Inter-American Convention for the Protection and Conservation of Sea Turtles

CIT-CC10-2013-Tec.5

Selecting Index Nesting Beaches in the IAC Region and Data Collection Guidelines

This report has been prepared by the IAC Scientific Committee Working Group on Nesting Trend Analysis and recommends that it be used to guide the selection of index sea turtle nesting sites in the IAC region. The goals of this document are: (1) to provide a justification for using real nesting numbers rather than ranges in nesting abundance in the IAC Annual Reports, (2) provide guidelines for selecting IAC index nesting sites that will be used in Annual reports, and (3) provide considerations for annual data collection on nesting females at each index beach.

Introduction

During the 9th Meeting of the IAC Scientific Committee Meeting in Buenos Aires, Argentina, we reported the results of a study to examine the value of IAC Annual Report data for monitoring changes in nesting abundance for sea turtles in the Party countries. There were three main results of this work that resulted in the formation of a new IAC Working Group on Nesting Trend Analysis. The goals of this new group, which are reflected in the present report, were 1) to more clearly explain why the IAC Scientific Team recommends the use of real numbers instead of ranges for monitoring long term changes in nesting abundance, 2) to describe the advantages and disadvantages of reporting only for nesting index sites rather than all sites in a country, and 3) to develop guidelines for determining which nesting beaches should be considered index sites within IAC countries. Recent advances for each of these IAC goals are summarized below.

1. Benefits of reporting real nesting numbers instead of using IAC abundance ranks

Ranges (number of females or clutches within an established range, for example, 1-10, 11-100, 101-500, 501-1000, 1001-5000, 5001-10,000, 10,001-100,000 etc.) do not adequately detect changes in abundance or population trends. The use of ranges varies

quite a bit according to the species and geographic location, which is why it is better to use actual numbers that are more sensitive/effective at detecting changes in abundance for a specific species. With small populations for which significant changes in population size may result from relatively small increases in total numbers, ranges will not adequately portray these changes. For example, hawksbills nesting in Machalilla National Park, Ecuador average 10 nesting females a season, yet still represent the most important hawksbill (*Eretmochelys imbricata*) nesting aggregation in the southeastern Pacific (Gaos et al. 2010). In this case, a change in population size from 10 females/year to 5 females/year would likely not be distinguished by a range (bin)-based reporting scheme, yet would still constitute a 50% decrease in the annual nesting population. In such cases, reporting the actual number of turtles would more adequately capture the nesting trend at this site. With larger populations, the situation is similar. While ranges can be instructive of general trends, the use of ranges does not capture the true inter-annual variation in nesting abundance that is so critical for monitoring population trends. As shown in Figure 1 and Figure 2, for leatherback turtles and green turtles, respectively, ranges can show only a portion of the overall change in annual abundance. However, important changes can occur from year-to-year and is very valuable information for managing both declining and increasing populations.

Clearly, the biggest shortcoming of nesting abundance ranges rather than use of real numbers is when a population is large (e.g. greater than 10,000 individuals) and is in a state of gradual decline. A good example of this is ongoing in Florida USA at present, where loggerhead turtles have been declining at a slow rate for more than 10 years (Figure 3). In such a case, this population fits best into the IAC range (10,001- 100,000). However, with a 90,000 difference in the lower and upper values of this range, it is very difficult to capture important trends. This is particularly problematic with declining populations, for which sea turtle managers must have real numbers to detect a decline - and change their management appropriately.

For the reasons mentioned above, the Scientific Committee recommends that actual (real) numbers of females and clutches are reported per nesting season and requests that only

real numbers are reported in the Annual Report for the most representative sites (for example, index sites or beaches) for each country. The SC believes that this will allow for more consistent reporting from a specific site, and with greater ease since data are only required from representative beaches. Having more consistent reporting of real numbers will help fulfill the goal of the Annual Reports, which taken over time, is to capture population abundance changes at the index sites included in the Annual Reports.

2. Advantages and disadvantages of Index Beach reporting

The State of the World's Sea Turtles (SWOT) defines index beach as the following: in situations where numerous, separated nesting beaches are used by the same population of nesting females, it is sometimes not possible to monitor all sites to ensure maximum coverage. In those situations, one can monitor an index beach or beaches within each population or management unit. The index beach approach assumes that annual abundance patterns observed by comprehensive monitoring of an index beach reflect a broader pattern that occurs at all other beaches used by the same nesting population of that species.

The use of index beaches allows for more consistent reporting from a specific site since these sites are partly selected for their ease of long-term monitoring of a representative portion of a nesting population. Furthermore, its use will reduce the effort needed to fill out the Annual Reports since the IAC Party countries will only be reporting on beaches representative of the different nesting populations and not on all nesting beaches in the country. For example, the analysis of Table 2 of the Annual Report indicated that one country alone reported more than 100 nesting beaches over the years, however, the same beaches are not reported year after year, and this inconsistency makes their analysis difficult over time. Another advantage to using index beaches is the ease with which information can be exchanged in order to perform a regional analysis since the majority of sea turtle conservation initiatives report data in the form of index beaches (Ex. IUCN, SWOT).

