MARINE TURTLE TAGGING

A Manual of Recommended Practices

Prepared by the Wider Caribbean Sea Turtle Conservation Network (WIDECAST)

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A Manual of Recommended Practices

Prepared by the Wider Caribbean Sea Turtle Conservation Network (WIDECAST)

Karen L. Eckert
Executive Director, WIDECAST

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Database Manager, Barbados Sea Turtle Project

2006
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PREFACE AND INTENT

For more than two decades the Wider Caribbean Sea Turtle Conservation Network (WIDECAST), with Country Coordinators in more than 40 Caribbean States and territories, has linked scientists, conservationists, resource managers, resource users, policy-makers, industry groups, educators and other stakeholders together in a collective effort to develop a unified management framework, and to promote a regional capacity to design and implement scientifically sound sea turtle management programs.

As a Partner Organization of the UNEP Caribbean Environment Programme, WIDECAST is designed to address research and management priorities at national and regional levels, both for sea turtles and for the habitats upon which they depend. We focus on bringing the best available science to bear on contemporary management and conservation issues, empowering stakeholders to make effective use of that science in the policy-making process, and providing an operational mechanism and a framework for cooperation at all levels, both within and among nations.

Network participants throughout the region are committed to working collaboratively to develop their collective capacity to manage shared sea turtle resources. By bringing people together, and by encouraging inclusive management planning, WIDECAST is helping to ensure that utilisation practices, whether consumptive or non-consumptive, do not undermine sea turtle survival over the long term.

Among these capacity building initiatives is the WIDECAST Marine Turtle Tagging Centre (MTTC), located at the University of the West Indies (UWI) in Barbados and operated by the Barbados Sea Turtle Project (BSTP) (http://www.barbadosseaturtles.org). The BSTP at UWI has been an active member of the WIDECAST network since 1991, and is proud to give the MTTC an institutional home within the region's primary university establishment.

The aim of the MTTC is to strengthen and coordinate dozens of otherwise isolated small-scale tagging projects, and to encourage and enable collaboration among range states with regard to sea turtle tagging and the documentation of international movements. Since its establishment in 2001, the Centre has distributed tags to research projects in more than 20 Caribbean States and territories. Many more have indicated their desire for training, advice, and information on best practices, as well as for tags. The Centre archives tag fate data for all participating projects and provides a central clearinghouse for information on international movements.

This *Manual of Recommended Practices* is designed to complement the training workshops hosted periodically at UWI for new projects wishing to become participants of the MTTC, and to contribute to a unified code of practice for tagging projects conducted in the Wider Caribbean Region. Please visit http://www.widecast.org/tagging for more information.

Karen L. Eckert
Executive Director
WIDECAST

ACKNOWLEDGEMENTS

We are very grateful to the United Nations Development Programme (UNDP) GEF Small Grants Programme for their support in the preparation and printing of this Manual.

In addition, the UNDP-GEF/SGP [Barbados] and the National Fish and Wildlife Foundation [USA] provided grants in 2001 that led to the establishment of WIDECAST's Caribbean regional Marine Turtle Tagging Centre (MTTC), including the purchase of an initial inventory of 30,000 Monel and Inconel tags and associated tagging equipment, the development of the first version of a database management software package (with User's Manual) and other essential documentation, and the hosting of the "First Regional WIDECAST Training Workshop on Sea Turtle Tagging and Record-Keeping" (October 2001) at the University of the West Indies Cave Hill Campus. NOAA (U. S. Department of Commerce) subsequently provided funding for finalising the database management software.

We are particularly indebted, for their contributed expertise during the development of the Manual, to Julia Horrocks and Barry Krueger (Barbados Sea Turtle Project), Scott Eckert and Stacy Kubis (WIDECAST), Hedelvy Guada (CICTMAR, Venezuela), Barbara Schroeder (NOAA/ NMFS Office of Protected Resources), Sheryan Epperly (NOAA/ NMFS Southeast Fisheries Science Center), George Balazs (NOAA Hawai'i), Jennifer Gray (Bermuda Turtle Project), Jeanette Wyneken (Florida Atlantic University, USA), and Sally Murphy (South Carolina Department of Natural Resources, USA). We thank, as well, the more than 20 colleagues with whom we conferred informally on various issues, and gained insight from all!

