northern Ireland held about half the total Irish population (Whilde, loc. cit.). Since then, numbers have shown a continuing decline (Table 1) from 217 in 1980 to 4 nests in 1991, or less than 1% of the Irish population of 422 (Roseate News, 1991).

Whilst the number of breeding pairs in the Province has dropped to its lowest recorded, observations by field staff of the Royal Society for the Protection of Birds (RSPB), and the National Trust (NT), suggest that roseates still occasionally occur in the vicinity of many of the sites known to have been attractive to them. It is also known that birds ringed on Jackdaw Island, Strangford Lough have been recorded nesting on Rockabill, Co Dublin. The little information available therefore suggests that mortality may not be a major factor in the decline of roseates in Northern Ireland.

The majority of the former roseate sites still support various colonies of Sandwich, common and Arctic terns, (RSPB and NT unpublished data and NT Warden's Reports - see Table 2) and may still be regarded as potentially suitable for roseate terns. However, increasing pressure by recreational activities on or near many islands on the Northern Ireland coast, particularly in sheltered sea loughs, poses a threat to their future suitability for roseates, as well as the other tern species. A review of the status of these sites is appropriate therefore, not only to identify any weaknesses in their current protection, but to highlight the need for their retention as key locations likely to resume their importance in the event of any significant recovery of the Irish roseate population.

A General Overview

The eastern Northern Ireland coast is intersected by four large sea loughs, originating mainly through folds and faults in the underlying bedrock, and subsequently enhanced by glacial action. Much of the surrounding bedrock is overlain by a blanket of glacial boulder-clays and gravels, although this is of varying thickness, and in many localities has been substantially eroded. All eleven islands known to have been used by roseate terns in Northern Ireland are within, or adjacent to, these sea loughs (Fig 1). In the more sheltered localities within the loughs much glacial material remains, particularly in the form of low, rounded islands (drumlins), and the nesting islands are dominated by fine gravel capped by maritime vegetation, largely composed of orache (Atriplex spp), mayweed (Matricaria maritima) and alexanders (Smyrnium olusatrum). Many such islands are highly subject to winter storms in spite of their location; erosion and deposition regularly cause changes in the availability of nesting ground. More exposed sites, prone to scouring by tidal currents and wave action are usually bereft of glacial material, and the birds nest directly on to bedrock, with shelter provided by thrift (Armeria maritima) and small tussocks of grass.

Out of the eleven islands, only Sandy Island near the entrance to Strangford Lough, lacks any structured management. The remainder are managed variously by the RSPB, NT or the Department of the Environment (DoE), either by direct ownership or by various management agreements. The foreshores are owned by the Crown Estate Commissioners (CEC), DoE, or by the NT. The effectiveness of this protection varies considerably; whilst roseate terns themselves are subject to full protection through their listing on Schedule 1 of the Wildlife Act 1985, a number of physical, biological, and human threats to their nesting islands still exist.

A number of statutory measures have been used to protect tern islands. Under the EC Wild Birds Directive (79/409/EEC) the Government is required to designate qualifying sites as special protection areas; virtually all the islands cited in this paper qualify (Pritchard et al 1992). Whether or not actually designated, qualifying sites require protection under National legislation as well, and there are a number of ways to achieve this. It is possible, for example, for Government to acquire sites and manage them as National Nature Reserves (NNRs) under the Nature Conservation and Amenity Lands Order (1985)(NCALO), and NNRs can also be established through agreement with appropriate private owners, often conservation bodies like the National Trust. The most generally applicable designation is that of Area of Special Scientific Interest (ASSI), which safeguards sites by determining the types of operations and activities which are appropriate or inappropriate for its scientific interest. Both NNRs and ASSIs can apply to land and intertidal areas, but generally neither extend subtidally.

In addition to these designations, ownership, leasing, or other management agreements by conservation organisations like the RSPB and the National Trust can provide strong safeguards. The latter has a particularly strong mechanism whereby sites may be declared Inalienable under the National Trust Act (1907). Lands designated in this way may not be substantially changed without Parliamentary assent, and this has only happened very rarely.

Case Histories

Swan Island, Larne Lough: A very small (0.1 ha), low lying gravel/rock island, capped by maritime vegetation, near the western shore of the lough. In 1984, with 39 pairs of roseate terns nesting, the island held 15% of the total Irish population; in 1991 with 4 pairs, it was the only site in Northern Ireland to support roseates. The island also supports up to 130 pairs of sandwich tern, as well as common and occasional Arctic terns.

Management: The island is owned by the DoE Environment Service, and managed for them by the RSPB. It has been designated an ASSI, and more recently an SPA - the first in the Province. The main threats to the island's nesting birds include predation and competition for nesting ground by gulls, and the possible development of a nearby quarry site (Magheramorne) as a refuse tip, further increasing gull activity in the area, and possible pollution by leachate from the quarry into the Lough. Disturbance by walkers (at low tide) and windsurfers has occurred in the past. RSPB's management includes selected control of gull nesting, occasional vegetation control when growth becomes excessive, and control of disturbance through wardening.

Cockle Island, Groomsport: This relatively exposed island of tightly folded bare bedrock lies outside the entrance to Belfast Lough, and fringes a busy recreational harbour. One pair of roseate terns nested in 1986.

Management: The island is owned and managed by the NT, whilst the foreshore is the property of the CEC. There are no statutory conservation designations, but the island has been declared inalienable by the NT. The main threats to breeding birds come from disturbance by the boating community (although there is co-operation from the harbour master in this respect) and by shellfish collectors on the island foreshore. There is no mechanism for controlling this at present. Predation by hooded crows is also known to occur, but is difficult to control. RSPB recommends that the island and its foreshore be designated an ASSI and SPA, and shellfish collection be prevented during the breeding season.

Gull Rock, Strangford Lough: A tiny (ca 10 x 7 m) remnant of a drumlin forming the most northerly island of the Boretree Islands group near the north-east shore of the Lough. Composed of shingle and grassy tussocks. Four pairs of roseates nested on the island in 1969.

Management: The island is owned by the NT and declared inalienable; it is a designated ASSI and part of a proposed National Nature Reserve. There are few management problems, although regular monitoring for rats and gull predation and competition is undertaken. In the event of problems from these sources, it is likely that control measures would be instituted.

Gabcock Is, Strangford Lough: A drumlin island (ca 0.5 hectares) off Greyabbey on the Eastern shore of the Lough, composed of gravels, shingle, and capped by tussocks of grass and alexanders intersected by disused rabbit (*Oryctolagus cuniculus*) burrows. Six pairs of roseates bred on the island in 1969, 2, 3, 5 pairs respectively between 1981-1983.

Management: The island is owned by the NT, declared inalienable, and designated an ASSI. It is within an area proposed as an NNR. In recent years numbers of common and arctic terns nesting have declined sharply, whilst that of herring gull has increased. Control measures on the latter have been undertaken by the NT.

Sheelaha Is, Strangford Lough: Two tiny, lowlying relict drumlin islands to the south of Gabbock Is, connected by a shingle and sand bank, each about 10 x 10 m in area.

Management: The two islands are owned by the NT and have been declared inalienable, and designated an ASSI. Both lie within the area of a proposed NNR. Gull competition and predation has occurred, and nesting attempts by herring and greater black-backed gulls have been controlled by Trust staff. Erosion is a major factor on the islands, resulting in unpredictable shifts in small shingle spits and banks following winter storms.

Dunynneill Is, Strangford Lough: A single island, lying to the north-east of Killyleagh, divided into two parts giving a distinctive 'dumbbell' shape, each section formed of a relict drumlin. One section is relatively high, and overgrown by a small copse; the other (ca 0.5 ha) is vegetated by alexanders, mayweed and maritime grasses. Complex patterns of erosion and deposition of fine shingle occur; sometimes both processes together. The island has been one of the most important roseate islands in Northern Ireland. In 1978 it held 126 nests, in 1982 it held 40, and was last used as a nesting site by one pair in 1986. The island also has held over 280 Sandwich and over 260 common/Arctic terns in the past (early NT counts did not differentiate between the two species).

Management: Dunynneill is privately owned, and managed under a loose agreement by the NT, and designated an ASSI. Disturbance by picnickers from Killyleagh and elsewhere has been considerable, although efforts by the Trust to confine this to the wooded part of the island have generally met with good co-operation. There have been fears however that the recent increase in herring gull numbers may be due to their greater ability than terns and other species to withstand disturbance. Rat control is regularly undertaken, and experimental strimming of the alexander thickets has taken place. In spite of this work, no tern species have used the island since 1987. (The latest 1992 information however, is that 38 pairs common terns nested successfully). A considerable risk remains however, that in the frequent absence of notable breeding birds it is increasingly difficult to highlight the island as an important nesting site, and the whole island will be viewed as a picnic area, co-operation will be lost, and resumption of management as a tern colony will be very difficult.

Jackdaw Island, Strangford Lough: A relatively large drumlin island (ca 3 ha) with a distinctive raised beach profile, in the south of the Lough. It is densely vegetated with rank grass swards, nettles (*Urtica dioica*), and alexanders. Although terns have nested in the centre of the island, the main location of nesting effort has been in various sections of the fringe, characterised by finer grasses, mayweed, and open shingle.

In the early and mid eighties Jackdaw was regarded as the most important tern island in Northern Ireland, holding 40% of breeding Sandwich terns (1918 pairs in 1985), and over 200 common terns (Whilde 1985). By contrast with the other tern species, roseate terns have never reached particularly large numbers, the maximum recorded being in 1987 when 40 pairs nested.

Management: Jackdaw Island is privately owned but managed by the NT by agreement with the owners. Both the island and its foreshore (owned by the CEC) have been designated as an ASSI. Human disturbance is minimal. Rat control is regularly conducted; the island is currently being grazed in winter; and larger species of gull are prevented from nesting. Although the terns may derive some measure of protection from the black-headed gull colony (over 3,500 in some years), their presence is likely to cause some measure of predation; both the Trust and RSPB agree that this aspect

requires monitoring. The most critical factor likely to affect the tern colonies has been predation and molestation by peregrines which are known to have taken tern pulli, and whose presence may have been responsible for fluctuations in nesting by the terns. Most recently a major decline in all tern species has occurred, possibly due to this cause.

Swan Is, Strangford Lough: Set within a sheltered harbour with strong tidal currents off the Eastern end, the island is composed of tightly folded bedrock capped by a thin layer of soil. Dense tufts of grass in the centre of the island are surrounded by a sparse mixture of salt marsh species in the gravel and clefts round the fringe. The island was set alight by vandals in 1982 and burnt for several days; only since then has it been notably attractive as nesting site. Seven pairs of roseate terns used the island in 1983, and two or three pairs until 1986.

Management; owned by the DoE, and managed by the NT, and designated an ASSI. Occasional control of the rank overgrown grasses on the top of the island is required. Main threat is disturbance, since the island lies in a small busy harbour. However, the regular passage of a ferry close by appears to cause little disturbance, and incursions by resident and visiting boating people on to the island are rare.

Sandy Island: A low lying spit of loose sand and shingle lying on a bedrock base, immediately south of the entrance to Strangford Lough. Lying between the much larger Gun's Island and the mainland, the island is largely protected from wave action. Vegetation is sparse, largely composed of orache, maritime grasses, and a few saltmarsh species. Up to three pairs of roseates have been recorded intermittently since 1983, whilst over 100 pairs of common terns. Little terns have also nested: 2 pairs in 1989 and probably 1 pair in 1990, the first such occasion in Northern Ireland since 1980, when they bred on Magilligan Point (N. Ireland Bird Report 1982-1985)

Management; The foreshore of the island has been vested by the DoE, but the ownership of the areas of the island above high water appears to be inadequately documented. In spite of its importance, and listing as an Important Bird Area (qualifying as an SPA - Pritchard et al, 1992) no statutory protection has been given to the site. The island is accessible by foot to Gun's Island at virtually all stages of the tide, and from a popular beach on the mainland at low water.

The lack of any defined responsibility for the island and its accessibility for predators including foxes, as well as frequent disturbance from day trippers, has resulted in frequently poor nesting success, and sometimes total abandonment of the colony. DoE have erected signs requesting people to leave the island alone, and at critical periods have sometimes operated a wardening service. RSPB has frequently expressed concern that government has failed to implement any effective management regime for this important site, but no progress has yet been made.

Green Island, Carlingford Lough: A subtidal/intertidal outcrop of bedrock, capped by a very rapidly eroding and mobile spit of shingle. In the early part of the century the island was grazed, in the last decade alone the shingle has not only reduced by 50% in size and lost virtually all of its vegetation, but also shifted in location due to redistribution of material. Its value as a nesting island is dependant on the absence of critical spring tide/SE wind combinations which can inundate the island. Green Island was the main site in Northern Ireland for roseate terns in earlier years (158 pairs in 1980), the last occurrence was three pairs nesting in 1990 (Allen, RSPB reports 1980-91). The island is also important for

Sandwich, common, and Arctic terns. Since these other species continue to nest successfully, it appears that the decline in roseate terns was not due to erosion of the island, although absence of vegetation cover may have played a role.

Management; Green Island is owned by the NT, declared Inalienable, and leased from them by RSPB. There are no statutory designations protecting the island. Although erosion is regarded as a potential problem for the future, preliminary investigations suggest there is no cost-effective way of combating it. There are few biological problems on the island, although any attempts at colonization by the larger gull species would be prevented. Human disturbance is limited, although occasional visits by military personnel do occur since the island lies close to the border with the Irish Republic. The possibility of increasing recreational pressure in Carlingford Lough would be a threat to the island (and to Greencastle Point - below). RSPB is of the view that designation as an ASSI, and as an SPA are essential to safeguard the colonies in Carlingford Lough.

Greencastle Point, Carlingford Lough: Two small, bedrock islands in a relatively sheltered location close to the mainland shore and accessible at low tide. There is a small cap of soil/gravel and maritime vegetation on both islands. They held 8 pairs of roseate terns in 1981, and one pair in 1983.

Management; RSPB manages the island under an agreement with private owners. There are no statutory designations protecting the island. Being easily accessible at low tide, and near a small village, the island is extremely vulnerable to disturbance, and this has probably had an adverse influence on productivity in the past.

Discussion

The roseate tern, in keeping with its listing as a Red Data species (Batten et al, 1990) is protected as a Schedule 1 Species under the 1985 Wildlife Order (Northern Ireland). Nevertheless, the future ability of the species to breed on the Northern Ireland coast (as well as in Britain and the Republic of Ireland) is more dependant on the maintenance of its breeding sites, centred on the Irish Sea coasts, than on protection of the birds themselves. Early indications (so far unpublished) of ringed birds identified on Rockabill Island are apparently consistent with the view that the Irish Sea roseates may be regarded as a single population capable of selecting from an array of possible breeding sites in the area. Whilst Rockabill, and to some extent Lady's Island (Wexford), have stabilised the Irish Sea population during the roseate decline, many other sites have suffered a variety of problems ranging from peregrine disturbance to the complete disappearance of Tern Island, Wexford Harbour in 1977 (Hutchinson, 1989). Although such problems undoubtedly influenced breeding success and distribution in the Irish Sea, it has been suggested that the general decline in the NW European population may be due more to fundamental problems at the wintering end of their range.

In Northern Ireland the general decline of breeding roseate terns has mirrored that of the wider scene. There is no particular reason to suppose that problems on breeding sites have been responsible for the general decline in the Northern Irish population. However, the apparently cyclic phases of increase and decline of roseates in Northern Ireland over 100 years and more, together with the ability of Rockabill to stabilise today's population and possibly generate recovery in the Irish Sea, should

stimulate a strong incentive to maintain potential sites in order to accommodate a future recovering population.