The SC also recognizes that one possible disadvantage to the use of index beaches is that it can leave out an important beach if it is not classified as an index beach, but may have other characteristics important to sea turtle conservation. Nevertheless, despite this disadvantage, the Index Nesting Sites present one way to arrive at an IAC reporting strategy that will be efficient and comparable among years.

3. Guidelines for selecting index beaches within each IAC country.

We recognize that not all Party countries have defined index beaches or sites; therefore, the SC will provide the following definitions and criteria to help define these sites. The Index Beach Guidelines below include suggestions presented in previous index reporting efforts by the IUCN Marine Turtle Specialist Group, the State of the World's Turtles (SWOT) nesting beach database, as well as suggestions in Schroeder and Murphy (1999), Gerrodette and Taylor (1999), Valverde and Gates (1999), Seminoff and Shanker (2008), and Sims et al. (2008). Prior to considering what sites within a country or region should be included as index sites, there are three key requirements that will facilitate correct selection. First, it is fundamentally important that there are sufficient nesting beach monitoring programs established at nesting beaches for each species within each country. Second, nesting abundance and trend data have been collected with robust methodologies on a consistent basis over the duration of each project (See nesting maps for Eastern Pacific, Figure 4). Third, there is some understanding of the genetic stock structure and geographic limits for each species in each country and region (Figure 5; e.g. Limpus 2008; Dutton et al. 2008, Wallace et al. 2010). Information on population genetic structure and regional management units (RMSs) is available for all nesting populations within the IAC region; this information is available in scientific publications that can be requested from IAC leadership, although perhaps the best document to use for this purpose is that by Wallace et al. (2010) that clearly describes the global regional management units. The SC, therefore, clarifies that the index beach criteria described below are neither exclusive nor the only ones that exist; they just serve as the basis for helping select index beaches or sites. Criteria to define index beaches will depend on many factors inherent to each country (politics, sampling, distribution, etc.). Table 1

provides five guiding principles for determining Index Nesting sites; each is elaborated on more fully in the text following Table 1.

Table 1. Guidelines for selecting index beaches/sites within each IAC country

1.	At the country level, each country should choose at least one index site for each species that nests at any significant level.
2.	An index beach might be selected because it hosts a significant proportion of the overall nesting population within a region or country, even if numbers are small.
3.	If there is significant population structure (e.g. genetics, RMUs), then index sites should be selected to represent the various segments of the regional population.
4.	Index beaches may include major nesting sites already under intensive study and long-term monitoring.
5.	Index sites for all countries should remain consistent from year to year and receive sufficient resources to maintain adequate and consistent monitoring.

Guideline 1. *At the country level, each country should choose at least one index site for each species that nests.*

It is important that all IAC countries select at least one index site for each sea turtle species that nests within its national boundaries. If a country has two coast lines (e.g. Costa Rica w/ Pacific and Caribbean coasts) then each ocean basin should be treated independently and have at least one Index Site per species.

Guideline 2. *An index beach might be selected because it hosts a significant proportion of the overall nesting population within a region or country, even if numbers are small*

Typically, an index site should be reflective of the overall trend for each respective species within the country or region. This is easily accomplished if the sites constitute a major portion of the overall nesting population for the genetic stock in question. It is important to note, however, that there may also be some index sites that have a small proportion of the overall nesting population but are selected because they represent a novel genetic or morphological population segment (see Guideline 3).

Guideline 3. *If there is significant population structure (e.g. genetics, RMUs), then index sites should be selected to represent the various segments of the regional population.*

Information on population genetic structure is vital to insure that the selected Index Sites are representative of all the genetic segments of a population. There are many scientific studies that have studied population structure in sea turtles, and the majority of stocks for the various species in the IAC region have been identified. Please contact IAC leadership for this information, and for PDFs of pertinent articles.

Guideline 4. *Index beaches may include major nesting sites already under intensive study and long-term monitoring*

A key characteristic of any site for which long-term trends are to be determined is that the site has relatively long-term monitoring data (e.g. 10 yr minimum). This is because most sea turtle populations exhibit significant inter-annual variation, and the only way to determine if a particular trend is occurring is to compare many years of information. A second and equally important requirement under this Guideline is that the monitoring effort is robust and is consistent from year to year at the selected Index Site. If a site has already been studied in a consistent manner for many years, this may make it valuable as an index nesting beach.

Guideline 5. *Index Sites for all countries should remain consistent from year to year and receive sufficient resources to maintain adequate and consistent monitoring.*

In order to monitor long-term trends, it is important that each Index Site remains so for long-term (e.g. more than 10 years) time frames. If for example, a site is selected to be an Index Site, but after five years it is no longer reported on, the IAC will be unable to determine the trends in abundance. Thus, the most appropriate Index Sites in a country or region are those for which data reporters have a high level of confidence that the infrastructure and funding for that site is stable for many years to come. This is often difficult to determine ahead of time, but a good example is that it would be more appropriate to pick a site if it is managed or overseen by more established and financially stable University, State,

or Federal Authorities as opposed to sites that are run by NGOs or volunteer organizations.

