

TCOT Advice Note 1:

Monitoring of Marine Turtle Nesting Populations

NB TCOT advice notes will be updated periodically. Please contact us if you have any comments/queries or you would like to receive the most up-to-date version:

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Nesting beach monitoring is one of the important components of an integrated approach to assessing marine turtle population status. One of the TCOT aims is to have at least two index nesting sites subject to comprehensive monitoring in each OT by the end of the project. It should be noted that as an outcome of recent Caribbean Range State Dialogue Meetings, discussions have been undertaken towards the development of monitoring protocols for index nesting beaches for hawksbill turtles in the wider Caribbean. Where possible, we seek to harmonise our advice with the outcomes of this process

Many useful reviews of relevant methodologies are included in Eckert *et al.* (1999). **Anyone who does not have a copy of this key publication should contact the TCOT team and we will endeavour to make sure a copy reaches you.**

Should we monitor by night or day?

Although at first, it might seem that the ideal plan for nesting beach monitoring would be to patrol the beach by night in an attempt to observe each turtle, one should think very carefully before embarking on such work, weighing up the relative advantages and disadvantages:

Advantages:

- 1) Confirms species identification
- 2) Allows identification of individual females and estimation of parameters such as:
 - Clutch frequency
 - Remigration intervals
 - Inter-nesting intervals
 - Nest-site fidelity
- 3) Allows sampling for:
 - Genetics
 - Epibionts
 - Morphometrics
- 4) Allows accurate marking of nests
- 5) Allows for a definitive assessment of whether a clutch has actually been laid.
- 6) Allows prompt nest relocation in the cool of the night.
- 7) May reduce predation/poaching threats & identify light problems.
- 8) Can be important in raising public awareness and funds.

Disadvantages:

- 1) It is very time and labour intensive.
- 2) It involved work during unsociable hours.

Although these are the only real disadvantages, they are major ones! Nesting seasons can last for many months. To carry out rigorous night-time monitoring one really needs to be out all night, every night and if beaches are long and/or turtles are few, motivation is quickly lost by even the keenest staff and volunteers. In addition, most experienced turtle researchers will tell you that daytime surveys will still be needed to ensure that all data were collected and collated. Thus, daytime surveys are

the keystone of all nesting beach monitoring operations. However, should you carry out night-time surveys, it is important to structure your data collection for best effect. We include a specimen Night-Time Nesting Data Sheet on the TCOT workshop CD that you are free to modify and use. TCOT personnel can run through using these datasheets during subsequent field visits.

For the purposes of TCOT, the status of nesting populations should be assessed using daytime surveys, at least in the first few seasons. This allows us to take advantage of the main benefits of daytime monitoring, i.e. there is much less work involved than in night-time monitoring, the work can be undertaken more intermittently and large stretches of beach can be comprehensively surveyed by a few personnel. Nocturnal monitoring of key, high density nesting beaches can be carried out in future, should resources be available. There are, however, great benefits to be gained from occasional night patrols *in addition* to a daytime assessment of nest numbers. Occasional night patrols, preferably at the peak of the nesting season on the beaches with the highest density of nesting will help provide workers/volunteers with enthusiasm and knowledge of the nesting process which improves track identification/interpretation capabilities.

This advice note includes an overview of daytime monitoring and a basic assessment of nest success. Given that many of the nesting turtle populations in the UK Overseas Territories in the Caribbean are likely to be small, (relative, for example, to the nesting populations in Costa Rica or Mexico), it is extremely useful to assess the success of at least a portion of nests to ensure fertility and evaluate hatching success. Additional benefits include obtaining genetics samples as well as confirming species ID.

Monitoring By Daytime Surveys

The underlying basis of daytime monitoring is that turtles leave tracks in the sand when they emerge to nest. These tracks can help us assess the species and whether or not egg-laying occurred. The basic principles of species and track identification are detailed in the Powerpoint presentation '*Marine Turtle Biology and TCOT Methodology*' on the TCOT workshop CD and in the Florida Fish and Wildlife Conservation Commission (FFWCC) video, "*A Beachcomber's Guide to Turtle Tracks*" (provided at the TCOT workshop with permission from FFWCC).