Although the majority of the islands featured in this review have some measure of legal protection, there is little consistency of approach. In view of the unpredictable way in which roseates select their nesting sites, there is a strong case for arguing that all these sites must be protected, and that the measures for achieving this should be consistent. Those islands which, through ownership, management and designations, at present appear to be adequately protected in legal terms are Swan Is (Larne Lough); Gull Rock, Gabbock Is., Sheelaha Is., Jackdaw Is., Swan Is (all in Strangford Lough). However, their security should be kept under review, particularly in the absence of effective legislation to control events in adjacent subtidal areas. Three islands have been protected to some extent, primarily through ownership; Cockle Is itself is protected by NT's ownership and Inalienability designation, but lack of government recognition through ASSI designation of the island and its intertidal area renders it vulnerable to events outside the NT's ownership of the land, whilst for similar reasons Green Island and Greencastle Point are left vulnerable in spite of RSPB's management. Designation of the former as an SPA, and both as ASSIs (land and intertidal areas) should be a priority.

The two remaining islands, Dunnyneill and Sandy, appear to be the most vulnerable. In spite of careful management by the NT, the former is still subject to disturbance during the breeding season, and considerable effort, probably needing Government support, is necessary if even the most basic requirements of the ASSI are to be met. Sandy Island, ironically one of the most interesting because of its attraction for little terns as well as the roseates, is virtually devoid of effective management, other than basic monitoring. Ad hoc measures by DoE, though of limited help, are inadequate to meet the needs of this complex site. Designation of the island and its intertidal area as an SPA and as an ASSI, backed up by consistent seasonal wardening to address the many management problems, is an international obligation which is essential for the existing value of the site, and should certainly be achieved before any roseate recolonisation takes place.

Acknowledgements

The author would like to acknowledge the considerable help and information provided by Dave Allen (Reserves Manager, N. Ireland), who also read earlier drafts of this paper, and National Trust staff for information on breeding islands in Co. Down, particularly Strangford Lough.

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TABLE 1 Roseate Terns Nesting in Northern Ireland

Island	Irish Grid Ref	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92
Swan Is	LL J426996												32	37	59	31	39	19	21	25	23	37	19	4	2
Cockle Is	BL J537838																								
Gull Rk.	SL J542684	4																							
Gabcock	SL J561657	6												2	3	5									
Sheelaha	SL J573646			1																					
Dunoyneill	SL J549540						42	110	70	126		27	P	40	3	2				1					
Jackdaw	SL J556510								P	25	30	30	35	P			14	40	4					1	
Swan	SL J590497															7	2	3	2						
Sandy Is	J596417															3					2	1	2	2	
Green	CL J241111																								
G'castle Pt	CL J241118												158	157	59	140	77	32	34	40	7	25	3		
													8		1										
TOTALS		10		1			>42	135	100	156	35	>217	196	161	190	134	94	63	67	31	64	24	4	2	

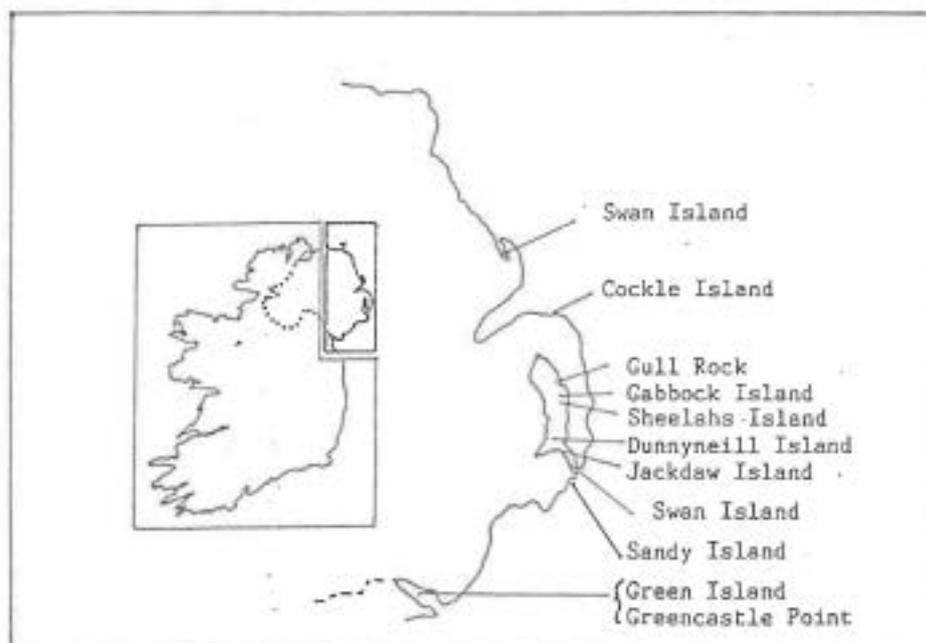


Figure 1. Roseate Tern nesting islands in Northern Ireland.

TABLE 2

Species recorded
nesting on Northern
Irish roseate tern
islands since 1980

	Green- castles Point, Carlingford L.	Green Island, Carlingford Lough	Sandy Island	Swan Island, Strangford Lough	Jackdaw Island, Strangford Lough	Dunneville Island, Strangford L.	Sheela's Island, Strangford Lough	Gabbock Island, Strangford Lough	Gull Rock, Strangford Lough	Cockle Island, Groomsport	Swan Island, Larne Lough	
<i>Tringa totanus</i>				*	*	*	*	*				Redshank
<i>Charadrius hiaticular</i>	*	*	*	*	*	*	*	*	*	*		Ringed Plover
<i>Haematopus ostralegus</i>	*	*	*	*	*	*	*	*	*	*		Oystercatcher
<i>Sterna sandvicensis</i>		*		*	*		*	*		*		Sandwich Tern
<i>Sterna hirundo</i>			*	*	*	*	*	*	*	*		Common Tern
<i>Sterna paradisaea</i>	*	*	*	*	*	*	*	*	*	*		Arctic Tern
<i>Sterna albifrons</i>			*									Little Tern
<i>Larus ridibundus</i>				*	*		*	*	*	*		Black Headed Gull
<i>Larus marinus</i>					*	*	*	*	*	*		Greater Blackbacked
<i>Larus argentatus</i>			*		*	*	*	*	*	*		Herring Gull
<i>Larus canus</i>	*	*	*			*	*	*	*	*		Common Gull
<i>Mergus serrator</i>				*	*		*			*		Red breasted merganser
<i>Somateria mollissima</i>								*				Eider
<i>Tadorna tadorna</i>					*	*	*					Shelduck
<i>Anas platyrhynchos</i>					*	*	*					Mallard
<i>Aythya fuligula</i>					*	*	*					Tufted duck
<i>Anas strepera</i>					*							Gadwall
<i>Branta canadensis</i>					*	*	*					Feral Canada Goose
<i>Anser anser</i>					*	*	*					Greylag Goose
<i>Anser leucopsis</i>					*							Feral Barnacle Goose
<i>Corvus corone corone</i>						*						Hooded Crow
<i>Gallinula chloropus</i>					*							Moorhen

STATUS, BREEDING SUCCESS AND CONSERVATION OF ROSEATE TERNS IN THE AZORES

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Most tern sites were visited during 1991. Complete coverage was made on Flores, Graciosa, Corvo, Faial, Sao Jorge and Pico. A total of c. 1 120 pairs were recorded, which represents a slight increase on previous years (Table 1). Marked inter-colony movements were recorded. In Table 2, we present the number of breeding pairs of the top of the ten colonies in the Azores during 1984. For comparison we also include the number of breeding pairs at the same colony during 1989, 1990 and 1991 : Baixa do Moinho (Flores 1) is the only colony with continued use, but exhibits a marked inter-year variation in the breeding population. Observations of ringed individuals indicate that between year, inter-colony movement regularly takes place.

Colony shifts have involved a broad range of colony size (5-270 pairs) both within and between islands over distances of 10-150 km.

Overall breeding success was low (mean = 0.91 chick /pair, +/- 0.10 S.D. = n-607 ; range = 0.73 - 1.07). However, considering the relatively low clutch size (mean = 1.1, 1991) Roseates on the Azores compared favourably with birds on Rockabill where clutch size is considerably higher (mean = 1.85, IWC unpublished data).

Predation (rats, goats, mustelids) and disturbance (fishermen, boats) still occurs at some colonies but considerable conservation effort has been directed towards the activities. All past, present (except one) and potential Roseate Tern colonies have been designated as Special Protection Areas under the EC Wild Birds Directive. The Regional Government of the Azores and the University of the Azores (Dept.'s of Biology and Oceanography) in association with island Camara's and several individual have intensified efforts to increase public interest and conservation of Roseate Terns. During 1991 The Azores archipelago held c.67 % (1120/1684 RSPB unpublished) of the European population of Roseate Terns. The Azores colonies included the largest colony (375) and 8 of the 10 largest colonies in Europe during 1991. We hope that conservation action will continue within the Azores so this rare and beautiful species may prosper and retain its previously higher population levels.



Table 1. The number of nesting pairs at the ten largest roseate tern colonies in 1984 and the number of pairs at the same colonies in 1989, 1990 and 1991.

ISLAND	1984	1989	1990	1991
Flores 1	126	160	54	375
Faial 1	70	0	53	70
Santa Maria 1	56	2	0	25
Graciosa 1	50	0	0	0
Flores 2	50	0	24	20
Graciosa 2	40	0	0	0
Terceira 1	28	3	2	0
Sao Jorge 1	20	0	0	0
Flores 3	20	0	5	4
Pico 1	20	0	48	21
Total	480	165	186	515
Azores Total	642	992	1051	1121
Sites as % of total	75	17	18	46

Table 2. Roseate tern breeding pairs for each island of the Azores 1984, 1989-92

ISLAND	1984 ¹	%	1989 ¹	%	1990 ²	%	1991 ³	%
Santa Maria	70	10.9	116	11.7	220	21.0	102	9.1
Sao Miguel	30	4.7	0	0.0	0	0.0	0	0.0
Graciosa	112	17.4	275	27.7	150	14.3	74	6.6
Faial	70	11.0	0	0.0	60	5.7	90	8.0
Sao Jorge	35	5.4	5	0.5	2	0.2	135	12.0
Pico	20	3.1	23	2.3	50	4.7	21	1.9
Terceira	42	6.5	93	9.4	95	9.0	5	0.4
Corvo	0	0.0	0	0.0	19	1.8	?	?
Flores	263	41.0	480	48.4	455	43.3	694	62.0
Total	642 867 ⁵	100	992	100	1051	100	1121	100

¹ complete survey of the Azores archipelago

² Most known tern sites were visited. Complete coverage of Flores, Graciosa, Corvo, Faial and Santa Maria.

³ Most known tern sites were visited. Complete coverage of Flores, Graciosa, Corvo, Faial, Sao Jorge and Pico.

⁴ Recalculated total, see del Nevo and al (in press)

ROSEATE TERN COLONIES IN NORTH AMERICA

IAN C.T. NISBET

Roseate Terns (*Sterna dougalli*) breed in two separate areas in North America (Figure 1). One population breeds in the north-eastern U.S.A. and southern Canada, between 41°N and 44°N. The other population breeds around the Caribbean Sea from Florida and the Bahama Islands to the Netherlands Lesser Antilles, with outlying colonies in Belize and Nicaragua, between 11°N and 25°N. Although both populations belong to the subspecies *S. d. dougalli*, they differ morphologically: the Caribbean birds are smaller and have much more red in the bill. Both populations are migratory, wintering in northern South America from Colombia to eastern Brasil, between 11°N and 14°S. The wintering area is poorly known and has been defined only by ringing recoveries (Nisbet 1984).

NORTHEASTERN POPULATION

History

The northeastern population was severely affected by human persecution in the late nineteenth century, and was reduced to roughly 2,000 pairs at four colony-sites by 1900 (Nisbet 1973, 1980, 1989a). Effective protection of the remaining colonies began in the 1890s, and the population increased rapidly, reaching a peak of about 8,500 pairs in the 1930s. The population then decreased to about 4,000 pairs in the 1950s, and decreased again during the 1970s, reaching a minimum of about 2,600 pairs in 1976. The decline is attributed to the expansion of the populations of Herring and Great Black-backed Gulls (*Larus argentatus* and *L. marinus*), and perhaps also to the effects of toxic chemicals (Nisbet 1980, 1989a). During this period, all the large colonies used by Roseate Terns prior to 1936 were occupied by gulls, and the terns moved to sites closer to the mainland, where they were subject to human disturbance and to predation by other predators. Following incidents of heavy predation, the birds moved to other sites, and they are now concentrated at a small number of sites with little or no predation (Nisbet 1981, 1989a).

Present status

Since 1977, the northeastern population has remained stable and have probably increased slightly (Table 1). Although the numbers in Table 1 suggest an increase of 50% in total numbers since 1977, much of this increase results from improvements in census methods at the two largest colonies (U.S. Fish & Wildlife Service 1989). In 1991, about 3,560 breeding pairs were counted in 18 colonies in the U.S.A. (Table 1). The numbers of Roseate Terns breeding in Canada were estimated to be between 110 and 125 pairs in the 1970s (Kirkham and Nettleship 1987) and now may be as low as 25 pairs (Lock et al. 1992).

Colony sites

In northeastern North America, Roseate Terns nest exclusively on islands where Common Terns (*S. hirundo*) also nest. The largest colonies of Roseate Terns are in the states of Massachusetts, New York and Connecticut, and are on islands formed from terminal moraines of the Pleistocene ice sheets (Figure 2). Most of the colony-sites are located near tide-rips or sand-bars, where tidal currents bring small fish to the surface. About 85% of the entire northeastern population breeds on two islands, and about 92% on four islands (Table 1). Each of the main colony-sites has different geological structure and vegetation, so that the birds occupy different types of nest-site.

Bird Island (41°40'N, 70°43'W). This colony has been described by Nisbet (1981) and Nisbet *et al.* (1990). This small island has supported about half of the northeastern population since 1978. It is located in the upper part of Buzzards Bay, Massachusetts, about 1 km from the mainland. Roseate Terns from this colony feed mainly in areas between 8 and 20 km away from the island (Nisbet 1981, D. Heinemann, pers. comm.). The highest point of the island is only about 2.5 m above mean high water, and the entire island is occasionally washed over by waves during winter storms or tropical hurricanes (e.g., hurricane "Agnes" on 22 June 1972, and hurricane "Bob" on 26 August 1991). The island is protected from erosion by a wall of granite blocks, built during the nineteenth century to protect the lighthouse (now disused). In 1991, the island supported about 1900 pairs of Common Terns and about 1,700 pairs of Roseate Terns. Most of the Roseates breed on the higher parts of the island (1-2 m elevation), on a substrate of rocks and cobbles covered with a thin layer of clay soil. The Roseates' breeding area is about 0.3 ha, with an average density of about 0.5 pairs m⁻². The substrate is bare in spring, but becomes occupied by dense vegetation during the breeding season. The dominant plants are black mustard (*Brassica nigra*), ragweed (*Ambrosia artemisiifolia*), lambs quarter (*Chenopodium alba*), smartweed (*Polygonum pennsylvanicum*) and morning glory (*Convolvulus sepium*). Although the vegetation is very dense and grows to heights of more than 2 m, the Roseate Terns are able to tend their eggs and chicks throughout the season. Many pairs now nest in nest-boxes (40 x 20 x 15 cm), which they prefer to any natural sites. Except for a Peregrine Falcon (*Falco peregrinus*) in May 1991 (Nisbet 1992), there are no predators on the island, and the Roseates have bred with high success (1.1-1.6 fledglings per pair) since at least 1970 (Nisbet 1989b). Gulls attempt to nest on the island each year, but are kept away by harassment and egg-breaking. The terns have been studied intensively since 1968 (Nisbet *et al.* 1984) and have become completely habituated to human presence; Roseate Terns often allow approach to within 5 m before leaving their nests. The island belongs to the Town of Marion and is protected as a bird sanctuary, but the beach is open to the public and is visited by many people by boat during the summer. Because the birds are accustomed to human presence, they are unaffected by these visits and the Common Tern colony is regularly used for educational purposes.