Benefits of the IAC Index Nesting Beach Annual Reporting

The IAC Scientific Committee has worked for several years to develop a reporting mechanism that would be both practical for reporting purposes (i.e. worksheets that are easy to fill in) and meaningful as a tool to help guide sea turtle conservation in the region. We believe that the two recently-adopted changes - reporting real numbers instead of ranges, and reporting for Index Sites instead of all beaches - are key advances for the IAC's ability to meet its sea turtle conservation goals. For the first time, the information on nesting beach abundance that is included in all IAC reports will be useful for monitoring changes in population trends at the most important nesting sites for each sea turtle species in the region.

In closing, we believe that the use of real numbers will allow IAC to more effectively meet the sea turtle conservation goals of identifying which nesting sites have declining populations, which in turn will allow us to focus our efforts on nesting sites that need extra help with respect to conservation attention and on-the-ground resources. To achieve this goal, we encourage the IAC Party countries to make full use of existing partnerships with other organizations such as IUCN-MTSG and SWOT that also have the goal of monitoring nesting trends at key sites around the IAC region.

Data collection considerations at IAC Index Beaches

The purpose of the following information is to provide guidance on the collection of data to measure annual abundance in nesting activity at each of the IAC Index Nesting Sites. By following these recommendations, data collected at index beaches will be of sufficient quality to measure long-term trends, assuming data is collected over long-term periods. Information below has been gathered from several resources including Bjorkland (2001), CITES (2002), IAC (2011), SWoT (2011).

(1) Monitoring Boundaries. Monitoring boundaries of index nesting beaches must be established and adhered to each year. Selection of monitoring boundaries (beach length) should take into consideration the needs for the survey length to be monitored over long term periods.

(2) Survey Frequency. Survey frequency (number of days per week the survey is conducted) must be specifically set and adhered to from year to year. Ideally, nesting surveys should be conducted daily, however, logistical considerations may preclude daily surveys. A survey frequency of every other day is considered a minimal requirement to reduce survey error. In the case of remote, isolated nesting beaches, where logistics preclude every other day surveys, a reduced survey schedule of 2-3 times evenly spaced across the week may be sufficient, provided all other criteria, including surveyor training are met (SWoT 2011).

(3) Survey Period. The survey period should encompass the peak of the nesting season and should be designed to allow for shifts in the peak of the nesting season from year to year. Beaches that have not been previously surveyed, or for which the nesting season has not been defined, will require pilot studies to identify the peak of the nesting season prior to setting the survey period. Pilot studies should be conducted for a period of 3 years, during which time the complete nesting season will be surveyed. Ideally, the complete nesting season should be encompassed, however, the minimal survey period is 8 weeks, shorter survey periods may be appropriate depending on local conditions and a complete understanding of variability in the nesting season.

(4) Nest Verification. Ideally, nesting beach monitoring personnel will be sufficiently trained to confirm nests by evaluating track and nest site characteristics. If there is a question whether a crawl has resulted in a nest, the presence or absence of eggs should be verified by hand digging.

(5) Surveyor Training. Training should include observations of nesting turtles to ensure that surveyors have a thorough understanding of the behaviors that result in crawl and

nest characteristics, this is key to correctly identifying nests vs. non-nesting emergences. Training should also include "hands-on" training evaluating crawls on the survey beach with experienced personnel. New personnel should work side-by-side with experienced personnel until the project leader is sufficiently convinced that new personnel have the knowledge and skills necessary to perform an accurate survey.

(6) Information to be collected each season. Based on Annex 2 of the IAC Annual Reporting Forms (Page 13), the following data are requested for each species that nests at each nesting beach.

1. Name of index nesting site or beach
2. Nesting season begins
3. Nesting season ends
4. Monitoring period begins
5. Monitoring period ends
6. Survey Frequency
7. Geographic location (latitude/longitude) in decimal degrees
8. Extension of beach monitored(Kilometers)
9. Declared protected area (yes or no)
10. Annual nesting abundance (exact count of females, clutches or nests)
11. Tagging program (flipper tagging, passive integrated transponder (PIT) tags, and/or satellite telemetry programs)
12. Tissue sampling (yes or no)
13. Organization providing data

Literature Cited

Bjorkland, R. 2001. Monitoring Population Trends, pp. 137-138. *In* K.L. Eckert and F. Alberto Abreu-Grobois (eds), Proceedings of the Regional Meeting: Marine Turtle conservation in the Wider Caribbean Region: A Dialogue for Effective Regional Management, " Santo Domingo, 16-18 November 1999. WIDECAST , IUCN-MTSG, WWF, and UNEP-CEP. xx + 154 pp.