It is vitally important to record data clearly, even during surveys when no nesting activity is recorded. We recommend that field data is recorded on at least two forms of backup datasheets/databooks. Many useful data have been lost over the years as a result of poor backup protocols. We include a specimen Daytime Nesting Data Sheet on the TCOT workshop CD that you are free to modify and use. Additional models are included in Schroeder and Murphy (1999). TCOT personnel can run through customising/using these datasheets during subsequent field visits.

Why undertake daytime monitoring?

The basic information which can be gathered includes: which species are nesting, how many nesting activities there are, the proportion of activities which result in egg laying, nest location, nesting season, nesting success and threats. Threats include categories such as nest depredation, inundation, adult female harvest. All of these allow the assessment of the nesting population status and help define priority areas and times for monitoring and protection.

How do I set up my monitoring operation?

There are a number of key criteria that need be considered. These include:

- **Method of transport**
- **Geographical scope of monitoring operation**
- **Location and accessibility of monitored beaches**
- **Frequency of survey**
- **When in the year to survey**
- **Timing of survey on monitoring days**
- **What to record**

We look at each of these in turn and provide additional tips from experience that will help you set up monitoring efforts that yield data of the best possible quality.

Method of transport

Daytime surveys can be conducted by aerial, vehicle based and foot survey. Aerial surveys are expensive, need ground truthing and in small island situations, as experienced by many TCOT partners, probably only have utility in the location of previously undocumented nesting areas e.g. on remote cays. Obviously, land vehicles or boats will be needed to move between monitoring areas and field teams usually evolve efficient methods of making best use of vehicles with multiple drop-off and pick up points. In some parts of the world the actual survey effort is undertaken on vehicles e.g. motor bike, quad bike, 4 wheel drive vehicle. This necessitates capital investment and can lead to prohibitively high maintenance costs. In addition, the environmental impacts of using vehicles on nesting beaches should be considered (e.g. beach impaction, dune degradation and encouragement of others to use vehicles on the beach by example). It is hard to imagine that vehicle-based surveys will be of great utility within TCOT as most beaches are relatively short. Surveying on foot may be hard work but it is the most reliable and is likely to be method of choice in most cases.

Geographical scope of monitoring operation

Various levels of monitoring may be appropriate for TCOT data collection. Any of the following strategies, or some combination, may be used:

- 1) Monitor all the beaches throughout the coastline
- 2) Monitor the main nesting beaches only
- 3) Monitor a few selected key index sites

It is unlikely that all nesting beaches in each OT will be surveyed for TCOT. We are confident that enough is known about turtle nesting in each OT to allow the identification of several index sites, that can be monitored from 2003 onwards so that all nesting is recorded on those sites. However, it may be that other important sites and/or diffuse nesting are found elsewhere, that can be included in further, less intensive surveys. Such surveys will highlight other areas of conservation concern and may highlight other suitable index sites. It should be noted that an index site can be made up of several smaller coves or cays in the same location.

Location and accessibility of monitored beaches

Accessibility is an important component to be considered in any monitoring effort. It may be that very remote beaches, although very good for nesting are monitored less intensively. However, one over-riding principle is important regardless of the monitoring regime undertake. It is vitally important to meticulously detail the boundaries of all study sites so that fair comparisons are possible with data collected in the future. As well as defining the boundaries of the index site, careful mapping of the site and the nest locations will yield important management data. GPS has utility in this

regard but orientation to immovable markers is more valuable as it facilitates the relocation of nests at a later date (e.g. for excavation after emergence to assess nest success). On beaches with few permanent markers, manmade markers e.g. PVC pipe can be driven into the sand at regular intervals.