Great Gull Island (41°12'N, 72°07'W). This colony has been described by Cooper *et al.* (1970), Heilbrun (1970) and Hays (1984). It now supports about 40% of the entire northeastern population; lower numbers included in Table 1 for 1977-1987 were probably underestimates. The colony is located at the entrance to Long Island Sound, about 11 km offshore. This is an area of high tidal currents and the Roseates feed mostly in tide rips within 15 km of the colony (Duffy 1986). The island is about 775 m long and 175 m wide at the widest point. It is composed of glacial till with steep sides rising to an elevation of about 25 m above high water mark. The island was fortified for military purposes during the First World War and the entire perimeter was protected from erosion with large boulders, 2-4 m in dimensions. In 1991, the island supported about 7,000 pairs of Common Terns (the largest colony in North America and perhaps the largest in the world) and about 1,300 pairs of Roseate Terns. Most of the Roseates nest under boulders on the steep slopes of the island, up to 3 m below the surface. Many of the nests are difficult to locate, and the colony was not reliably censused until detailed studies of Roseates started in 1988. Common Terns have been studied intensively since 1966 (Cooper *et al.* 1970, DiCostanzo 1980); up to 15 biologists live on the island throughout each breeding season and conduct intensive trapping and banding studies. A few Roseates occupy nest boxes set into the soil near the top of the slopes. Gulls are kept away from the island by the biologists, and there is little predation by other species. Productivity is probably high in most years, but was not measured reliably until 1991, when it was estimated to be about 1.2 fledglings per pair (G. Commons, pers. comm.). The island is maintained as a research station by the American Museum of Natural History and public access is strictly prohibited, but the research work involves many young people and has a strong educational component.

Falkner Island (41°13'N, 72°39'W). This island has been described by Spendelow (1982) and Spendelow and Nichols (1989). It usually supports 5-6% of the northeastern population. It is located in Long Island Sound, about 5 km south of the mainland of Connecticut. Feeding areas of the Roseates from this colony have not been determined. The island is about 2 ha in area. It is composed of glacial till with steep sides rising to an elevation of about 12 m, with an automated lighthouse at the highest point. Unlike Great Gull Island, the sides of Falkner Island are not protected, and the clay cliffs are eroded in heavy rainstorms. In 1991, the island supported about 4,000 pairs of Common Terns and 180 pairs of Roseates. Most of the Roseates nest among rocks and gravel on a low spit at the north end of the island, 1-3 m above high water mark. Natural nest-sites were under rocks, but most of the birds now nest in artificial sites, either nest-boxes or old automobile tyres partly buried in the gravel substrate. The tyres are the preferred sites and the Roseates nest with higher success in tyres than in any natural sites (J.A. Spendelow, pers. comm.). The terns have been studied at this site since 1978 (Spendelow 1982) and biologists live on the island throughout the breeding season. Except for occasional incidents of predation by gulls, predation is infrequent at this site, and the average productivity is about 1.0 fledglings per pair (J.A. Spendelow, pers. comm.). The island is now owned by the U.S. Fish & Wildlife Service and is maintained as a National Wildlife Refuge; public access is strictly prohibited.

Cedar Beach (40°37'N, 73°21'W). This colony has been described by Gochfeld (1976), Gochfeld and Burger (1988), Burger and Gochfeld (1988a) and Nisbet *et al.* (1990). It usually supports about 3% of the northeastern population. It is located on the south shore of Long Island, about 100 km east of New York City. Roseate Terns from this colony feed mostly in and near a tidal inlet within 5 km of the colony (Safina *et al.* 1988). The colony is located on a low sandy area between lines of sand dunes on a barrier beach. In 1991, about 5,000 pairs of Common Terns and 90 pairs of Roseates nested at this site. The nesting area is partly covered with stands of beach grass (*Ammophila breviligulata*), with scattered clumps of seaside goldenrod. The Roseate Terns nest in discrete groups of 5-40 pairs; most nests are situated adjacent to or under dense vegetation, usually patches of seaside goldenrod. Common Terns have been studied at this site since 1969 (Burger and Gochfeld 1991) and Roseates since 1984 (Safina *et al.* 1988). The colony is subject to predation by Herring Gulls, Northern Harriers (*Circus cyaneus*), and feral cats (*Felis catus*), among other predators (Burger and Gochfeld 1991). Although predation usually falls more heavily on Common Terns, Roseate eggs and chicks are taken in varying numbers and productivity is usually in the range 0.5-1.1 fledglings per pair (Nisbet *et al.* 1990, J. Burger, pers. comm.), lower than in the other large colonies. However, Safina *et al.* (1988) reported higher productivity (1.4-1.9 fledglings per pair) in 1984-1985. The island is connected to the mainland by a bridge and has been developed for beach recreation. On every weekend during the summer, the beach adjacent to the colony is used by tens of thousands of people. However, public access to the dunes and to the tern colony is strictly prohibited (primarily to protect the dunes from trampling), and the presence of large numbers of people has little effect on the terns (Burger and Gochfeld 1991). However, some Common Tern fledglings are killed by cars (Gochfeld 1978) and human activities promote the population of cats and other predators (Burger and Gochfeld 1991).

Other colonies. In recent years, Roseate Terns have nested at 30 other sites in the U.S.A. (Table 1, Figure 2), and at 3 or 4 sites in Canada (Lock *et al.* 1992). About 12 of these sites are established colonies in which Roseates have nested in each year from 1987 to 1991. Numbers of Roseates at each site have ranged from 1 to 90 pairs, whereas numbers of Common Terns at the same sites have ranged from about 30 to about 4000 pairs. Most of the sites in the southern part of the range (New York and Massachusetts) have been on sand dunes on barrier islands, with similar habitat and nest-sites to those described above for Cedar Beach. In contrast, most of the sites in the northern part of the range (Maine and Nova Scotia) have been on glaciated rocky islands. Most of these islands have thin layers of peat soil and thick vegetation of grasses or low herbaceous plants; at several islands the grass is kept short by grazing sheep. Several islands have been subject to predation by Great Horned Owls (*Bubo virginianus*) or other predators, and the Roseate Terns have tended to move away from these islands (Nisbet 1981, 1989b). In Maine and Nova Scotia, Roseate Terns nest in association with Arctic Terns (*S. paradisaea*) as well as with Common Terns. These tern colonies are threatened by Herring and Great Black-backed Gulls; the two largest colonies in Maine have been re-established in recent years by programmes to remove the gulls (Kress 1983).

CARIBBEAN POPULATION

The population of Roseate Terns breeding on islands in the Caribbean Sea and in the Bahama Islands is much less well-known than that in the northeastern U.S.A. Historically, Roseates have been recorded nesting at more than 70 sites, mostly very small islets off small or medium-sized islands (Nisbet 1980). Van Halewyn and Norton (1984) estimated the total population on islands around the Caribbean Sea as 3,000-4,000 pairs, and Sprunt (1984) estimated the total population in the Bahamas as about 1,000-2,000 pairs. However, both estimates are very rough; no complete census has been attempted. The largest numbers in recent years have been in Puerto Rico and the Virgin Islands, where colonies of up to 1,500 pairs have been reported. Most colonies are situated on low rocky islands composed of broken coral or eroded limestone (Nisbet 1981). Roseate Terns generally nest in association with Sooty and Bridled Terns (*S. fuscata* and *S. anaethetus*). Nest are usually placed in much more open sites than those in the northeast, often in hollows or crevices in broken limestone (Burger and Gochfeld 1988b). In Florida, birds at one colony nest on open coral sand (Robertson 1964), and in recent years several colonies have been established on gravel roofs of flat-topped buildings (A. Sprunt, IV, pers. comm.).

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Table 1. Colony-sites and estimated numbers of nesting pairs of Roseate Terns in the northeastern U.S.A., 1977-1991

State Colony-site	1977	1984	1987	1989	1991
Maine					
Petit Manan Island	20	9	38	45	52
Eastern Egg Rock	-	30	2	16	50
Other sites (13)	60	28	21	14	23
Massachusetts					
Nauset New Island	3	40	90	60	20
Gray's Beach	7	64	2	1	13
Monomoy, North Island	400	2	7	-	-
Long Beach, Plymouth	12	6	5	11	15
Dead Neck, Sampson's Is.	-	53	35	27	-
Bird Island	900	1650	1558	1473	1728
Other sites (3)	5	5	-	4	2
Rhode Island					
2 sites	1	2	-	-	-
Connecticut					
Falkner Island	50	205	165	165	180
Other sites (5)	14	5	10	9	-
New York					
Great Gull Island	800	700	750	1200	1300
Hicks Island	2	72	1	36	3
Warner Island	4	-	13	11	77
Lanes Island	5	68	3	-	11
Moriches Inlet (E & W)	19	7	20	63	9
Cedar Island	25	70	100	63	81
Other sites (5)	6	-	79	4	-
Total					
Breeding pairs	2333	3016	2898	3202	3564
Colonies	21	26	21	18	18

Source: U.S. Fish & Wildlife Service, unpublished compilation



Fig. 1 Breeding and winter distribution of Roseate Terns in the Western Hemisphere.



Fig 2. Roseate Tern colonies active 1987-1991

PRELIMINARY REPORT ON TERN TRAPPING IN COASTAL GHANA

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INTRODUCTION

It is well known that several thousands of Palaearctic terns and other water-birds migrate to the coast of Ghana during autumn to escape the harsh conditions of the Northern winter. Here they exploit the rich fisheries resources of the marine and coastal wetland habitat. Waterbirds which occur in internationally significant populations on the Ghana coast include four species of terns, the Black tern *Chlidonias niger*, the sandwich tern *Sterna sandvicensis*, the Common tern *Sterna hirundo* and the Roseate tern *Sterna dougallii* and at least eleven species of waders (Ntiamao-Baidu, 1991).

Unfortunately, it is also well known that a large number of terns perish on the Ghana coast through tern trapping by the coastal people (Dunn and Mead 1982 ; Ntiamao-Baidu, 1988). The magnitude of tern trapping in coastal Ghana and its possible effect on the dwindling populations of the Roseate tern led to the establishment of the Save the Seashore Birds Project (SSBP-G). This project, which is a joint venture between the Ghana Government, the Royal Society for the Protection of Birds (RSPB) and the International Council for Birds Preservation (ICBP) aims at protecting sea - and shore-birds and their coastal wetland habitats through research, site protection and education.

A few short term studies on tern trapping activities along the Ghana coast has been undertaken in the past eg. Dunn and Mead 1982; Ntiamao-Baidu 1988, but there has been no long term systematic studies of tern trapping in Ghana, this study was undertaken to assess the magnitude of the problem, the species being caught and the spatial and temporal variations in trapping intensity. Such data, would not only enable the assessment of the importance of trapping in the population dynamics of the different tern species, but will enable the evaluation of the effectiveness of the SSBP-G's conservation education efforts.

METHODS

The Ghana coastline was divided into ca. 10 km, beach sections and six of these were randomly selected for the monitoring of tern trapping. The selected beach sections were :

Woe - Keta
Ada Foah - Totopé
Accra - Bortianor
Abandze - Edumafa
Sekondi - Shama
Amanzuru - Ankobra

The sections were visited several times between August 1991 and March 1992 by two person teams. At each visit, the site was covered on three consecutive days (Sunday, generally a non-working day; Monday, a normal working day and Tuesday, the most common taboo day for marine fishing) starting at one end and walking at a more or less constant pace to the other end. The starting point was alternated on successive days. Initially, the observation was planned to cover the period, from 06.00 hrs - 18.00 hrs. However, most sites were completed by 14.00 hrs if started at 06.00 hrs. To obtain records for the latter part of the day, the sites were covered in the mornings on days one and two, while on day three, coverage started at 12.00 hrs.

Incidents of tern trapping and catching of shore-birds were recorded. At each point where trapping occurred, the activity was observed for 30 minutes and records were taken of the method of trapping, numbers and ages of the

people involved and the catch. Later, some of the trappers were interviewed for information on the purpose of trapping and sale prices of the different species. At hourly intervals a count of terns passing offshore or roosting on the beach was taken for a fixed period of 10 minutes. Birds seen in between the hourly counts were recorded separately.

RESULTS AND DISCUSSION

Methods used for catching terns

Five main methods were adopted for catching terns on the Ghana coast : snaring (various forms) "angling", sand and stone throwing, wet cloth throwing, and catapulting. The use of snares accounted for ca. 90 % of all terns captured. Snares were set along the receding tideline or on the sand banks and mudflats where terns and shorebirds roost. Two forms of snares were commonly used. In both forms, nylon thread or strings of coconut frond and a bait of fish were used. In one form, a weight, (stone or shell) was attached to a ca. 2m long nylon thread. The end of the thread with the weight was buried in the sand. The other end of the thread was looped and held between two pieces of sticks firmly fixed in the sand by a trigger. In attempt to take the bait, the tern puts its head in the loop and when it tries to fly off the trigger goes off and the loop tightens around its neck. The weight at the other end of the thread buried in the ground prevents the tern from escaping with the snare.

A variant of the above involved the use of a short stick, ca. 10 cm long, buried in the sand, to which is attached three to five loops of nylon thread which lie on the surface of the sand. The fish bait was left in the centre of the loops and a bird attempting to take it got its legs entangled in the thread. This method was commonly used by children in the western regions to catch waders feeding on the sandy beaches. It had very low efficiency and larger birds often flew off with the snare. A small number of the waders, caught during ringing operations whimbrel, bar-tailed godwit, grey plover and turnstone had nylon strings cutting deep into the tarsal or metatarsal joints with the legs severely swollen. Sometimes the bird lost a leg through such accidents.

Another snare type consisted of a nylon thread attached to a metre long stick which was firmly fixed into the sand or mudflats. The exposed end of the stick was bent down and the looped end of the thread was held down by two smaller sticks. A bird walking or swooping down to take the bait steps in or puts its head in the loop and in an attempt to get away the trigger is released and immediately the bent stick springs up tightening the loop around the leg or neck of the bird.

"Angling" involved the use of hooked lines baited with fish. A tern attempting to take the fish, swallowed the hook and was caught. This method was particularly popular at James Town Fishing Harbour in Accra, where children "fished" for terns from the breakwaters. Fortunately, through the hedge the Seashore Birds Project (SSBP-G's) educational programmes, tern trapping at this once popular spot, has been virtually eliminated.

Throwing of stones, sand and wet cloth was occasionally used to capture terns as they approached the shore following a seine net being pulled by fishermen. The tern dropped into the water, depending on the force of the throw and was quickly grabbed. This method was used particularly when there was a large landing of fish and thousands of terns were hovering around.

Catapults were also used regularly to kill terns and other birds by both children and adults. Occasionally, terns got accidentally entangled in fishermen nets and were caught.

Who traps terns and why ?

Although reports from the fishermen indicated that a few adults trapped terns occasionally and SSBP-G staff have come across a few fishermen who caught terns, young boys (7 - 15 yr age group) were by far the major tern trappers. All the 1,216 (cumulative total) persons recorded involved in trapping activities were boys. Most of these were children who either did not go to school and spent most of the day playing on the beach and helping with the fishing activities, or were school children who went to the beach after school and at weekends.

Terns were caught for three main reasons : sport/fun, food or income but more often than not, it was for a combination of two or all three reasons. In the past a few fishermen caught terns for bird rings, with the hope that when the rings were returned to the country of origin, the finder would receive gifts from the ringing organisation.

Black tern sold for C30.00* - C50.00, Common tern and Roseate tern sold for C50.00 and Sandwich tern sold for C100.00. These prices represent an increase of around 400% over the prices quoted in 1986 (Ntiemoa-Baidu, 1988). Ringed terns fetched higher prices : any tern with two rings sold for C500.00 while a tern with one ring was C200.00.

