

CENTRE FOR EVIDENCE-BASED CONSERVATION

SYSTEMATIC REVIEW No. 53

**DOES THE TRANSLOCATION OF CARIBBEAN MARINE TURTLE
NESTS TO HATCHERIES IMPROVE THEIR HATCHING SUCCESS?**

REVIEW PROTOCOL

Lead Reviewer: *Hedely Guada, Joaquín Buitrago*
Assistant reviewer(s): *Joaquín Buitrago*
Postal Address: *CICTMAR, Apdo. 50.789, Caracas 1050-A, Venezuela.*
E-mail Address: *hjuada@cantv.net, jbuitrago@edimar.org*
Telephone: *0058-212-7616355*
Fax: *0058-212-7616355*

COVER SHEET

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Contact address	<i>CICTMAR, Apdo. 50.789, Caracas 1050-A, Venezuela, hjuada@cantv.net, jbuitrago@edimar.org</i>
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1. BACKGROUND

The marine turtles of the Caribbean have a cultural, ecological and economic value. The indigenous communities like the settlers benefited themselves from marine turtles and the products of the latter. The effects of historical captures and of the different impacts on marine turtle populations have led to most populations experiencing drastic decreases or being in the process of doing so (Eckert & Abreu-Grobois 2001).

The six marine turtle species present in the Wider Caribbean Basin are catalogued under different threat categories of the IUCN (www.iucnredlist.org), CITES, SPAW protocol and others. This is due to the capturing of females in nesting beaches, nest poaching, illegal trade as well as to incidental factors.

In order to revise, evaluate and question whether the present national and international regimes are sufficient to stabilise population, one must consider that to be able to manage Caribbean marine turtles regionally, the countries of the region must enforce a regime of information gathering and monitoring in a consistent and comparable manner between local populations.

One of the management strategies whose objective is to increase the number of released hatchlings is the use of hatcheries. Ideally marine turtle eggs must be incubated in their natural nests. The decision of whether to move the nest to protected areas as are “hatcheries”, must only be considered as a last resort when *in situ* protection is impossible (Mortimer 2000)

In most of the nesting beaches, translocation programs have only been considered to be positive for those nests located in beaches which are prone to dangerous situations- for example those nests that are found close to the high tide water level mark, in sites with erosion, heavy pedestrian traffic and vehicle paths. In many areas of the world, egg predation by humans and human associated animals (dogs, pigs, rats, etc.) is so intense that the mortality can reach 100%, if nests are not moved to protected hatcheries (Mortimer 2000). However, in other beaches the probability of nest poaching varies according to the number of factors which are not assessed or controlled.

Area selection by the female for nest construction has been considered (Runemark 2006) to be influenced both by the selective forces that encourage the nest location to be further away from the coast, and the selective forces in conflict that favour those locations which are closer to the sea (Bjorndal & Bolten 1992, Godfrey & Barreto 1994, Kamel & Mrosovsky 2004).

The decision to whether or not move a nest or not is determined by the taking into account of both natural and anthropogenic risks. All this is needed to determine how useful nest relocations to hatcheries and other beach areas are.

Moreover, programs involving hatcheries have other risks and serious limitations that can produce a considerably negative impact on marine turtle populations. Namely, same sex of all hatchlings in a season, possible modification of population genetic base by saving doomed eggs, among others. Consequently there must exist an evaluation of management techniques (Restrepo et al., 2005), site availability for hatcheries, the proportion of eggs to be collected and transported to the hatcheries, staff that is available and trained to watch over the facilities and sufficient financial resources for the maintenance of the latter (Mortimer 2000). Hatcheries are expensive and their usefulness for marine turtles conservation has not been proved. The general opinion among marine turtle conservationist is that final goal are that: A) Present day and previous nesting beaches are kept in as natural an state as possible. B) Marine turtles nest undisturbed in the beaches selected by them. C) Clutches hatch and newborns go to the sea in a natural way, with as little as possible human interference.

However this goal vision is not possible in many places of the Caribbean, so it is necessary to find out if the results documented to date, prove a benefit to sea turtles from nest translocation. Or in the other hand if it is only an expensive way to contribute to the diminishing of their populations and money may be better employed in education or other conservation purposes. The purpose of this review is to evaluate the results of projects carried out in the Caribbean region that assess the effects of nest translocations to hatcheries.

2. OBJECTIVE OF THE REVIEW

Primary question

Is the management of relocated marine turtle nests in hatcheries improving the hatching success compared to *in situ* nests in the Caribbean?

Secondary question

What factors (management, environmental or others) affect the effectiveness of nest translocation to hatcheries, in terms of hatching rate?