Frequency of surveys

Ultimately the more often the better, but monitoring can be undertaken according to either of three main strategies:

- 1) **Daily monitoring** results in less confusion, error and records all activities but is relatively expensive in time and effort.
- 2) **Monitoring every 2-3 days** records most if not all activities, but erosion of tracks due to weather and beach use may lead to some confusion. This is most suitable for low density nesting sites and is economical with respect to human and vehicular resources.
- 3) **Regular and sporadic monitoring** of major nesting beaches (e.g. every 7-21 days) for two consecutive days in each survey bout. This will allow recording of all nesting activities that occur during the two-day period. Although only a small proportion of activities is actually recorded, the pronounced seasonal distribution of nesting allows missing data to be interpolated. This is the technique used at high-density nesting beaches (e.g. Ascension Island in Godley *et al.* 2001) and is very economical with respect to manpower resources. It is, however, unlikely to be of great utility within TCOT for index nesting sites. One role for this survey technique would be in the assessment of the relative importance of the nesting levels and seasonality at inaccessible sites proposed as for more detailed work in the future (e.g. a remote cay known for high levels of nesting activity).

Your choice is very dependent on the density of nesting and the duration of the nesting season and the resources available to you. For the purposes of TCOT, we anticipate that monitoring frequencies of between every 1-3 days will provide the optimum efficiency and coverage.

When in the year to survey

It is important, wherever possible to ensure that your survey efforts encompass the whole nesting season and to remember that each Territory hosts nesting populations of different species that have different nesting seasons. In the initial 2 years of beach monitoring we would suggest the following:

Index beaches

- 6 weeks prior to expected commencement of the nesting season, index beaches should be monitored **once per week**.
- Commencing on the date of the first recorded nesting activity of the season on the index nesting beaches (or through opportunistic reports from other beaches), **full scale monitoring** begins. Survey effort is kept constant until 7-10 days have elapsed of no activity.
- After 7-10 days of no activity monitoring continues occasionally about **once per week** for an additional 4 weeks.

Extensive monitoring

- Monitoring begins at the same time as that on index beaches.
- Survey effort kept constant until cessation of main efforts on index beaches.
- Surveying can be less often than that of index nesting sites but when the survey interval exceeds 3 days, the quality of information is likely to decline.

It is advisable to stratify efforts so that the more important areas receive higher effort and areas thought to be of minimal importance are only monitored occasionally to ensure that no important pockets of nesting are being missed. An example of a possible schedule:

- Index nesting sites monitored every 1-2 days
- Beaches of moderate importance are monitored every 2-3 days
- Beaches thought to be of minor importance are monitored every 3-4 days in the first season. These can either be promoted to the status of moderately important beaches or considered of minimal importance and either discarded from the monitoring schedule or subject to occasional monitoring to ensure that they are not being used for nesting.

Timing of surveys on monitoring days

Undoubtedly, the earlier in the day the survey is undertaken the better. Dawn is without doubt the best time to survey. The tracks are fresher at dawn and are clearer, due to the angle of sunlight creating strong shadows that provide more contrast and allow a more accurate assessment of nesting activity and species ID. In addition, the ambient temperature is more comfortable to work in, particularly work which involves walking any distance along beaches.

What to record

The key information being recorded in all daytime surveys is:

For each survey:

- Location
- Date
- Notes on threats

For each track

- Species
- Type of activity (nest, false crawl)
- Position to known markers

Tips to help improve quality of data

Recording data. Before you collect any data, reflect on why you are recording the information and how it will be analysed. Remember, the information you write down on the beach will ultimately be used in analyses and possibly for management decisions. Therefore, be as accurate and clear as possible. If your data sheet has boxes or columns that are to be filled in, remember never to leave any blank. If you did not find anything on your survey or there was no information to report, remember to put a "n/a" in the space. This will help you or someone else in the future interpret the datasheet.

Consistency. One of the objectives of nesting beach surveys is to look for trends in the nesting population. Analyses and interpretation of data from nesting beaches are greatly facilitated by consistent monitoring efforts. It is important to choose your survey protocols carefully and to stick to them, both across the nesting season and across years. Otherwise, it becomes difficult to fully use the data collected

Night work: If you plan to monitor nesting beaches by day it is still important to watch turtles nesting at night in order to understand the nesting process. Regular observation of nesting behaviour will provide the researcher with more accurate interpretation skills when deciphering the tracks and indentations left by the turtle in the sand when undertaking daytime surveys.