Frequency of tern trapping

Tern trapping was observed on nine days out of the total of 64 days of observations. Trapping was not recorded at two of the six selected sections: Sekondi - Shama and Ada Foah - Totope (Table 1).

Although this does not necessarily mean that tern trapping has been eliminated completely in villages along the two sections of the coast, it indicates that even if tern trapping occurred, the level was very low.

The village of Shama was one of the sites where tern trapping was very intensive in the 1970s (Alistair Smith, pers com.) and in 1989 (Del Nevo, pers com.). Because of this, it was one of the sites which received special attention from the SSBP-G's conservation education unit. Conservation education work has also been carried out in the villages along the Ada Foah-Totope section. Totope itself was a base for wader ringing operations in 1990 and this provided opportunities for the villagers to meet and talk with the team about bird conservation and the importance of ringing. During the exercise, the Chief fisherman of the village took it upon himself to ensure that the children stopped trapping terns. The low level or absence of trapping activities in the two areas may therefore be the result of the SSBP-G's education programmes.

Tern trapping was observed in the remaining four sites. One of the four, Abandze - Edumafa had the highest frequency of tern trapping. A single village in this area, Ankaful, alone contributed 67 % of the total captured terns recorded in the study. Ankaful is one of the busiest fishing villages along the Ghana coast, where large quantities of sardinella and anchovies are landed. Reports from the fishermen indicated that a greater proportion of the children in this village did not go to school and spent most of their time on the beach. The children readily admitted to trapping terns regularly, displayed their traps and demonstrated how they were used and offered to catch some terns for anyone interested.

Intensity of tern trapping

Tern trapping intensity was defined as the number of terns caught per snare per hour (where snares/traps were used) and as number of terns caught per man hour (in the case of stone/sand or wet cloth throwing). Very little data are available at the moment for the latter, and so the trapping intensity analysis was based on the catch from the use of snares. The intensity of tern trapping varies greatly from one locality to the other and also with time.

Trapping intensities were generally low in most areas, but intensities recorded in two areas, Dzelukope and Ankaful, give cause for great concern. The highest rate of trapping, 14 terns per snare per hour, was recorded at Dzejokope, a village near Keta. Rates of up to 3.5 terns per snare per hour were recorded at Ankaful. At this village, boys interviewed claimed that they regularly caught 12 - 15 terns each on "good" days. These rates are probably comparable to the very intensive trapping recorded by Euan Dunn and Alistair Smith at Kedzi (another village in the Anlo - Keta district) in 1979. They reported a catch of 20 terns in two hours, the number of snares being used was not given (Dunn and Mead, 1982).

The indigenous people from the coastal areas east of the Volta estuary, the Anlo people, appear to have a long tradition of tern trapping. Evidence of this is provided by the large number of ring recoveries reported from this area. The Anlos are well known for migration to other areas of the coast ; Anlo fishing settlements are scattered all along the coast, and unfortunately, the tern trapping tradition has been carried into the new settlements. Reports from fishing communities interviewed showed that terns were trapped in all the Anlo settlements, even where the settlement is in areas where the people traditionally do not trap or eat terns.

Observations on the trapping activities also showed that the boys at Dzelukope and Ankaful were most experienced and efficient in the setting of the snares. The least efficient trappers were found on the Amanzura - Ankobra site, and area where traditionally the people do not eat sea birds.

* Approx 650 cedis is equivalent to £ 1.

Species and numbers of terns caught

A total of 99 terns were recorded caught by the boys during the study period, comprising four species Sandwich, Common, Roseate and Black. Common terns accounted for 67.7% of the total catch, while Black, Roseate and Sandwich contributed 19.2%, 9.1% and 4% respectively (Table 3). No Royal or Little terns were seen caught although they were regularly recorded in the areas where terns were trapped.

SUSCEPTIBILITY OF DIFFERENT TERN SPECIES TO TRAPPING

Comparison of the species proportions in the total terns caught with the relative abundance of the different tern species along the Ghana coast showed that the proportions of the different species in the catch do not mirror the population sizes available on the coast. Black and Common terns constitute the most abundant tern species on the coast accounting for 33.7% and 35.3% respectively of the estimated tern population ; followed by Sandwich (15.4%), Royal (8.7%) and Little (3.5%). Roseates contributed less than 1% of the tern population on the Ghana coast (Ntiamao-Baidu, in prep.). Data on the numbers of the different tern species caught, were compared with the counts of terns present in the locality at the time of trapping, for the few cases where it was possible to collect such data (Table 4).

Although the data available presently is limited, there is indication that the proportion of Common and Roseate terns caught were consistently higher than the proportions of these two species in the tern populations available for capture (the number of Common terns caught were actually significantly higher than what would be expected from the population available for capture $X^2=10.629$, $P<0.01$, $df=2$). The numbers of Black and Sandwich terns caught, on the other hand, were lower or similar to what would be expected from the available population. This would imply that Common and Roseate terns are more susceptible to trapping than the other species. Detailed studies initiated towards the end of the season which are expected to continue next season, would provide more information on the susceptibility of the different tern species to trapping.

CONCLUSION

It is obviously too early to make any definitive conclusions regarding the actual magnitude of tern trapping and the effects of trapping on tern populations. It is, however, obvious that the frequency and intensity of tern trapping depends on a number of identifiable factors. The primary factors which determine whether or not terns would be caught in any area along the coast include :

1. Socio-economic factors
2. Availability of terns
3. Availability of prey items i.e Anchovies and Sardinella

Other secondary factors which influence tern trapping through their effects on a primary factor include :

1. Tidal cycle
2. Weather conditions
3. Lunar cycles
4. Fish landing times

Detailed studies and more data would be required for better understanding of the linkages between these factors and tern trapping. Further studies on feeding ecology and behaviour of the different tern species would also be necessary to explain the differences in their susceptibility to trapping and the importance of trapping on tern population dynamics. From the information collected on the magnitude of tern trapping, it should be possible to redefine and direct conservation education programmes, and identify villages which require special attention in the education programmes. Continuous assessment of tern trapping would also provide a means of evaluating the effectiveness of the SSBP-G's education programmes.

Table 1. Frequency of tern trapping at the different sites

Stretch of coast	Number of days visited	Number of days trapping observed	Total number terns caught
1. Woe - Keta	13	1	20
2. Ada loah - Totope	9	-	-
3. Accra - Bortianor	8	1	-
4. Abandze - Edumafa	12	5	78
5. Sekondi - Shama	13	-	-
6. Amanzura - Ankobra	9	2	1

Table 2. Tern trapping intensity

Locality	Date	Duration of observation mins	No. of snares in use	Total number terns caught	Trapping intensity *
Dzelukope ¹ **	22.10.91	10	3	7	14.0
Ankufull ⁴	30.09.91	52	2	1	0.6
"	01.10.91	40	20	19	1.4
"	28.01.92	30	12	21	3.5
"	29.01.92	30	3	0	0

* Trapping intensity was defined as the number of terns caught per snare per hour

** Numbering refers to stretch of coast (Table 1) within which village is situated

Table 3. Species & numbers of captured terns recorded over the period of study

Sites	Species & captured terns recorded					
	Sandwich	Royal	Common	Black	Little	Roseate
Ankalful ⁴ *	4	-	46	8	-	9
Ehure ⁴	-	-	10	-	-	-
Amisa ⁴	-	-	1	-	-	-
Dzelukope ¹	-	-	2	5	-	-
Keta ¹	-	-	7	6	-	-
Bobrama ⁶	-	-	1	-	-	-
Total	4	-	67	19	-	9
% overall total	4.0	-	67.7	19.2	-	9.1

* Numbering refers to stretch of coast (Table 1) within which village is situated

Table 4. Susceptibility if different tern species to trapping

Locality Date	Tern species	No.	Present % Total	No.	Caught % Total
Ankaful 30.09.91	Sandwich	8	0.2	-	-
	Common	4315	96.3	10	100
	Black	155	3.5	-	-
Ankaful 01.10.91	Sandwich	16	0.6	-	-
	Royal	1	-	-	-
	Common	2612	90.8	36	100
Ankaful 28.01.92	Black	249	8.7	-	-
	Sandwich	24	17.5	4	19.0
	Royal	17	12.4	-	-
	Common	16	11.7	-	-
	Black	45	32.8	8	38.1
Ankaful 28.01.92	Roseate	35	25.5	9	42.9
	Sandwich	7	9.9	-	-
	Royal	3	4.2	-	-
	Common	5	7.0	2	28.6
	Black	55	77.5	5	71.4
Keta 22.10.91	Little	1	1.4	-	-
	Common	15	17.2	7	53.8
	Black	70	80.5	6	46.2
	Little	2	2.3	-	-

**LA CAPTURE DES STERNES PAR LES ENFANTS AU SENEGAL
ET SON IMPACT POSSIBLE SUR LA STERNE DE DOUGALL,
(*Sterna dougallii*)**

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MOTS - CLEFS : Sternes, Sternes de Dougall, Piégeage, Sénégal

RESUME

La capture des sternes par les enfants est une pratique très répandue le long des côtes sénégalaises. La LPO et la Direction des Parcs nationaux du Sénégal mènent depuis plusieurs années une action en faveur de la protection des sternes dans les écoles, ce qui permet aussi de sensibiliser les enfants à la protection de l'environnement en général. Les premières estimations établies à la suite de deux missions d'étude font état de 7.500 à 13.500 oiseaux piégés par an le long des côtes sénégalaises. Les données de Dubois et Rouge (1990) traduisent la plus grande susceptibilité au piégeage de la Sterne pierregarin par rapport aux autres espèces : Guifette noire, Sterne caugek et Guifette leucoptère. La Sterne de Dougall, qui n'est pas connue pour hiverner en grand nombre au Sénégal où elle est observée au passage, ne figure pas parmi les principales espèces victimes du piégeage. L'existence d'une quinzaine de reprises d'oiseaux bagués en Irlande et au Royaume-Uni suggère toutefois que l'espèce est bien présente dans ce pays tout au long du cycle annuel et qu'elle y est également victime du piégeage.

KEY - WORDS : Terns, Roseate tern, Trapping, Senegal

SUMMARY

Tern trapping by children is a very common activity along the coast of Senegal. Since several years, LPO and the Department of National Parks of Senegal have started on educational project focused on tern protection and aiming to develop concern about environment conservation in general. First estimates give 7500 to 13.500 birds trapped every year. Data from Dubois and Rouge (1990) show a higher susceptibility of Common tern to trapping compared to other species : Black tern, Sandwich tern and White-winged black tern. Roseate tern does not winter in big numbers in Senegal where it is observed in migration, and cannot be considered as a main victim of trapping in this country. However, about 15 ring recoveries of Roseate terns ringed in United Kingdom and Ireland suggest that the species occurs regularly and can be trapped in Senegal throughout the year.

INTRODUCTION

Les côtes d'Afrique de l'Ouest et du Golfe de Guinée constituent la zone d'hivernage de la plupart des populations de sternes nichant en Europe. Les côtes sénégalaises jouent dans ce contexte un rôle important pour ces populations.

Un premier recensement réalisé en 1988 par la LPO (Delaporte et Dubois, 1990) fait état de 41.000 sternes hivernant au Sénégal. Les espèces présentes sont par ordre d'importance la Sterne caugek, *Sterna sandvicensis*, la Sterne pierregarin, *Sterna hirundo*, la Guifette leucoptère, *Chlidonias leucoptera*, la Sterne naine, *Sterna albifrons*, la Sterne caspienne, *Sterna caspia*, la Sterne royale, *Sterna maxima*, la Guifette noire, *Chlidonias niger*, la Guifette moustac, *Chlidonias hybridus* et la Sterne hansel, *Gelochelidon nilotica*.

D'autre part, la plupart des sternes hivernantes présentes dans le golfe de Guinée transitent avant et après la saison de reproduction par le Sénégal. C'est notamment le cas de la Sterne de Dougall, *Sterna dougallii*, dont une grande partie des populations européennes, hiverne le long des côtes ghanéennes (Cramp, 1985).

Par ailleurs, le Sénégal possède également des populations de sternes nicheuses très importantes. Ainsi, 30.150 couples de Sternes royales, *Sterna maxima*, et 5.730 couples de Sternes caspiennes, *Sterna caspia* furent recensés en 1991 par Delaporte (1991).

La pratique du piégeage des sternes, répandue sur l'ensemble des côtes africaines, peut constituer un facteur de mortalité important, notamment dans les pays à forte population humaine comme le Sénégal. Ce piégeage peut avoir des conséquences particulièrement graves pour les espèces les plus menacées comme la Guifette noire, *Chlidonias niger*, en régression sur une bonne partie de l'Europe (Tucker, 1992) ; ou la Sterne de Dougall, *Sterna dougallii* dont les populations européennes subissent une régression alarmante depuis les vingt dernières années (Everett et al., 1987)

1. La campagne "Je protège les Sternes"

La Ligue française pour la Protection des Oiseaux et la Direction des Parcs Nationaux du Sénégal mènent depuis plusieurs années, avec le soutien du WWF France, une campagne en faveur de la protection des sternes. Celle-ci s'inscrit dans le cadre d'une action plus vaste d'éducation à la conservation de l'environnement menée dans différents pays d'Afrique de l'Ouest sous l'égide du Conseil International pour la Protection des Oiseaux. A l'image du "Save the Seashore Bird Project" mené par la RSPB au Ghana, l'action engagée au Sénégal comprend deux volets :

- Une action éducative auprès des écoliers, visant à les sensibiliser au problème de la capture des sternes et, à travers cet exemple, aux problèmes plus généraux de la conservation de l'environnement ;
- Une action de suivi scientifique visant principalement à estimer l'importance des prélèvements de sternes effectués par les enfants.

Les animations dans les écoles comprennent la projection d'un montage de diapositives sur l'écologie des sternes et l'intérêt de les protéger. Des dépliants, des autocollants et des affiches sont distribués aux enfants.

D'ores et déjà, près de 5.000 enfants ont été sensibilisés par ces animations. La poursuite du programme pour les années à venir comprend : la création de clubs nature dans les écoles, l'échange de correspondance entre les écoles sénégalaises et françaises, l'organisation de matchs de football, des actions avec la Direction des Pêches et la création d'un disque par le chanteur sénégalais Omar Pene sur le thème de la campagne.

Le suivi scientifique a consisté en deux missions réalisées en mars et août 1990 qui ont permis d'inventorier les sites où les captures sont les plus intensives et de recueillir des informations sur l'importance et la nature des prélèvements à deux époques différentes de l'année (Dubois et Rouge, 1990).

Une mission de dénombrement et de baguage de poussins de Sternes royales et de Sternes caspiennes a été réalisée dans le but d'obtenir des informations concernant l'impact du piégeage sur les populations de sternes qui nichent au Sénégal (Delaporte, 1991).

Dans le cadre de la poursuite du programme, nous chercherons en priorité à récolter des informations concernant le piégeage des sternes pendant la période hivernale, et si possible, sur l'ensemble du cycle annuel. Une fois les campagnes de sensibilisation effectuées, le suivi des prélèvements devrait permettre de conclure sur le succès réel de l'action éducative.

2. Importance et nature des prélèvements

La pratique de la capture des sternes est connue de longue date au Sénégal. Morel et Roux (1973) soulignèrent l'importance de ce piégeage dans certaines régions et s'interrogèrent sur son impact sur les populations de sternes.