3. METHODS

Search strategy

The following searches will be performed:

Generalist sources

- 1) Science Citation Index
- 2) Scielo
- 3) ISI Web of Science
- 4) Blackwell Publishing Journals
- 5) Science Direct
- 6) Google Scholar

BIO ONE 1 y 2

JSTOR

Inter Research Science Center (IR)

Specialist sources

- 1) Marine Turtle Specialist Group website
- 2) Proceedings Symposium on Sea Turtle Biology and Conservation (8th-28th)
- 3) Marine Turtle Newsletter # 1-120
- 4) Sea Turtle Online Bibliography (ACCSTR, University of Florida)
- 5) Herpetological Contents

Some of the main publications to be consulted are the following:

- Journal of Herpetology
- Biological Conservation
- Conservation Biology
- Endangered Species Research
- Caribbean Journal of Science
- Herpetologica
- Herpetological Review
- Revista de Biología Tropical
- Memorias de la Sociedad de Ciencias Naturales La Salle
- Copeia
- Chelonia Conservation and Biology
- The Journal of Animal Ecology
- Functional Ecology
- Science, New Series
- Ecology
- Ecological Applications
- Wildlife Society Bulletin
- American Zoologist
- Actual Biology
- Biology Education Centre and Department of Animal Ecology, Uppsala University
- Animal Behaviour
- Evolutionary Ecology Research
- Journal of Wildlife Management
- Israel Journal of Zoology
- Marine Biology

The search in online magazines and data bases will be based on the terms (in English and Spanish) listed in Table 1 in the following manner:

1. The title, abstract contains at least one of the terms describing the intervention (keywords below marked with an *).
2. The Keywords or Topic includes one of the terms listed in table 1
3. The word “Sea turtle” will be systematically combined with 1

We will additionally include new keywords from the bibliographical search.

Table 1. Terms in English and Spanish

<i>Terms in English</i>	<i>Terms in Spanish</i>
*Nest protection	*Protección de nidadas
*Nest conservation	*Conservación de nidadas
*Nest management	*Manejo de nidadas
*Nest relocation	*Transplante de nidadas
*Hatcheries	*Corrales o viveros
*Nest relocation	*Relocalización de nidadas
Emergence success	Éxito de emergencia
Hatching success	Éxito de eclosión
Hatching success of translocated nests	Éxito de eclosión de nidos transplantados
Hatching success of relocated nests	Éxito de eclosión de nidos relocalizados
Hatching success of in situ vs. relocated nests	Éxito de eclosión de nidos in situ vs. re-localizados
Factors affecting incubation at hatcheries	Factores que afectan la incubación en viveros
Hatchery management	Manejo de viveros
Human factors affecting nest management	Factores humanos que afectan el manejo de viveros
Environmental factors affecting nest management	Factores ambientales que afectan el manejo de viveros
*Marine turtle	*Tortuga marina

We will examine the first 100 abstracts, PDF or word documents generated by the search engines. The references of word or PDF documents will be revised to get further information on the primary question of this review.

Researcher and institution consultation

Copies of monographs, technical reports, theses, articles, books and published notes dealing with nest management in nesting beaches in the Caribbean will be requested from governmental organisations, NGOs and/or universities.

A data base will be created encompassing details of the institutions and researchers that have worked on the topic of nest management in the Caribbean.

We will also consult regional experts in the field to clarify any doubts and obtain additional information via email or Skype.

A recent data base (January to February 2007) on nest relocation opinion, with the answers of 27 members of the MTSG List-SSC (Species Survival Commission) IUCN (both authors are members). Will be used as a consultation source.

Study inclusion criteria

Relevant subject(s):

Marine turtles that nest in the wider Caribbean (*Dermochelys coriacea*, *Chelonia mydas*, *Eretmochelys imbricate*, *Lepidochelys kempii*, *Lepidochelys olivacea*).

Types of intervention:

Management of nests relocated to hatcheries.

Types of comparator:

Hatching probability of unmanaged nests before carrying out any type of nest management, and hatching probability of relocated nests in beaches or hatcheries.

Types of outcome:

1. Hatching success (*in situ* vs relocated nests)
2. Emergence success (*in situ* vs. relocated nests)
3. Recruitment (*in situ* vs. relocated nests)

Types of studies:

Considering that part of the bibliography coming from the Caribbean is grey literature, exclusion criteria for this information will not be established and all of the latter will be used.

Potential reasons for heterogeneity:

The data may present some heterogeneity for numerous reasons. This variability may be due to:

1. Differences between projects: protocols used, training of field staff, intensity of supervision, etc.
2. Differences between seasons: For the same project in the same location the results can vary between seasons for the same reasons that have been previously mentioned. On top of this there may be environmental factors as could be the metocean

conditions (climate, storms, etc.), biological conditions (turtle physiology that will probably vary according to the different feeding areas) and by sociological events as could be contingent physical damage to the hatcheries by humans, animals, etc.