Adequate Training: It is important that all personnel receive adequate training and mentorship. It is preferable that all individuals have seen all key species nesting and that a period of working in tandem with an experienced fieldworker is undertaken before data recorders are left to undertake monitoring on their own.

Raking of Tracks: To avoid confusion and double counting it is highly recommended that all tracks are raked over and disguised after recording. A suitable, light-weight rake is an essential element of the monitor's beach surveillance equipment. NB: Researchers in the Cayman Islands rake tracks with the back of the rake because egg collectors (illegal in Cayman) recognise the patterns left by the prongs and use them to locate and excavate a nest!

Clutch finding: Even the most experienced beach monitors cannot tell whether or not a turtle has successfully laid a clutch from tracks in every case. If in doubt, attempts can be made at locating a clutch by clearing away some of the surface sand from the nesting site and probing the sand column for eggs. While this can be accomplished using a stick, inexperienced use can result in the top layer of eggs being punctured. Careful digging with the hands and probing with an extended index finger to feel for soft, recently excavated sand and eggs is less likely to result in egg damage. Unless the eggs are located, it is not possible to say with 100% certainty that a suspected nest contains eggs, especially on beaches with stones or debris in

the sand column. In such cases of uncertainty it is best to err on the side of caution and record the nesting attempt as unsuccessful. This verdict may be reversed if a clutch subsequently hatches or is predated at that site.

Assessing the success of turtle nests

Why monitor the nests?

There are a number of reasons why it is important to monitor and assess the fate of at least a portion of nests (see Miller 1999):

1. To confirm species ID
2. To obtain genetic samples
3. To assess fertility and hatching success
4. To assess the likely level of recruitment from the beach
5. To assess threats such as predation, poaching, inundation etc
6. To identify “good” and “bad” sites
7. To evaluate and amend conservation measures

In some projects the fate of almost every nest is attained by detailed marking of nests with an internal “nest tag”, external markers, and mapping of their locations in relation to visible beach markers, planted at equal distances along the back of the beach. The use of these types of markers may not always be possible for TCOT research as a result of manpower constraints or the potential of signalling nest location to potential poachers. However, some form of nest location should be recorded and existing land marks along the back of the beach, such as rocks, buildings, trees and other sturdy and permanent vegetation can be used to relocate nests, as long as the position of the nest was accurately recorded in relation to these landmarks when it was first recorded. This method can be discussed with TCOT personnel during subsequent field visits.

It is important to record data clearly. We include a specimen Fate of Nests Sheet on the TCOT workshop CD that you are free to modify and use. TCOT personnel can run through customising and using these sheets during field visits.

How to Excavate hatched nests

With a full excavation of nest contents it is possible to estimate the clutch size and hatching success of the nest. See Miller (1999) for details. Where possible nest excavation should be carried out after 48 h has elapsed since the last hatchling emergence or after 70 days of incubation. Always wear gloves and adhere to strict hygiene standards when excavating nests. Decaying turtle tissue is extremely smelly and may contain pathogens harmful to humans. Once you have put on some rubber gloves, dig down directly above the slight depression in the sand from where the hatchling tracks emerge. Take care as there may be live hatchlings in sand column.

Remove any live hatchlings to a bucket for closer examination and species ID. Dead hatchlings and embryos should be kept for genetic sampling. If live hatchlings are found at night then they should be released immediately to facilitate maximum chances of survival. However, if the excavation is carried out during daylight,, the hatchlings should be retained in an escape proof container (e.g. a bucket) containing some moist sand, which should be placed in a cool, dark and secure building until night fall, when they should be released, preferably on the beach from which they were collected. Daytime release will increase the chances of hatchlings being predated by diurnal fish and birds (e.g. frigate birds). It is important to vary the location of hatchling release sites along a beach so as not to encourage predator build up at certain areas. After excavation and data collection, return all leftover eggshells and other nest contents to the nest cavity and cover with sand. This material provides nutrients and energy for the beach ecosystem. If you are unsure about this methodology, refer to Miller (1999)

and ask TCOT personnel to demonstrate a nest excavation during subsequent field visits.

References

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