Au cours d'une première mission du CIPO, Meininger (1989) aboutit, au terme d'un travail d'enquête, à une première estimation de 5.000 à 20.000 oiseaux capturés annuellement. Dans le cadre du programme précédemment décrit, Dubois et Rouge (1990), réalisèrent une autre mission d'un mois où fut appliquée la méthode développée et utilisée par la RSPB au Ghana. Celle-ci consiste à parcourir des itinéraires échantillons sur des parties de côte tirées au sort où les groupes d'enfants rencontrés en train de capturer font l'objet d'observations détaillées (nombre et âge des enfants, nombre de pièges, nombre d'oiseaux capturés par unité de temps, composition spécifique...). Parallèlement, les effectifs et l'activité des groupes de sternes sont également notés.

A partir des premiers résultats (mars 1990) où la majeure partie de la côte sénégalaise fut prospectée (carte 1), ces auteurs donnent une estimation minimale comprise entre 7.500 et 13.500 oiseaux piégés par an, estimation basée sur les dix sites majeurs de capture.

Le taux moyen de captures obtenu au printemps au Sénégal est de 1,14 oiseaux/heure/piège (calculé sur une durée totale de 11 heures d'observation), ce chiffre pouvant énormément varier d'une localité à l'autre.

Ntiamoa Baidu (1992) arrive à des constatations similaires au Ghana. Les données préliminaires recueillies à l'automne ou en hiver par cet auteur sont insuffisantes pour conduire une analyse mais elles fournissent cependant des indications intéressantes concernant l'intensité du piégeage qui paraît également très élevée dans ce pays (2,08 oiseaux/piège/heure en moyenne sur un total de 2,7 heures d'observation ; calculé d'après les données de l'auteur).

Au Sénégal, l'activité de capture varie en fonction du moment de la journée et du jour de la semaine. Elle est maximale en milieu et fin d'après midi, lorsque les enfants sont sortis de l'école et que les bateaux rentrent de la pêche, suivis par de nombreuses sternes. Notons que l'instauration d'une journée scolaire continue depuis 1991 pourrait modifier ce résultat.

Le nombre moyen de pièges par site est proche de 4 ($n = 16$) et le chiffre journalier d'oiseaux capturés varie entre 5 et 9 par site.

Les jeunes garçons sont âgés en moyenne de 8 à 13 ans. Bien que les oiseaux capturés puissent être occasionnellement vendus aux touristes ou consommés, il faut souligner que l'activité de piégeage est essentiellement ludique au Sénégal, tout comme au Ghana (Ntiamo Baidu, 1988 b).

Les chiffres donnés par Dubois et Rouge permettent de renseigner sur la vulnérabilité des différentes espèces à la capture. Parmi les 54 captures observées en mars 1990 tout au long des côtes sénégalaises, figurent la Sterne pierregarin (72,2 %), la Guifette noire (13,0 %), la Sterne caugek (7,4 %), la Sterne caspienne (3,7 %), la Sterne royale (1,9 %) et la Guifette leucoptère (1,9 %). Or, d'après les recensements effectués à cette période sur les côtes où ont lieu l'essentiel des captures, la Sterne pierregarin représentait seulement 26,7 % et la Guifette noire 13,3 % du total d'oiseaux recensés contre 33,3 % pour la Sterne caugek et 16,6 % pour la Guifette leucoptère (Tab. 1).

La sur-représentation de la Sterne pierregarin dans l'échantillon d'oiseaux capturés (statistiquement significatif pour $P < 0,01$; test du χ^2) met en évidence sa plus grande vulnérabilité au piégeage, par rapport aux autres espèces qui sont représentées par un pourcentage égal (Guifette noire), ou inférieur (Sterne caugek et Guifette leucoptère) à leur relative abondance le long de la côte (différences statistiquement significatives pour $P < 0,01$; test du χ^2). Bien qu'il s'agisse ici d'un calcul grossier effectué à partir d'un faible échantillon d'oiseaux capturés ($n = 54$), on aboutit aux mêmes conclusions que Ntiamo Baidu (1992) concernant la vulnérabilité au piégeage de ces différentes espèces de sternes au Ghana (la Guifette leucoptère étant absente de ses échantillons). Notons que parmi les 39 Sternes pierregarins dont la capture a été observée, 87 % correspond à des immatures. La Sterne de Dougall est, quant à elle, totalement absente de la liste des captures observées au Sénégal.

3. La Sterne de Dougall au Sénégal

La Sterne de Dougall est un oiseau rarement observé au Sénégal. Dubois observa plusieurs individus dans la région d'Abéné (Casamance) en février 1988 ainsi qu'en migration près de Dakar en mars 90. Quelques années auparavant, Roux (com. pers.) avait également observé quelques individus en hiver et en concluait que l'espèce devait probablement hiverner en petit nombre le long des côtes sénégalaises. L'espèce y a également été observée en période de migration en quelques rares occasions. Fin avril 92, Porter et al. (RSPB, in prep.) observèrent plusieurs groupes de Sternes de Dougall se dirigeant vers le nord dans la région de Dakar.

Nous disposons également de quelques reprises au Sénégal d'oiseaux bagués en Irlande ou en Grande-Bretagne, que la RSPB et le BTO nous ont aimablement communiqués. Bien que le nombre de reprises soit très faible, 15 oiseaux seulement ce qui est bien insuffisant d'un point de vue statistique, l'analyse des reprises fournit toutefois des informations intéressantes :

1 - Ces 15 reprises, distribuées dans le temps de 1953 à 1989, montrent tout d'abord que l'espèce est présente de façon régulière au Sénégal, même si ce n'est qu'avec de très faibles effectifs. Elles représentent en effet seulement 5,3 % des 282 reprises de Sternes de Dougall en Afrique occidentale, dont l'essentiel (68 %) provient du Ghana, les autres pays ayant une importance comparable à celle du Sénégal en termes de reprises (Fig. 1).

2 - Parmi les 15 oiseaux repris au Sénégal, on remarque que 11 (73 %) sont des jeunes de moins d'un an (Fig. 2). D'autre part, la majorité de ces oiseaux (8/11) ont été repris entre le 10 mai et le 13 juillet, soit pendant la période de reproduction des adultes ce qui montre que nombre de jeunes de première année passent leur premier été sous les tropiques. Les quatre autres oiseaux de plus d'un an ont tous des dates de reprise en dehors de cette période. Malgré la faiblesse de notre échantillon, l'existence d'une pic de reprises d'oiseaux de moins d'un an en période de reproduction (Fig. 3) pourrait résulter

d'une remontée vers le nord de jeunes oiseaux ayant hiverné dans le golfe de Guinée venant séjourner le long des côtes sénégalaises au printemps.

Malgré la faiblesse de notre échantillon, on retrouve ici le même résultat qu'au Ghana concernant la plus grande vulnérabilité des oiseaux de première année, qui représentent près de 80 % du total des captures (Everett et al. ; 87).

Une seule des 15 reprises du Sénégal est répertoriée en tant que telle comme résultant du piégeage, 2 nous indiquent que l'oiseau a été probablement tué, 1 cas correspond à un oiseau trouvé blessé, 2 cas à des oiseaux capturés vivants puis relâchés, les 9 autres reprises étant d'origine inconnue et correspondent la plupart du temps à des oiseaux "trouvés morts".

Toutefois la majorité des oiseaux repris provient de la zone où le piégeage est le plus intense : région dakaraise, Thiaroye, Ruffisque, presqu'île du Cap Vert. Malgré la part importante d'oiseaux pour lesquels l'origine de la mort n'est pas précisée, nous pensons cependant qu'une proportion beaucoup plus importante des oiseaux repris provient directement du piégeage (ou de toute autre forme de prédation) car nous savons que les enfants ne déclarent généralement pas avoir capturé les oiseaux, ceux-ci craignant d'éventuelles sanctions.

Quoiqu'il en soit, ces données montrent que le problème de la capture des sternes au Sénégal concerne également la Sterne de Dougall. La présence de cet oiseau et l'évaluation de l'impact du piégeage devraient donc être recherchés de préférence pendant la période de reproduction, pendant laquelle les jeunes de première année semblent plus abondants le long des côtes sénégalaises. Bien que la Sterne de Dougall ne soit présente au Sénégal que sous de faibles effectifs, l'importance relative du piégeage de cette espèce ne doit pas être a priori minimisée, en raison du caractère particulièrement sensible au piégeage de l'espèce et en particulier de juvéniles.

D'une façon générale, nous savons aujourd'hui que le piégeage des sternes concerne de nombreux pays d'Afrique de l'ouest et que ce sont probablement plusieurs dizaines de milliers d'oiseaux qui sont capturés chaque année le long des côtes africaines. Toutefois, les données dont nous disposons sont aujourd'hui encore insuffisantes pour pouvoir juger de l'incidence réelle de ce piégeage, qui touche surtout les jeunes, sur la dynamique de populations de ces espèces longévives.

REMERCIEMENTS

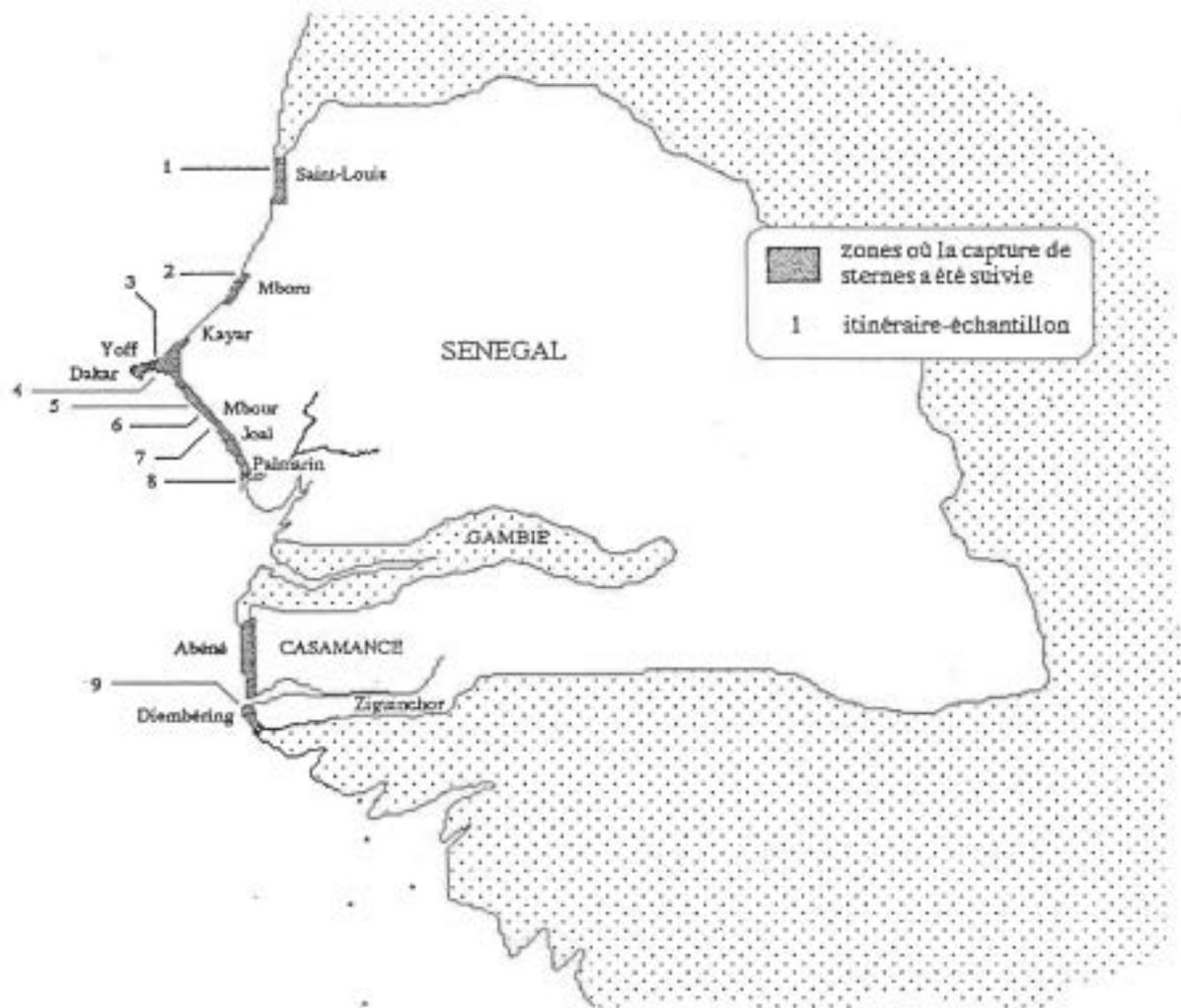
Nous tenons à remercier Adrian del Nevo (RSPB), le BTO et Mr Csaikowsky (CRBPO, Paris) pour nous avoir communiqué les informations en leur possession concernant les reprises de bagues de Sternes de Dougall au Sénégal. Nous remercions également Philippe Delaporte pour avoir relu le manuscrit et Nadège Maillet pour en avoir assuré la dactylographie.

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carte 1 :

Zones de prospection - Etude Sternes/Sénégal
mars-avril 1990



Tab. 1 : Susceptibilité au piégeage des différentes espèces de Sternes au Sénégal (données recueillies par Dubois et Rouge en mars 1990)

(Résultats statistiquement significatifs pour *S. hirundo*, *S. sandvicensis* et *C. leucopterus* pour $p < 0,01$, test du χ^2)

ESPECE	Nbre total d'oiseaux comptés le long de la côte	% TOTAL	Nbre d'oiseaux capturés observés	% TOTAL
<i>S. sandvicensis</i>	5000	33,3	4	7,4
<i>S. hirundo</i>	4000	26,7	39	72,2
<i>C. niger</i>	2000	13,3	7	13,0
<i>C. leucopterus</i>	2500	16,6	1	1,9
<i>S. caspia</i>)		-	2	3,7
<i>S. maxima</i>)	1500	-	1	1,8
Autres)		-		
	15000	100,00	54	100,0