CITES. 2002. Report to the Range States on the Development of Hawksbill (*Eretmochelys imbricata*) Population Monitoring Protocols for the Wider Caribbean. Second CITES wider Caribbean hawksbill turtle dialogue meeting Grand Cayman (Cayman Islands), 21–23 May 2002

Delgado-Trejo C, Alvarado-Diaz J (2012) Recovery of the black sea turtle. In: Seminoff, J.A. and B.P. Wallace (editors). 2012. Sea Turtles of the Eastern Pacific Ocean: Advances in Research and Conservation. University of Arizona Press, Tucson, Arizona. 376 pp. ISBN: 978-0-8165-1158-7

Dutton PH, Balazs GH, LeRoux RA, Murakawa SKK, Zarate P, Sarti-Martínez L (2008) Composition of Hawaiian green turtle foraging aggregations: mtDNA evidence for a distinct regional population. Endangered Species Research 5:37-44.

Gaos, A.R., F.A. Abreu-Grobois, J. Alfaro-Shigueto, D. Amorocho, R. Arauz, A. Baquero, R. Briseño, D. Chacón, C. Dueñas, C. Hasbún, M. Liles, G. Mariona, C. Muccio, J.P. Muñoz, W.J. Nichols, M. Peña, J.A. Seminoff, M. Vásquez, J. Urteaga, B.P. Wallace, I. Yañez, and P. Zárate. 2010. Signs of hope in the eastern Pacific: international collaboration reveals encouraging status for the severely depleted population of hawksbill turtles *Eretmochelys imbricata*. Oryx. doi:10.1017/S0030605310000773.

Gerrodette T, Taylor B (1999) Estimating Population Size. In: Eckert KL, Bjorndal KA, Abreu-Grobois FA, Donnelly M (Eds). Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group, Publication No.4.

Hamann, M., M.H. Godfrey, J.A. Seminoff, K. Arthur, P.C.R. Barata, K.A. Bjorndal, A.B. Bolten, A.C. Broderick, L.M. Campbell, C. Carreras, P. Casale, M. Chaloupka, S.K.F. Chan, M.S. Coyne, L.B. Crowder, C.E. Diez, P.H. Dutton, S.P.

Epperly, N.N. FitzSimmons, A. Formia, M. Girondot, G.C. Hays, I-J. Cheng, Y. Kaska, R. Lewison, J.A. Mortimer, W.J. Nichols, R.D. Reina, K. Shanker, J.R. Spotila, J. Tomás, B.P. Wallace, T.M. Work, J. Zbinden, and B.J. Godley. 2010. Global research priorities for sea turtles: informing management and conservation in the 21st century. Endangered Species Research. 11:245-269.

Inter-American Convention for the Protection and Conservation of Sea Turtles (IAC). 2011. Manual of Management Techniques for Sea Turtle Conservation at Nesting Beaches CIT-CC8-2011-Tec.2. 52 pp.

Limpus C (2008) Status of sea turtles in Australia. Queensland Parks Dept.

Schroeder B, Murphy S (1999) Population surveys (Ground and Aerial) on nesting beaches. In: Eckert KL, Bjorndal KA, Abreu-Grobois FA, Donnelly M (Eds). Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group, Publication No.4.

Seminoff, J.A. and K. Shanker. 2008. Marine turtles and IUCN Red Listing: a review of the process, the pitfalls, and novel assessment approaches. Journal of Experimental Marine Biology and Ecology 356:52-68

Sims M, Bjorkland R, Mason P, Crowder LB (2008) Statistical power and sea turtle nesting beach surveys: How long and when? Biological Conservation 141:2921-2931

SWOT Scientific Advisory Board. 2011. The State of the World's Sea Turtles (SWOT) Minimum Data Standards for Nesting Beach Monitoring, version 1.0. Handbook, 28 pp.

Valverde RA, Gates CE (1999) Population surveys on mass nesting beaches. In: Eckert KL, Bjorndal KA, Abreu-Grobois FA, Donnelly M (Eds). Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group, Publication No.4.

Wallace, B.P., A.D. DiMatteo, B.J. Hurley, E.M. Finkbeiner, A.B. Bolten, M.Y. Chaloupka, B.J. Hutchinson, F.A. Abreu-Grobois, D. Amorocho, K.A. Bjorndal, J. Bourjea, B.W. Bowen, R. Briseño Dueñas, P. Casale, B.C. Choudhury, A. Costa, P.H. Dutton, A. Fallabrino, A. Girard, M. Girondot, M.H. Godfrey, M. Hamann, M. López-Mendilaharsu, M.A. Marcovaldi, J.A. Mortimer, J.A. Musick,

R. Nel, N.J. Pilcher, J.A. Seminoff, S. Troëng, B. Witherington, and R.B. Mast. 2010. Regional Management Units for marine turtles: A novel framework for prioritizing conservation and research across multiple scales. PLoS ONE 5(12): e15465

Wallace, B.P., A.D. DiMatteo, A.B. Bolten, M.Y. Chaloupka, B.J. Hutchinson, F.A. Abreu-Grobois, J.A. Mortimer, J.A. Seminoff, D. Amorocho, K.A. Bjorndal, J. Bourjea, B.W. Bowen, R. Briseño Dueñas, P. Casale, B.C. Choudhury, A. Costa, P.H. Dutton, A. Fallabrino, E.M. Finkbeiner, A. Girard, M. Girondot, M. Hamann, B.J. Hurley, M. López-Mendilaharsu, M.A. Marcovaldi, J.A. Musick, R. Nel, N.J. Pilcher, S. Troëng, B. Witherington, R.B. Mast. 2011. Global Conservation Priorities for Marine Turtles. PloS ONE. 6(9):e24510