3. Between different locations in the same field season.
4. There may be some variations between locations and seasons due to the both intrinsic abiotic (type of sand, humidity etc.) and biotic (natural predators, roots of vegetation, etc.) conditions of the beaches.
5. Between species: The six marine turtle species that nest in the basin of the wider Caribbean have very different breeding characteristics both in terms of fertility and nest site selection choice. Therefore, the requisites for the successful relocation of nests are different.
6. Factors that affect the development of projects that involve nest management.

Table. 2. Components to be included in the systematic review

<i>Relevant subject</i>	<i>Intervention</i>	<i>Comparator</i>	<i>Outcome</i>
Marine turtles that nest in the wider Caribbean (6 species)	Nest management in nesting beaches	Hatching percentages of <i>in situ</i> nests before carrying out any type of hatchery management Hatching probability in unmanaged nests vs. managed nests (relocated in beaches and relocated to hatcheries)	1. Increase or maintenance of hatching probability in hatchery nests compared with <i>in situ</i> nests 2. Factors that affect project development that encompass nest management

Study quality assessment

Each of the studies will be evaluated according to how robust the data is. Information such as sample number, rigidity of the treatments, absence of biases, etc. will be considered.

With the objective of filtering the most relevant studies, we will use the following inclusion criteria in three phases:

1. Title and keywords: Those studies whose titles are ‘obviously not’ relevant to the review will be excluded.
2. Abstract: all abstracts will be studied and only the most relevant to the review’s objective will be considered
3. Entire manuscript: the most relevant studies will be read over and reviewed to determine which are most adequate for data extraction

In each of the selection phases, a second reviewer will assess a sample of 25% of the studies to verify whether the previously mentioned criteria are clearly defined and whether they have been correctly used to include or exclude studies from the review. The results will be contrasted using a Kappa analysis, in which the criteria will be considered adequate and replicable if the result of the analysis is equal or greater than 0.6. If the values of the Kappa

Analysis are smaller/lower than 0.6, the criteria will be readjusted and the studies will be once again assessed.

Moreover, if low quality data is to be included in the review, we will carry out a sensibility analysis.

The quantitative studies will be evaluated to determine the quality of the methodology of the studies considering possible experimental biases associated with the scale of analyses, autocorrelation, pseudo-replication, detectable biases, omission biases and possible post-experimental biases as well as sample size. Moreover, we will consider the profession and formal background of the person in charge of the design and development of the initiative (if this information is available in the reference), and the duration of the initiative. For each possible source of bias, we will establish a code with the appropriate indicator variables to categorise the quality of the studies quantitatively.

Data extraction strategy

We will create a data base in Excel with the following information:

- Reference
- Type of study
- Protocol used
- Location
- Species
- Evaluation of the intervention
- Study methods and statistical methods if mentioned/used
- Results:
 - Quantitative/qualitative
 - Number of seasons
 - Raw data (yes/no)
 - Detailed results
 - Information about contingent effects
- Conclusions
- Any other information related to the question(s) of the systematic review

To evaluate the quality of the studies, we will carry out the extraction of the data. It will be necessary to compile information on the possible sources of bias and the methods that the researchers have used to mitigate them. In this way we will consider the following sources of experimental bias:

- In the procedures, and methods used to mitigate any of these biases
- In the detection of the object of study and methods used to mitigate these
- Of omission and methods to mitigate these
- In the scale of the procedure and in the scale of the analysis
- In the use of comparators

These potential sources of bias will be evaluated on a scale that will vary from 0 to 1. The results will be added up to determine the study's bias probability. A study will be considered for the review if the bias percentage is not higher than 40% of the total marks. This will help determine the aptitude of the study to be able to perform a narrative, semi-formal, secondary synthesis or meta-analysis.

Data synthesis

Depending on the quality of the data, the information will be evaluated qualitatively or quantitatively or within a Bayesian structure (Wade 2000), all of which will facilitate the carrying of a meta-analysis. We hope that a considerable part of the studies carried out in the Caribbean will have good quality quantitative data that will permit the carrying out of traditional parametric inferential comparisons, especially in projects that have been performed in the Yucatan and in the Virgin Islands (United States) (Boulon 2000). In this way we hope to obtain through this regional study, a good approximation of how the nest protection hatchery projects are going.

4. POTENTIAL CONFLICTS OF INTEREST AND SOURCES OF SUPPORT

None expected.

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