FIGURE N° 1

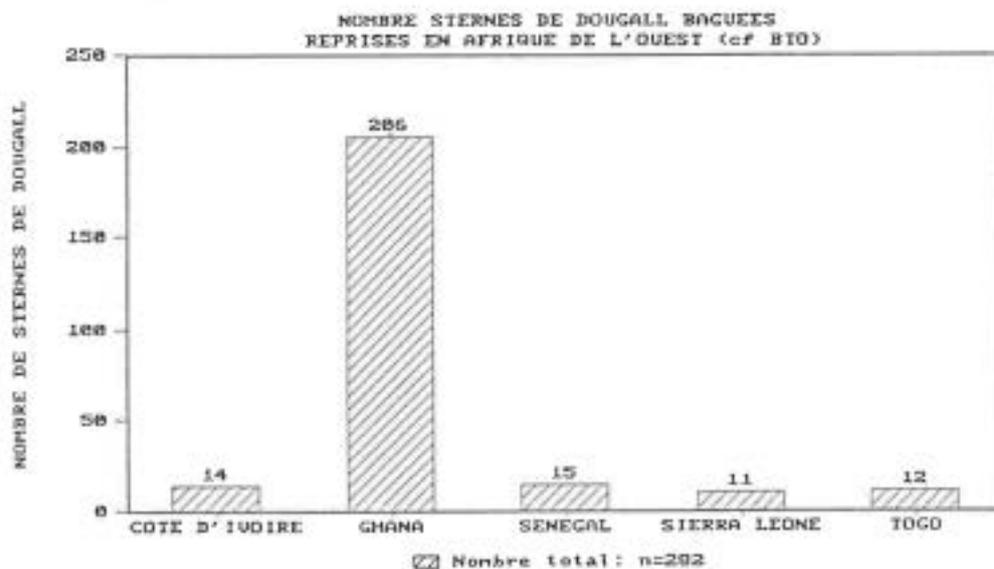


FIGURE N° 2

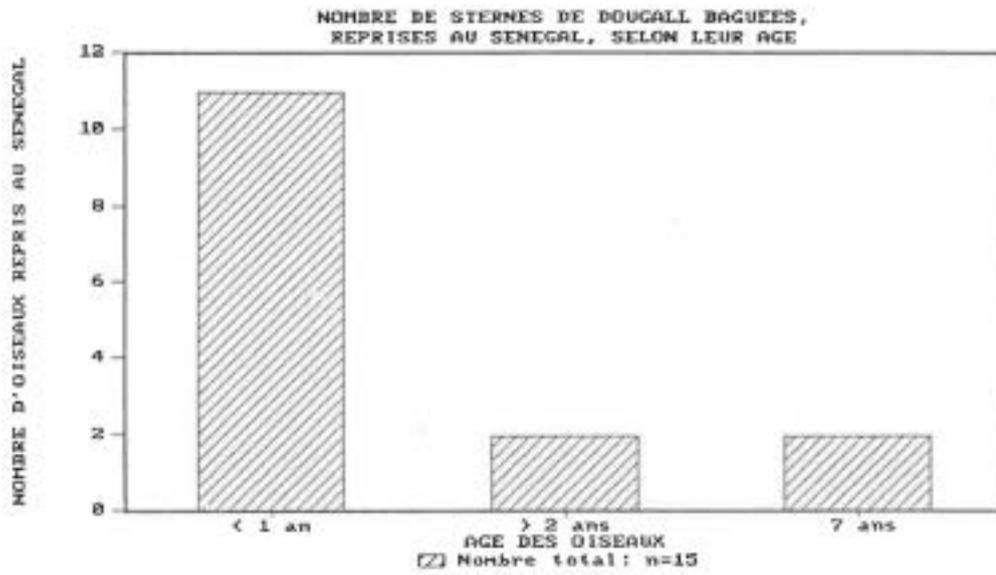
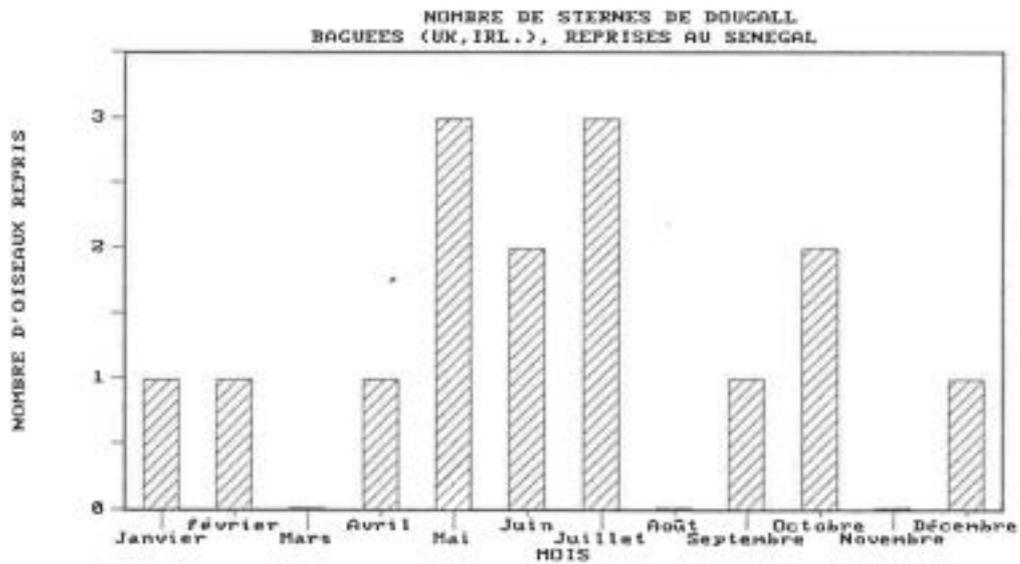


FIGURE N° 3



ROSEATE TERNS (*Sterna dougallii*) ON ARIDE ISLAND, SEYCHELLES

Ian BULLOCK, Robert LIDSTONE-SCOTT
Gill CASTLE, Robert MILETO, James CADBURY

Aride Island, a Royal Society for Nature Conservation (RSNC) reserve, has supported all the breeding roseate terns in the Seychelles in recent years. The population was estimated to be 4,300 - 4,800 pairs in 1975 and was probably at least as large in 1978. Estimates in 1986 and subsequently have been considerably lower (900 - 2 000 pairs). In 1991, there were sporadic visits, but none nested. Over seven years 1984-1990 there were five in which the majority of young failed to fledge, largely due to the adults deserting their chicks en masse when they had problems obtaining small fish.

Aride has the world's largest colony of lesser noddies *Anous tenuirostris* (c 170.000 pairs). Their chicks which are fed on similar food, lost weight at the same time as roseate tern chicks were starving, but most survived. In 1991, only a handful of young were reared. Sooty terns *Sterna fuscata* (up to 160. 000 pairs) bred a month later than normal that year. There is no evidence of overfishing by man in the sea around the Seychelles.

The majority of roseate terns nest in *Pisonia grandis* woodland, flying in under the dense canopy to reach their nest on the ground which is almost bare of vegetation except for clumps of ferns. A minority of terns nest in glades.



Ces dernières années, Aride Island, une réserve du RSNC, a accueilli toutes les sternes de Dougall nicheuses des Seychelles. La population était estimée à 4 300-4 800 couples en 1975 et était probablement au moins aussi importante en 1978. Les estimations en 1986 et plus tard étaient beaucoup moins fortes (900 - 2 000 couples). En 1991, il y eut quelques prospecteurs sporadiques, mais aucun ne nicha. Entre 84 et 90, il y a eu 5 années pendant lesquelles la majorité des jeunes n'a pas été jusqu'à l'envol, ceci est largement dû à l'abandon en masse des jeunes par leurs parents, lorsqu'ils avaient des problèmes pour trouver des poissons de petite taille.

Aride a la plus grande colonie au monde de noddis (*Anous tenuirostris*) (env. 170 000 couples). Alors que les poussins de sternes de Dougall mourraient de faim, leurs poussins, qui ont la même nourriture, perdaient du poids (mais la plupart ont survécu). En 1991, seulement une poignée de jeunes furent élevés.

La sterne fuligineuse (*Sterna fuscata*) (plus de 160 000 couples) ont niché cette année-là un mois plus tard que la normale. Il n'y a aucune preuve qu'il y ait un lien avec la pêche au large des Seychelles.

La majorité des sternes de Dougall niche dans les bois de *Pisonia grandis*, volant sous la canopée pour rejoindre, au sol, leurs nids construits sans apport de végétaux sauf de touffes de fougères. Une minorité de sternes niche dans des clairières.

TALK : Graham HIRONS

NEST SITES SELECTION BY ROSEATE AND COMMON TERNS IN THE AZORES ARCHIPELAGO

Jaime RAMOS
University of Durham

INTRODUCTION

Habitat selection during the breeding season is likely to have repercussions on survival and reproductive fitness because, while breeding, birds are confined to the habitat where they place their nests. In mixed colonies of Roseate terns (*Sterna dougallii*) and Common terns (*Sterna hirundo*), the main subjects of this study, this is particularly important. Common terns are slightly larger than Roseate terns (Cramp, 1984 ; Burger & Gochfeld, 1988b), and prefer relatively open areas whilst Roseates prefer sheltered areas (Laugham, 1974 ; Burger & Gochfeld, 1988a). When nesting in the open grounds, Roseates may compete with Commons for available nest sites (Spendelov, 1982).

In this study, I examined nest site preferences of Roseate and Common terns in the Azores archipelago using discriminant analysis. The Roseate tern has a patchily cosmopolitan breeding distribution. The atlantic race, *Sterna dougallii dougallii*, has declined dramatically on both sides of the atlantic and is now considered threatened or endangered (Gochfeld, 1983). Azorean terns are now considered to be of international important (del Nevo et al, 1990) and, therefore, a knowledge of nest-site requirements there, for a comparison with nest sites elsewhere and as a basis of future conservation measures, is important.

Colonies were stratified and points located in a systematic way. Physical parameters, vegetation cover and density of nests were measured for these points (random points) and the nearest nest. Sampling was done at or a few days after the peak of egg-laying. Measured nest site parameters were compared between species and with random points in the colony.

RESULTS

Site characteristics of Roseate terns differed significantly from those of Commons (ANOVA : $F=29.71$ $P<10^{-6}$, $df = 13.260$). The discriminant analysis indicated that the number of neighbours within 2 m of nest, % of vegetation cover within 0.5 m of nest and position of the nest in the colony (Roseates nested more often in the center of the colony) were the variables that distinguished optimally between the two terns species nest sites (Table 1). The discriminant function scores for Roseate terns had little overlap with the scores for Common terns (Fig. 1), indicating that both species base their nest site selection on different habitat parameters. Overall, Roseates nested closer to other terns and had more neighbours within 2 m, indicating the Roseates seem to tolerate closer neighbours than Commons.

In the comparison between nest sites of each tern species and random points, the important discriminators varied considerably among colonies. The differences in rates of correct classification of pooled colony data between Roseate nest sites vs Random points on the one hand and Common nest site vs Random points on the other hand was highly significant ($G=21.34$ with Yate's correction, $P>0.001$, $df=1$). This shows that areas where Roseate terns chose to nest differed more from the available habitat than areas where Common terns nested.

To differentiate between the characteristics of Roseate nest sites and random points, the discriminant function highlighted only 4 variables than explained more than 10 % of the discriminant analysis whereas for Common terns 7 variables were selected. The total % explained by this variables was significantly higher for Roseate than for Common ($T=2.25$ with arcsine transformation $P<0.05$ $df=9$). These results suggest that two interacting mechanisms are involved in determining the degree and criteria of habitat selection by nesting Roseate and Common terns : Roseate tern nesting habitat selectivity is higher. On the other hand, Common tern nesting habitat is more similar to randomly located points and they are more disposed to use what is available.

DISCUSSION

The results of my analyses reaffirm much of what has been suggested for Roseate and Common tern nest sites selection based upon univariate methods (Langham, 1974 ; Burger & Gochfeld, 1988a ; Gochfeld & Burger, 1988).

The larger and more aggressive Common tern have greater competitive ability (Schoener, 1974) and requirements of closely match available and thus should have higher probability of resource acquisition. The more restricted nesting preferences of Roseate terns and their more restricted nesting locations suggest that they might face a shortage of optimal nest sites. Not only in nesting but also overall they seem to be more specialised birds than Common terns. This was shown in relation to their foraging locations in north-eastern North America by Safina (1990) who concluded that this explains the usually lower population size of this species in America.

In the Azores, Roseate terns nested earlier, within higher densities and significantly outnumbered Common terns in the most of the colonies ; the reverse is true for most colonies in North-eastern North America (Burger & Gochfeld, 1988b) and in Britain (Langham, 1974). Differences in the spatial distribution of Roseate tern optimal nesting areas between the Azores and these other locations may be the origin of the differences. Spendlow (1982) suggested that the most sheltered sites are the first ones to become occupied. These will be defended by older, more competitive Roseate terns forcing younger Roseates to more open areas where they might have to face aggressive Common terns. Therefore, the breeding population size of a Roseate colony seems to be limited by the amount of optimal for Roseate terns. Experiments are needed to prove these ideas.

My study has two main implications for the conservation of Roseate terns. Firstly, management considerations should be taken to maintain Roseate tern optimal nesting habitat because (1) they are more specialised and (2) nesting in open areas might be disrupted by competition with Common terns. Secondly habitat discriminators varied greatly between colonies and thus management should be considered on a colony-by-colony basis.

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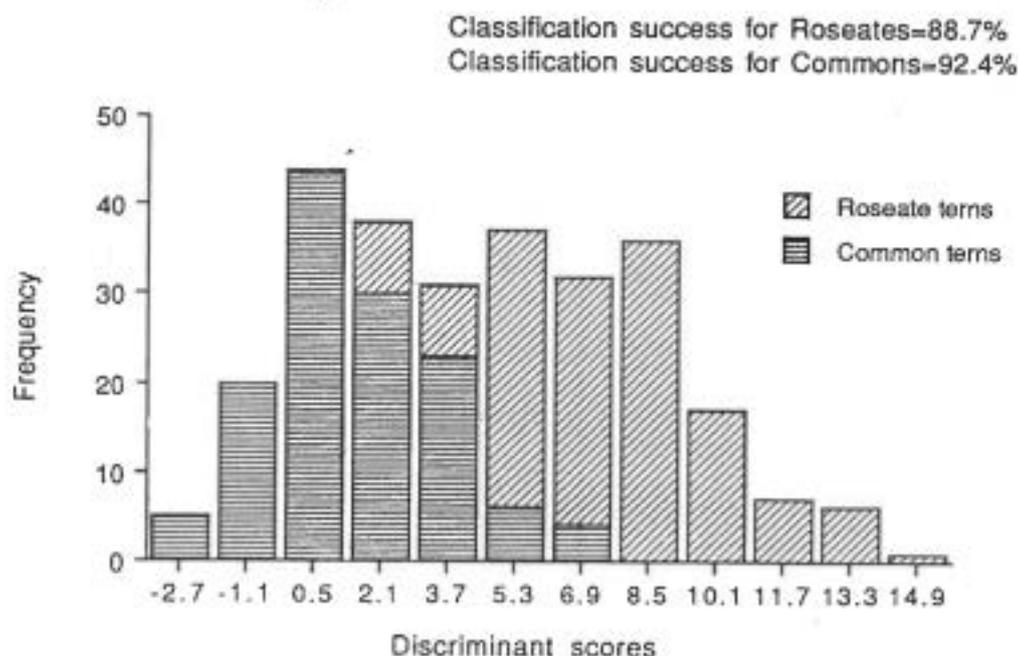
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Table 1. Summary of the discriminant analysis of nest site characteristics among Roseate terns and Common terns for pooled colony data. Arcsine transformation was used on % variables, logarithmic on other continuous variables and square root on counts (Sokal & Rohlf, 1969)

HABITAT VARIABLE	STANDARDISED COEFFICIENT	PERCENT ADDED
WALLS : number of walls around nest	1.73	31.17
NN 2m : number of neighbours within 2 m	0.26	24.28
VISIBILITY : % of nest visible from above	-0.47	21.95
COVER 0.5 m : % of vegetation cover within 0.5 m of nest *	0.01	15.35
POSITION of the nest in the colony (edge, middle, centre)	-0.93	9.57
DNEAVEG : distance to nearest vegetation (cm)	0.08	4.42
OVERHANG : with non (0) or partial (0.5) or complete (1)	2.59	3.88
OVERALL SLOPE max slope within 2 m section around the nest	-2.88	0.38
HNEAVEG : height of nearest vegetation (cm)	-1.11	0.19
VEGETATION TYPE : grass (1), not grass (0)	0.42	-0.01
SUBSTRATE : hard (bare rock)=1, soft (soil, vegetation, mixed)=0	1.36	-0.20
COVER 3 m : % of vegetation cover within 3 m of nest *	0.20	-5.11
DNN : distance of nearest neighbour	0.68	-5.90

* : visual estimation

Figure 1. Frequency distribution of scores for the discriminant function from the analysis of characteristics of Roseate and Common terns nest sites. The arrow indicates the midpoint between mean discriminant scores of the two types of nests.



COMPARATIVE FEEDING ECOLOGY OF ROSEATE TERNS
(*STERNA DOUGALLII*) AND COMMON TERNS (*STERNA HIRUNDO*),
AT TWO EUROPEAN COLONIES.

Adrian del NEVO (1), *Michael O'BRAIN* (2),
Liam RYAN (2), *Alastair MORALEE* (1)

(1) RSPB
(2) IWC

Initial findings of the comparative ecology of *Sterna dougallii* and *Sterna hirundo* at three locations in Western Europe are presented. Observations and methods follow those of del Nevo (in prep). Differential population trends have been recorded for both *dougallii* and *hirundo* within the Azores and also for *dougallii* at three sites ; the Azores, Rockabill and Anglesey. This paper provides some preliminary information on inter-specific and inter-regional variation in tern feeding ecology in order to assess how variation in breeding ecology may explain variation in population levels and trends.