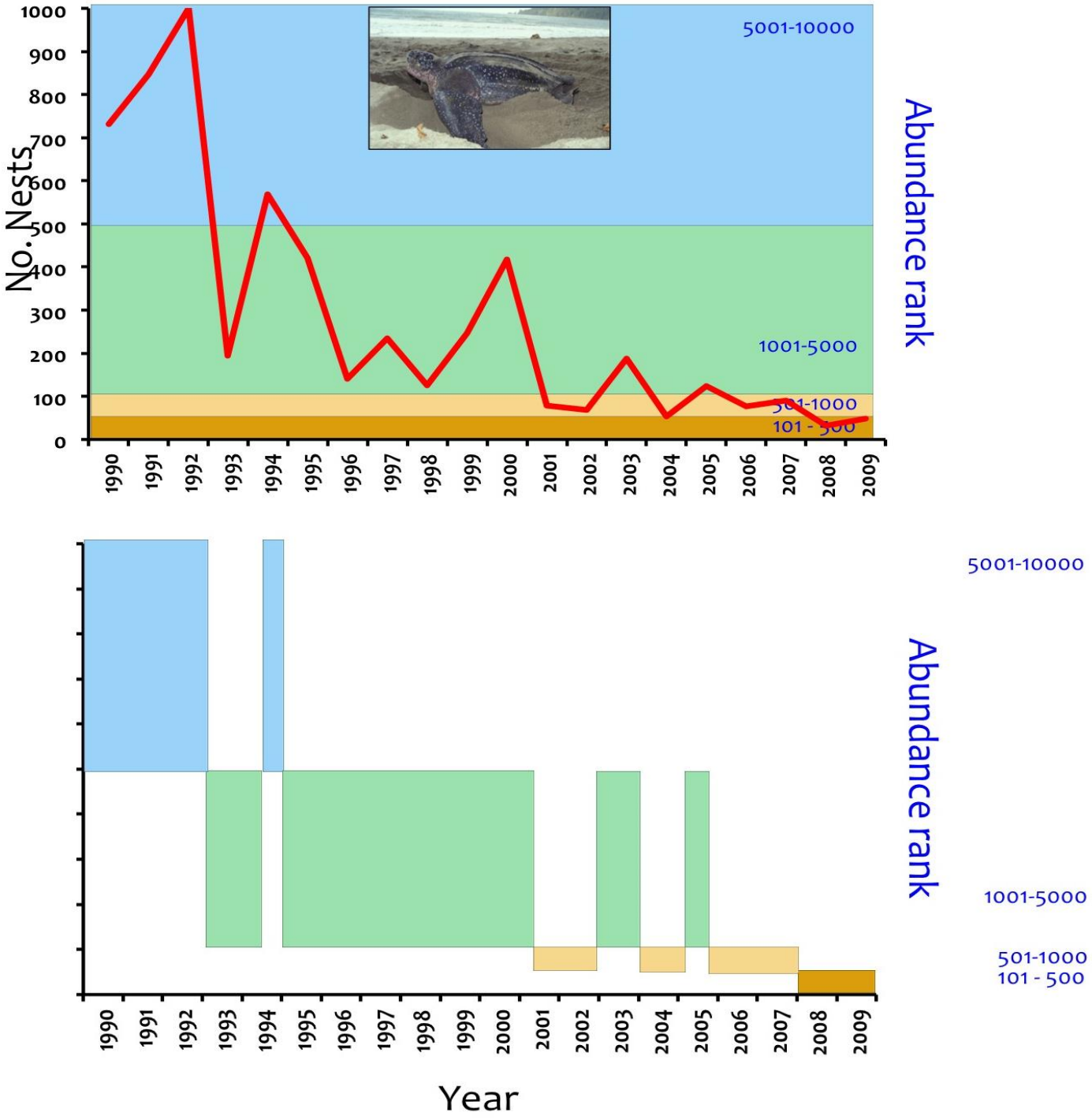

Figure 1. (TOP) Leatherback nesting trends at Playa Grande, Pacific Costa Rica (1990/91-2009/10) overlaid on IAC Nesting Abundance Ranks. Data courtesy of Leatherback Trust and James Spotila; (BOTTOM) Leatherback nesting trends at Playa Grande determined by rank categories and not real numbers. The declining trend is apparent with rankings, but there is much less resolution on actual nesting numbers.

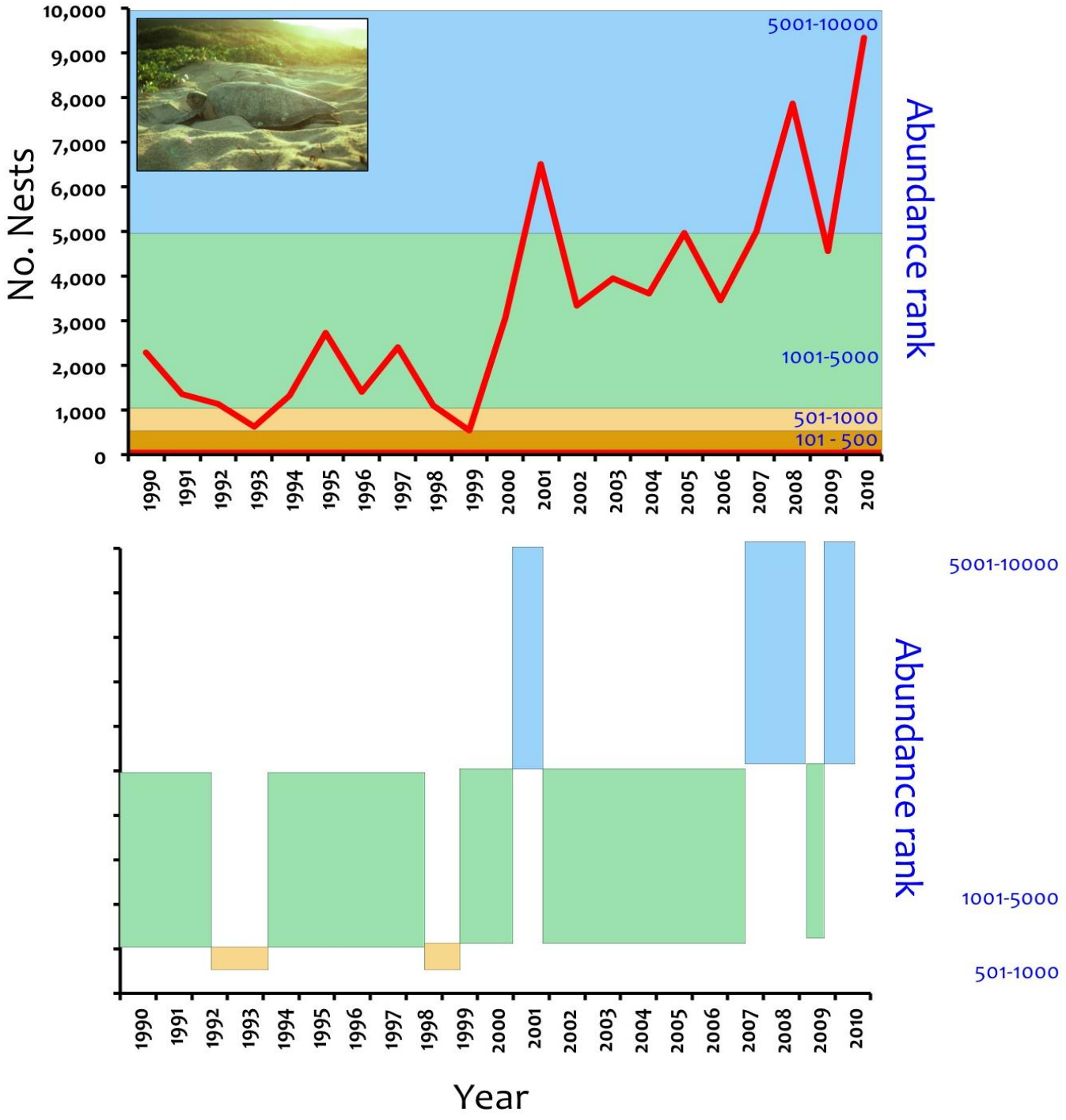

Figure 2. (TOP) Green nesting trends at Colola, Michoacan, Mexico (1990/91-2009/10) overlaid on IAC Nesting Abundance Ranks. Data from Delgado-Trejo and Alvarado-Diaz 2012 (BOTTOM); Green turtle nesting trends at Colola, Michoacan, Mexico by rank categories and not real numbers. The increasing trend is apparent with rankings, but there is much less resolution on actual nesting numbers.