Within the Azores inter-specific and inter-islands variation in the timing of breeding occurred consistently in each year 1989-91. Median laying dates for *dougallii* were consistently earlier (mean = 12 days + or - 2 days) than common terns. In each year and for both species, laying commenced in late April in Flores and was progressively later with decreasing degrees of longitude. The timing of laying in *dougallii* was more synchronised than *hirundo*. Differences in the timing of breeding and the synchrony of laying may, in part, be due to inter-specific differences in feeding ecology.

On Anglesey and Rockabill the diet of *hirundo* and *dougallii* are dominated by *Ammodytes* and to a significantly lesser extent *Chupeidae*. On the Azores a greater variety of fish species are brought to the colony both at *picturatus*, *Pegellus bogaraves* and also mid-water and bottom feeding species e.g. *Bothus podas*. On the Azores, adult *hirundo* and *dougallii* feed larger and more nutritional fish as chicks become older. In general both tern species feed their young between 9.00-11.00 and 15.00-17.00 although some variation exists depending on the fish species. The variation may be explained by a mark inter-specific variation in spatial distribution of fish and their availability. In both the Azores and Rockabill *hirundo* have shorter foraging trips than *dougallii*. *Dougallii* feed chicks on larger more nutritional prey than *hirundo*.

The mean feeds/day for *dougallii* chicks at two locations is presented in Table 1. Daily food consumption by *dougallii* chicks was higher on the Azores than on Rockabill. *Dougallii* chicks on the Azores grew faster and reached a higher day ten weight than chicks from Rockabill (Table 2). Adult *dougallii* were heavier than Rockabill birds. Chicks at day ten on the Azores represent 77% of adult body weight compared to 71 % of adult body weight on Rockabill. There was no evidence that the proportionally heavier Azorean chicks resulted in higher cost to adults in term of weight loss. We do not know the differences in chick growth and adult weight result in differential survival rates between the two colonies.

Rockabill *dougallii* have a larger clutch size and fledge more chicks than the Azores. Further studies will indicate wether these inter-colony differences are consistent between years and how the differences may influence survival rates and variation in population trends.

Table 1 . Comparison of parameters for chick feeding and growth for *Sterna dougallii* in the Azores and Rockabill.

	<i>Sterna dougallii</i>	
	ROCKABILL	AZORES
Mean feed rate (feeds/day) Taux moyen d'alimentation (repas/jour)	10.1	11.8
Mean mass of food (g) Masse moyenne de nourriture	1.8	2.5
Mean daily food consumed (g) Moyenne de nourriture consommée/jour (g)	18.2	29.5
Mean calories/day (kJ.g ⁻¹) Moyenne de calories/jour	143.0	184.0
Mean daily weight increase of chicks (g/day) Moyenne d'accroissement du poids/jour (g/jour)	3.9	6.4
Conversion rate Taux de conversion	21.4	21.7
Fish weight (g) required to increase chick weight by one gram Poids de poisson nécessaire pour augmenter d'un gramme le poids d'un jeune.	4.6	4.6

Table 2. Comparison of parameters for chick growth and breeding biology for *Sterna dougallii* in the Azores and Rockabill

	<i>Sterna dougallii</i>	
	ROCKABILL	AZORES
Mean day ten weight (g) of chicks Poids moyen des jeunes au jour dix	85.0	96.2
Mean adult weight (g) Poids moyen adulte	120.3	124.3
Chick day ten weight as % of adult body weight Poids du jeune jour dix, en % du poids adulte	70.6	77.0
Mean clutch size Moyenne du nombre d'oeufs	1.8	1.1
Mean chicks/pair Nombre moyen de jeunes/couple	1.5	0.89

BREEDING ECOLOGY OF ROSEATE TERNS IN THE U.S.A.

IAN C.T. NISBET

STUDIES PRIOR TO 1987

Prior to 1970, most of the published information on Roseate Terns (*Sterna dougallii*) in North America was concerned with distribution, numbers, and general breeding biology (e.g., Mackay 1896, Jones 1906, Bent 1921, Forbush 1929, Robertson 1964; see review by Nisbet 1981a). Between 1966 and 1978, long-term ecological studies of Common Terns (*Sterna hirundo*) were started at four sites in the northeastern U.S.A. and these studies are still in progress (Nisbet *et al.* 1984, DiCostanzo 1980, Burger and Gochfeld 1991a, Spindelow 1982). Although each of the four sites where Common Terns are being studied is also the site of a large colony of Roseate Terns, comparatively little work was done until 1987 on the ecology of Roseate Terns, because they are more difficult to study. Nevertheless, large numbers of Roseate Terns were ringed and recaptured (Nisbet 1984, Spindelow and Nichols 1989), and a number of studies of their ecology were published in the period 1970-1988. These studies were reviewed by Nisbet (1981a), with an update in 1989 (Nisbet 1989b). The more important published studies include those of Burger and Gochfeld (1988), Collins and LeCroy (1972), Cooper *et al.* (1970), Duffy (1986), Gochfeld and Burger (1987), LeCroy and Collins (1972), Nisbet and Cohen (1975), Nisbet and Drury (1972), Nisbet (1978, 1981a, b, 1984), Safina (1990a,b), Safina *et al.* (1988, 1990), Spindelow (1982) and Spindelow and Nichols (1989). These publications include data on general reproductive biology, age at first breeding, nest-site selection, clutch-size, egg-size, hatching asynchrony, chick growth, feeding ecology, reproductive success, migration, and demography.

Co-OPERATIVE STUDY 1987-1991

In 1987, the population of Roseate Terns in the northeastern U.S.A. was designated as endangered (U.S. Fish & Wildlife Service 1987). The need to prepare a recovery plan for this population (U.S. Fish & Wildlife Service 1989) created new interest in studying its biology and demography. In 1987, a co-operative study programme was started at the four major colonies, under the direction of J.A. Spindelow of the Patuxent Wildlife Research Center. The programme included co-ordinated ringing, retrapping and resighting of marked birds, and a number of biological studies. The programme was planned to run for four years, but a fifth year's work was conducted in 1991. Ringing, retrapping and resighting activities will continue for several more years, but many of the biological studies have been completed and the results are being analyzed and prepared for publication. Some of these studies will be presented at a symposium on Roseate Tern biology, to be held at the meeting of the Colonial Waterbird Society in Arles, France, in October 1993. This paper summarizes some of the results that are available in April 1992. Because the multi-colony studies are not yet complete, most of the data presented in this paper are from the author's own studies at Bird Island, Massachusetts.

METHODS

Most of the research has been conducted at the four largest colonies of Roseate Terns in the U.S.A.: Bird Island (41°40'N, 70°43'W), Great Gull Island (41°12'N, 72°07'W), Falkner Island (41°13'N, 72°39'W), and Cedar Beach (40°37'N, 73°21'W). These colonies are described in an accompanying paper (Nisbet 1993). During the period of study, these colonies supported about 1,600, 1,200, 170 and 90 breeding pairs of Roseate Terns, respectively. Because studies of Common Terns had already been conducted at these sites for many years, the Roseate Terns were already habituated to the presence of biologists. It was possible, therefore, to start intensive studies of Roseate Terns, including trapping of adults and regular checking of nests and chicks, without a period of less intensive work to accustom the birds to the research activities. Roseate Terns were ringed and some biological studies were performed at five smaller colonies also.

Methods of study were similar in all colonies. Adult Roseate Terns were trapped in treadle-traps ("Potter" traps) set over their nests. Birds were usually trapped during the last 3 days of incubation, when trapping does not lead to desertion or to neglect of chicks (Nisbet 1981b, Burger and Gochfeld 1991b). At Falkner Island and Cedar Beach, most of the breeding birds (70-90% of the total population) were trapped in each year, but at Bird Island and Great Gull Island, only about 200 adults (6-8% of the breeding population) could be trapped in each year. All birds were measured (usually wing, tail, culmen, head-length and tarsus), weighed, and ringed with a unique combination of one numbered incoloy ring and three Darvic colour-rings (two rings on each leg). Birds trapped in 1987 were ringed with one incoloy ring only. Most birds were released within 5-10 minutes of trapping.

In each colony, 70-250 nests were marked for detailed study in each year. Information recorded included laying and hatching dates, laying and hatching intervals, clutch-size, and (in some cases) egg-mass. Chicks were ringed at hatching with an incoloy ring on one leg and a Darvic colour-ring on the other leg. One colour was used for each colony. Many other chicks from unmarked nests were ringed and colour-ringed at ages of 15-25 days.

In 1989-1991, telescopes were used at each colony to identify colour-ringed birds as they rested on rocks or beaches outside the nesting area. Colour-ringed birds were also located at resting-sites away from the breeding-colonies during post-breeding dispersal in July-September.

Feeding studies were conducted at three colonies, including recording of fish species, fish lengths and feeding frequencies at a number of study nests. Foraging birds from Bird Island and Cedar Beach were also studied at sea during two breeding-seasons.

RESULTS

This section summarizes results obtained by the author at Bird Island in 1980 or in 1987-1991, except where the results of multi-colony studies have been published or are ready for publication. These results illustrate the work carried out during the co-operative study, and will be amplified when all the results from the study are available.

Laying-dates and clutch-sizes

Table 1 summarizes the numbers of nests studied at Bird Island and the mean clutch-sizes in six-day periods during the season. Each nest is classified by the date of laying the first egg; second eggs are usually laid three days later than the first eggs. In each year, the laying pattern was skewed: there was a large "wave" of laying in the first 20-25 days of the season, followed by a long "tail" of late nesters until mid-July. In my sample of 712 nests studied in 1987-1990, the modal date of laying was 27 May and the median date was 30 May. Late nests were slightly oversampled in order to obtain samples large enough to analyze.

The fourth column of Table 1 shows the statistical significance of differences in mean clutch-sizes. There were no significant changes in mean clutch-size during the main wave of laying, but later pairs laid progressively smaller clutches. All clutches laid after 3 July contained one egg only.

Among Roseate Tern clutches at Bird Island, about 4% (27/712) contained three or four eggs. Table 1 shows that these clutches were usually laid in the later part of the main wave of laying. We plan a detailed study of these "super-normal" clutches in 1992.

Productivity

Nisbet et al. (1990) described methods used to estimate breeding productivity (number of fledglings raised per nesting attempt) of Roseate Terns at Bird Island and Cedar Beach. At Bird Island, we searched for chicks on alternate days, and weighed them whenever we could find them. No chicks were taken by predators, but chicks were difficult to find under the dense vegetation. The best estimate of productivity was obtained by counting as "fledglings" all chicks that reached the age of 5 days and were in good condition (i.e., with mass within the normal range) when last found. Using this method, productivity at Bird Island was estimated as 1.43 fledglings per nest in 1980, 1.05-1.26 fledglings per nest in 1987- 1989 (Nisbet *et al.* 1990), and 1.18-1.28 fledglings per nest in 1990-1991 (unpublished data).

Table 2 shows the dependence of productivity at Bird Island on the date of laying. There was a uniform and highly significant decline in productivity during the season. This decline was due almost entirely to a decline in the survival rate of the second chicks in the brood ("B-chicks"). Except in the latest nests, survival of the first chicks in the brood ("A-chicks") was uniformly high, averaging 97% (605/623). However, survival of the B-chicks was very variable, declining from high values early in the season (80% in good years, 40% in poor years) to zero after about 20 days (i.e., by the end of the main wave of nesting). This decline was already significant by the 7th day of the season - i.e., within the first third of the main wave of laying. I also found that egg-mass declined significantly by the 7th day of the season (Nisbet 1981a).

Age and breeding performance

I trapped 130 birds of known age on study-nests at Bird Island, either in 1980 or in 1987-1991. Most of these birds were 2-5 years old, because comparatively few chicks had been ringed before 1986. Table 3 summarizes data on the laying dates of these birds as a function of age. Among 67 birds trapped in 1987-1990, laying dates became progressively earlier with age until the age of 5 years, but older birds (6-16 years, N = 24) did not lay significantly earlier than those aged 4-5 years. In 1991, two-year-old birds laid significantly earlier than in 1987-1990, and in 1980, older birds (6-16 years old) laid much earlier than in 1987-1990.

Table 4 summarizes data on the clutch-sizes of 123 birds as a function of age. Within this sample, super-normal clutches (3 or 4 eggs) were attended only by relatively young birds (3-5 years old). Excluding these birds, mean clutch-size increased significantly from ages 2-3 to ages 4-5, but did not increase further and may have become lower among older birds. Among birds 6-16 years old, mean clutch-size was significantly higher in 1980 than in 1987-1990. Among three-year-old birds, clutch-size was significantly higher in 1991 than in 1987-1990. These results are still preliminary: the sample of known-aged birds is small and unbalanced, and more data are needed to clarify variations between years and between age-classes.

Table 5 shows productivity as a function of age. Although the sample size is small (33 broods with one parent of known age), the data show a marked and significant increase in productivity with age. Among birds aged 6-16 years, productivity was significantly higher in 1980 than in 1987-1990: eight of the nine birds aged 6-16 that were followed in 1980 raised two chicks to fledging.

The data in Tables 1-5 show that breeding performance of Roseate Terns varies with laying date, with age of parent bird, and among years. The sample of known-aged birds from Bird Island is still small, however, and it is difficult to separate the effects of these factors. Data from a larger sample of known-aged birds from Falkner Island will soon become available and will help to solve this problem.

Post-fledging survival

Table 6 shows preliminary results of studies of post-fledging survival as a function of date of hatching. Between 1986 and 1989, I ringed 3,576 Roseate Tern chicks at Bird Island. About one-third of these chicks (1,138) were ringed at hatching, so that the date of hatching was known exactly. The remaining 2,438 chicks were ringed at ages of 8-25 days, and their hatching dates were estimated using plumage/age criteria published by Nisbet and Drury (1972). Using the survival criteria published by Nisbet et al. (1990), I estimated that about 95% of the chicks that were ringed (i.e., about 3,400 chicks) survived to fledging.

In 1989-1991, I trapped 78 of these birds on nests at Bird Island. I identified 35 others by reading bands with a telescope, two more were killed by a Peregrine Falcon (*Falco peregrinus*), and two were trapped on nests at other colonies. Thus, 117 of the 3,400 birds ringed (3.4%) are known to have survived for the 2-4 years between fledging and first breeding. Table 6 classifies these 117 survivors according to the dates when they hatched in the year of hatching. For each year (1986-1989), I divided the study nests into four groups according to the date of hatching of the A-chick. In each year I separated "peak" nests (those laid in the first "wave" of laying in the first 20-24 days of the season) from "post-peak" nests (those laid after the main "wave"). Based on the dates of hatching of the A-chicks, I divided the peak nests in each year into three groups: "early peak", "mid-peak" and "late peak". The three groups were defined so that they contained approximately equal numbers of nests. Because more chicks are raised to fledging from early nests than from late nests (Table 3), there were more chicks in the "early peak" group than in the "mid-peak" or "late peak" groups (Table 6). For each of the four groups of nests, I combined the chicks from each of the four years. Because laying dates varied by up to 4 days between years, there is some overlap in calendar dates; for example, birds hatching on 21 June were "early

peak" in two years and "mid-peak" in the other two years. In other words, the variable examined is the date of hatching relative to the peak of hatching in the same year, not the calendar date.

The second line in Table 6 shows the number of birds from each of the four groups that are known to have survived to enter the breeding population 2-4 years later. The proportion of survivors decreased from 4.4% in the "early peak" group to 2.2% in the "late peak" group, a difference which is statistically significant ($P < 0.05$, X^2 -test). The proportion of survivors in the "mid-peak" group was intermediate (3.3%), but some of these birds may have been misclassified because estimates of hatching date are subject to errors up to +2 days (Nisbet and Drury 1972). The proportion of survivors in the "post-peak" group was small (2.1%), but the number of returns is too small for statistical comparisons.