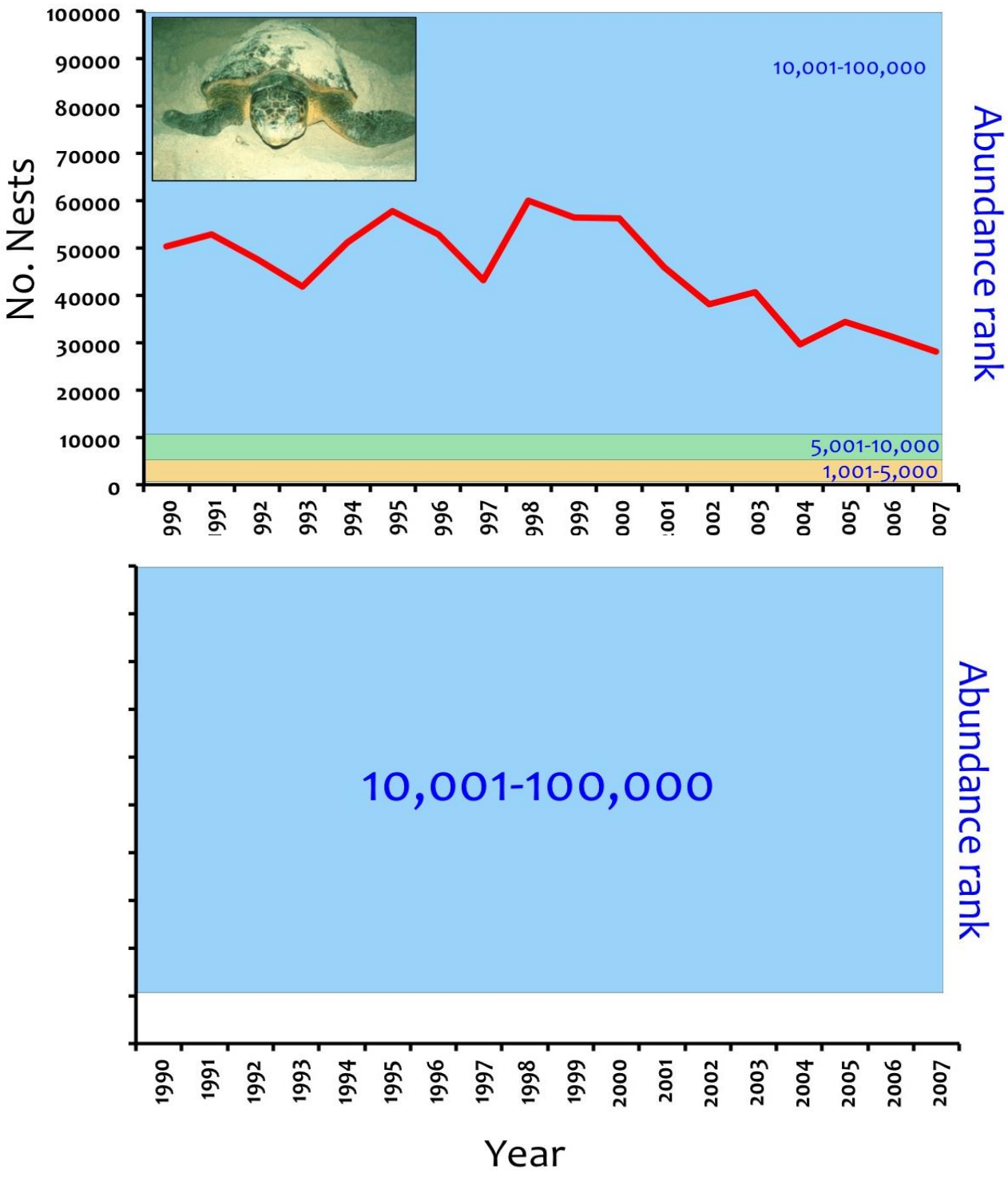

Figure 3. (TOP) Loggerhead turtle nesting trends at Florida Index Beaches (1990-2007) overlaid on IAC Nesting Abundance Ranks. Data from FWC 2013 (BOTTOM); Loggerhead turtle nesting trends at Florida USA Index Beaches by rank categories and not real numbers. **Note that the declining trend is undetectable using IAC abundance rankings.**