The results in Table 6 suggest that chicks that hatch and fledge early in the season are more likely to survive and enter the breeding population than chicks that hatch and fledge late in the season. The early chicks survive better than the late chicks both before fledging (Table 2) and after fledging (Table 6). I plan to continue these studies and to obtain larger samples of survivors in 1992 and 1993. If I can obtain sufficiently large samples, it may be possible to analyze the dependence of survival on other factors, including age of parents and mass at fledging.

Growth rates

In 1987-1990, I measured growth rates of more than 700 Roseate Tern chicks at Bird Island. These chicks were weighed at hatching and on alternate days thereafter; about half the chicks were followed until they reached asymptotic weights (about 105 g). Including data from Falkner Island and Cedar Beach, growth data will be available for about 1,800 chicks. These data are being entered into a data base, but are not yet ready for analysis.

Adult weights

Roseate Terns readily use nest-boxes. In 1991, Dr. J.J. Hatch and I designed nest-boxes that could be used for automatic weighing of adult birds. After a pair had occupied a box and laid eggs, the floor of the box could be removed and replaced by a styrofoam tray on top of an electronic balance. Weights could be determined at a remote station using an electronic system modified from that designed by Monaghan et al. (1989). Although the system proved difficult to use, we obtained weights of adults from five breeding pairs at Bird Island. Figure 1 illustrates the results that we obtained by showing a decline in body weight during the incubation and chick-raising periods.

Demography

To date, demographic parameters have been estimated only for the population of Roseate Terns breeding at Falkner Island. Analysis of capture-recapture data yielded an estimate of 0.74-0.75 for the annual adult survival rate (Spendelov and Nichols 1989), and an estimate of 0.16-0.20 for survival from fledging to age 3 yr (Nichols et al. 1990, Spendelov 1991). This estimate of annual adult survival rate is extremely low for a seabird, and the parameter estimates are incompatible with the observed stability of the population at Falkner Island. The annual adult survival rate would be biased downwards if adults ringed at Falkner Island were emigrating to other colonies. One of the main purposes of the co-operative study was to mark and recapture Roseate Terns in all the major colonies, and hence to measure rates of movement between the colonies.

Between 1987 and 1990, about 2,780 adult Roseate Terns were ringed in the co-operative study, and almost 2,000 of these were given unique combinations of colour-rings. We have more than 800 retrappings of ringed birds, and more than 2,000 sightings of colour-ringed birds. The data are being analyzed using models of "meta-population" dynamics that include parameters for rates of movement between colonies (Nichols 1992, Brownie et al. 1992). Preliminary results available in April 1992 indicate that conditional movement probabilities (the probability that a bird breeding in colony i in year N and surviving to year $N + 1$ will be breeding in colony j in year $N + 1$) range up to 0.08, a surprisingly high value for a seabird. The same preliminary results suggest that the average annual adult survival rate is about 0.80, a surprisingly low value for a seabird. However, this estimate of survival rate is probably too low, because some of the colour-rings were lost within one year after ringing. New models are being developed which will take into account losses of rings. It is hoped that improved

estimates of survival rates will be available by October 1993. Nevertheless, the demographic data available to date (April 1992) suggest that North American Roseate Terns have unusually low annual survival rates. This may explain the endangered status of this population and has important implications for conservation.

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Table 1. Mean clutch-size of Roseate Terns at Bird Island, 1987-1990, as a function of date of nest initiation

Dates ¹	Number of clutches	Mean clutch-sizes ²	Clutches of 3/4 eggs
16-23 May	119	1.70 a	0
24-27 May	229	1.71 a	8
30 May- 4 June	146	1.65 a	14
5-10 June	66	1.66 a	4
11-16 June	56	1.40 b	1
17-22 June	27	1.48 b	0
23-28 June	26	1.08 cd	0
29 June-4 July	26	1.23 c	0
5-10 July	11	1.00 d	0
11-16 July	6	1.00 d	0

¹Clutches are classified by the date of laying the first egg

²Mean are for clutches of 1 or 2 eggs only; (mean clutch-size - 1) is the proportion of 2-egg clutches

a,d,c,d Means without a letter in common are significantly different (Duncan's multiple range test, P<0.05)

Table 2. Mean productivity of Roseate Terns at Bird Island, 1987-1990, as a function of date of nest initiation

Dates ¹	Number of broods followed ²	Mean productivity ³
16-23 May	117	1.38 a
24-27 May	220	1.24 b
30 May- 4 June	140	0.95 c
5-10 June	62	0.85 d
11-16 June	48	0.75 de
17-22 June	23	0.70 def
23-28 June	13	0.62 ef
29 June-4 July	11	0.27 f
5-10 July	8	0.37 f
11-16 July	4	0.25 f

¹Broods are classified by the date of laying the first egg

²Including nests in which no eggs hatched, but excluding nest from which chicks could not be followed for at least 5 days

³Productivity is the number of chicks raised to fledging (using criteria of Nisbet *et al.* 1990) per nest

a,b,c,d,e,f Means without a letter in common are significantly different (Ducan's Multiple range test, P<0.05)

Table 3. Laying dates of 130 Roseate Terns of known age at Bird Island, 1980 and 1987-1991.

Age (yr)	Mean laying-date ¹ ± s.e. (sample size)		
	1980	1987-1990	1991
2	-	67 ± 2.5 (N= 2)a	52 ± 2.9 (N= 4)*
3	-	52 ± 3.7 (N=27)a	47 ± 1.1 (N=26)
4-5	-	34 ± 0.83 (N=14)b	44 ± 1.4 (N=24)*
6-16	20 ± 0.75 (N=9)*	30 ± 1.1 (N=24)b	-

¹ 1 May = 1. For example, 67 ± 2.5 means 6 July ± 2.5 days

a,b, Means for 1987-1990 without a letter in common are significantly different (P<0.05, Duncan's multiple range test)

* Significantly different from mean for same ages in 1987-1990 (t-test or Mann-Whitney test, P<0.05)

Table 4. Clutch-size of 123 Roseate Terns of known age at Bird Island, 1980 and 1987-1991.

Age (yr)	Mean clutch-size (sample size) ¹			Clutches of 3/4 eggs
	1980	1987-1990	1991	
2	-	1.00 (N= 1)	1.00 (N= 4)	-
3	-	1.31 (N=26)#	1.64 (N=25)*	1
4-5	-	1.92 (N=12)	1.68 (N=22)	4
6-16	2.00 (N=9)*	1.63 (N=19)	-	-

¹ Means are for clutches of 1 or 2 eggs only; (mean clutch-size - 1) is the proportion of 2-egg clutches

Significantly different from older birds in 1987-1990 (test, P<0.05). Means for 4-5 and 6-16 yr groups were not significantly different (X² test, P= 0.08)

* Significantly different from birds of the same ages in 1987-1990 (X²-test or Fisher exact test, P<0.05).

Table 5. Productivity of 33 Roseate Terns of known age at Bird Island, 1980 and 1987-1991.

Age (yr)	Mean productivity (sample size)	
	1980	1987-1990
2	-	0.00 (N=1)
3	-	0.50 (N=6)
4-5	-	0.86 (N=7)
6-16	1.89 (N=9)*	1.30 (N=10)

* Significantly different from birds of the same ages in 1987-1990 (X²-test or Fisher exact test, P< 0.05).

Table 6. Roseate Terns banded as chicks at Bird Island, 1986-1989, and numbers found breeding, 1989-1991, classified by period of hatching.

	Period of Hatching ¹			
	Early Peak	Mid-Peak	Late Peak	Post-Peak
Chicks ringed, 1986-1989	1,280	1,006	857	433
Returns (found breeding, 1989-1991)	56	33	19	9
Percent returns	4.4%	3.3%	2.2%	2.1%
Statistical significance ²	a	ab	b	ab

¹See text for definitions of the four periods during the season

²Columns without a letter in common are significantly different (X^2 -tests, $P < 0.05$)

Congrès international à l'Eveil pour sauver la Sterne de Dougall

Durant 48 heures, le centre de l'« Eveil » a accueilli dans ses installations un congrès international consacré à la Sterne de Dougall, un oiseau marin régisseur très menacé.

Durant ces 48 heures, les participants venus de huit nations (Grande-Bretagne—pays de Galle et Angleterre—, Irlande, Açores—Portugal, Ghana, Seychelles, U.S.A., Sénégal et France) n'ont pas chômé.

Les communications, égrenées au nom de projections, se sont succédées à un rythme rapide.

Après les présentations d'usage, et un exposé sur les Sternes de Bretagne, les débats ont été axés autour de trois thèmes principaux : les principales colonies du monde, la biologie de l'espèce, et les projets en cours dans le domaine du suivi et de la gestion.

Seuls moments de détente : le temps des Teas, le soirée musicale de samedi et la visite au barreau de la réserve de la baie de Morlaix hier après-midi.

Celle-ci aurait dû se terminer à Carantec. Le mauvais temps a obligé les congressistes à célébrer à Roscoff.



Des représentants de huit nations participent à ce congrès qui s'est déroulé dans les locaux de l'Eveil, à Carantec.

Sterne de Dougall Péril au sein des colonies

Autrefois, la Sterne était l'oiseau régisseur marin le plus répandu sur les côtes de Bretagne. « Aujourd'hui, elle est devenue rare. A tel point que l'une de ses variantes, la Sterne de Dougall fait l'objet d'un programme européen de protection.

Huit nations à Carantec

Quarante personnes représentant huit nations (Grande-Bretagne, Irlande, U.S.A., Seychelles, Açores—Portugal, Ghana, Sénégal et France) ont passé le week-end à Carantec d'une politique commune en faveur de cette Sterne de Dougall.

La chose du lieu n'est pas le fait du hasard. La seule colonie de Sternes de Dougall connue en France réside sur une des îles de la baie de Morlaix, l'île aux Dames. Cette colonie est fragile. Evalée l'an passé, à cent couples, elle a été victime d'un prédateur qui a fait cinquante victimes. Elle se limite cette année à 40 voire 50 couples.

Ce congrès organisé par la S.E.P.N.B. à la demande de la R.S.P.S. (Royal Society Protection



La Sterne de Dougall était, autrefois, l'oiseau marin le plus répandu en Bretagne.

of Birds), qui coordonne le programme européen, a permis de faire le point sur ce dossier et sur l'avancement des travaux réalisés au cours des trois dernières années.

Des moyens très divers

Mais, les moyens ont été très divers. Les anglo-saxons avaient délégué des scientifiques. Les Africains, des

fonctionnaires de ministères... Les Français, essentiellement des bénévoles (gardiens, conservateurs de réserves, représentants de la S.E.P.N.B.). Le ministère de l'Environnement, invité, s'était fait écouter.

Les participants se sont efforcés de cerner les raisons de cette sous-développement : changements humains durant les siècles, présence de prédateurs sur les îles, pollution des golfands, réduction des petites nourrices marines...

Chaque pays a porté de ses expériences en suivi scientifique et biologique, en matière d'aide à la reproduction, ou encore en réglementation...

Malgré les différences de moyens entre les nations, tous les participants ont convenu qu'il devient nécessaire d'unifier les méthodes de suivi et de protection de la Sterne de Dougall.

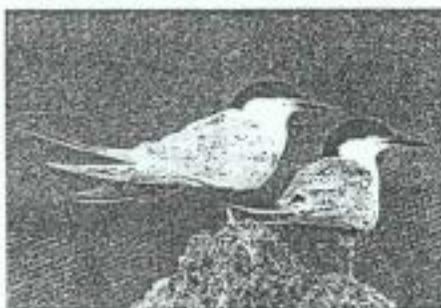
Si l'on en croit les intervenants, il y a péril au sein des colonies de ce bel oiseau. La Sterne de Dougall est devenue l'oiseau marin le plus rare et le plus menacé du monde...

René LE CLECH

6 Informations générales

C'est l'oiseau marin le plus menacé d'Europe SOS pour la sterne de Dougall

L'élégante sterne de Dougall était au siècle dernier l'oiseau marin le plus commun des côtes de l'Ouest. C'est aujourd'hui l'espèce la plus rare d'Europe, et ne survit plus qu'une dizaine de colonies de reproduction. La France en préserve une en baie de Morlaix.



Société pour l'étude et la protection de la nature en Bretagne

La sterne de Dougall, autrefois l'oiseau marin le plus commun sur les côtes de l'Ouest, aujourd'hui le plus rare en Europe.

MORLAIX — « Les témoignages des naturalistes laissent penser que la sterne de Dougall était au siècle dernier l'oiseau emblématique des côtes bretonnes. Le plus commun, il n'y avait alors ni irlandais, ni hollandais, qui ne sont apparus que dans les années vingt... témoigne Guillaume Rolland, responsable du réseau de réserves biologiques de la Société pour l'étude et la protection de la nature en Bretagne (S.E.P.N.B.).

« Aujourd'hui, la sterne de Dougall est l'oiseau marin le plus rare en Europe et l'un des cinq les plus menacés de disparition au monde... »

D'Irlande au Ghana

Légers comme le vent, bête comme une mure, la plus grande des inondations de mer est aussi la plus tragique. De toutes, c'est celle qui a le moins supporté le développement des activités de loisir. Celle qui a le plus souffert de la forte expansion des hollandais, véritables héros des îles côtières.

Pas à pas, la sterne s'est éteinte : seulement 1 818 couples reproducteurs l'an dernier en Europe, répartis entre l'Irlande, la Grande-Bretagne, le Bretagne et les Açores ; 3 000 aux USA.

Malgré cela, la sterne de Dougall passe la mauvaise saison sur les côtes ghanaises et sénégalaises. L'unique colonie française survit sur l'île-aux-Dames en baie de Morlaix. Elle avait disparu dans les années 1970. Mais un impressionnant effort de protection a été mené par deux bénévoles de la SEPNE : surveillance des plantations, limitation des golfands, et aménagements réalisés au sol.

Réserve : en 1983, la sterne de Dougall était de retour. En 1990 et 1991, cent nids ont été trouvés à l'abri d'armilles plastiques, de petits cônes de granito assemblés pour la cause : un besoin de protection deviné par Evén de Kergeriou, conservateur de la réserve (1).

En ce début mai, l'ornithologue scrutait le ciel avec inquiétude. L'an passé 47 adultes ont été victimes d'un furet et d'un vison, mystérieusement abattus sur l'île. Aujourd'hui, il ne sait pas si les Dougall vont revenir. En 1991, une colonie de 1 270 couples a disparu aux

Seychelles : les activités touristiques l'avaient dérangée l'année précédente.

Tierry CREUX

(1) La réserve compte encore un millier de sterne adulte et présumé et quelques milliers de nids, récemment.

Patrick Legrand, et ses collègues de recherche à l'Institut national de recherche agronomique, à 800 km président de la Mission France-Mars Environnement lors de la réunion du conseil d'administration qui a suivi son 2^e congrès à Nantes.

Sous l'aile de l'Europe

Depuis quatre ans, la Communauté européenne participe financièrement à la protection de la sterne de Dougall. Sous la direction de la Royal Society of Protection of Birds (R.S.P.B., anglaise), les spécialistes des sept pays qui hébergent l'oiseau mettent au point un programme commun de protection. Ils étaient là avril en baie de Morlaix pour faire le point et harmoniser leurs méthodes : professionnels anglais, irlandais, écossais, américains, sénégalais, ghanais, et bénévoles bretons. En 1991, la SEPNE a bénéficié de 100 000 F (R.S.P.B. et ministère de l'Environnement) pour la surveillance et la gestion de la réserve monastérienne.

Le Télégramme

26.04.92

Ouest-France 12.05.92