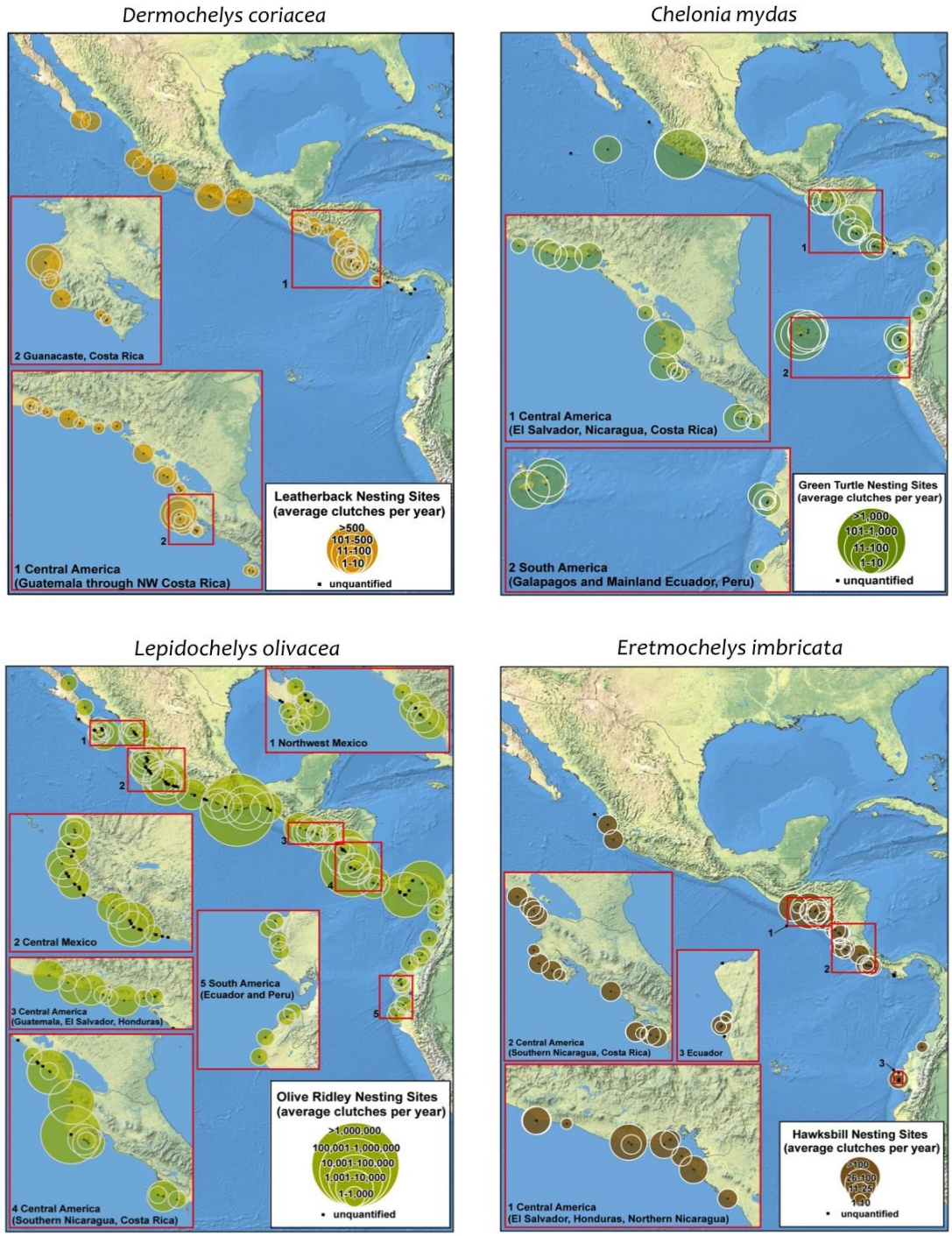

Figure 4. Summary of nesting locations and relative size for the four sea turtle species that occur in the Eastern Pacific Ocean. Note, the authors would like to add, but are unaware of similar information for the Atlantic IAC region. NOTE to IAC Members: similar maps will soon be developed for Caribbean and Atlantic nesting sites.

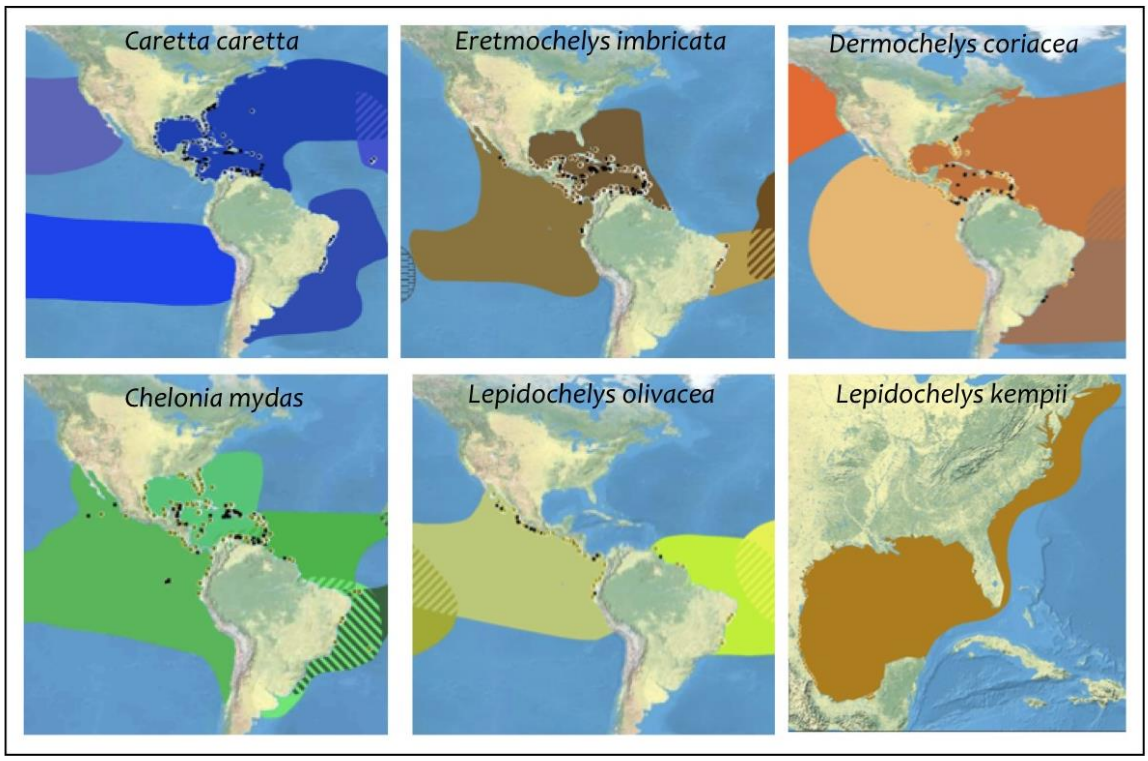

Figure 5. Regional management units - based largely on genetic analyses - for each of six sea turtle species occurring within the IAC Region. Maps modified from Wallace et al. (2011).