Finally, we extend our gratitude to the network of WIDECAST Country Coordinators who labour tirelessly throughout the Wider Caribbean Region on behalf of endangered sea turtles and who, through their professional efforts and willingness to collaborate, contribute so much to the survival of sea turtles through the MTTC and other region-wide capacity building initiatives.

Karen Eckert's time was partially supported by the *Mary Derrickson McCurdy Visiting Scholar* Fellowship at Duke University, and a grant from the Pew Fellows Program in Marine Conservation Collaborative Initiatives Fund.

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LIST OF ACRONYMS

BAMZ	Bermuda Aquarium, Museum and Zoo
BSTP	Barbados Sea Turtle Project
MTTC	Marine Turtle Tagging Centre
NOAA	National Oceanic and Atmospheric Administration (U.S.)
NMFS	National Marine Fisheries Service (U.S.)
PIT	Passive Integrated Transponder
SCL	Straight Carapace Length
UWI	University of the West Indies
WIDECAST	Wider Caribbean Sea Turtle Conservation Network

Checking for tags applied to the rear flippers of an adult leatherback, still on the beach at dawn after nesting the night before. Photo: Turtugaruba Foundation, Aruba.
«

The correct placement of Inconel tags to the front flippers of a juvenile loggerhead. Photo: Scott A. Eckert/ WIDECAST. »

Applying an Inconel tag to the front flipper of a nesting hawksbill turtle, after successful egg-laying. Photo: Scott A. Eckert/ WIDECAST.
«

I. OVERVIEW

WHY TAG SEA TURTLES?

The primary purpose of tagging is to *identify a sea turtle as an individual*. Physical means of identifying sea turtles include uniquely painted or coloured marks, tattoos, carapace [shell] tags or drilled holes, flipper tags, coded wire tags, "living tags", and PIT (Passive Integrated Transponder) tags.

Flipper tags are modified livestock tags that must be pierced through the flesh and clamped closed using tag applicators specially designed for each tag type. Flipper tagging is the most commonly used identification mark on sea turtles. PIT tags, which are injected under the skin and therefore not as easily lost, are more expensive than flipper tags and require electronic equipment to read the tag number.

Flipper tagging can provide information on population trends, habitat residency, movement patterns (including international movements among range states), individual growth rates, reproductive life history (e.g. remigration intervals, nesting frequency, clutch size, and/or hatchlings produced per female), and strandings. Note that estimating trends in the relative abundance of females on a nesting beach need not require any tagging at all, and can be achieved through an appropriately designed daytime nest survey (cf. Schroeder and Murphy, 1999; Gerrodette and Taylor, 1999).

The design of your tagging programme will depend upon your objective(s). If your objective is to determine the number of individual females utilising a particular nesting beach and to assess trends in their abundance over time, a long-term commitment of time and resources is essential. In this case "saturation tagging" on the nesting beach may be required, necessitating all-night coverage of a beach stretch and the tagging of *all* females using the beach over the course of the annual nesting season.

For a population trend to be detected, a minimum of three data points is required. Sea turtles in the Caribbean region nest, on average, every 1.5 to 3.5 years, depending on the species (scientists refer to this as the average remigration interval). A tagging programme must continue for 5-10 years, again depending on the species, before it is possible to detect a trend in abundance of the nesting population. Note that with very small populations or low remigration rates, it may take considerably longer for a statistically significant trend to emerge (Bjorkland, 2001). Saturation tagging at a nesting beach also facilitates the collection of data needed to assess nesting frequency, remigration intervals, and reproductive output for individual females.

Tagging on a *consistent* but less-than-saturation basis (for example, three times per week over the course of the nesting season) can also provide important management information, such as insight into the minimum number of females using a nesting beach or insight into nest distribution (including shifts in nest placement over time due to erosion, disturbance or other factors), but less-than-saturation coverage cannot, for example, confirm clutch frequency or help you to develop a robust estimation of the average remigration interval.

Tagging of sea turtles in their foraging habitats is also very useful and facilitates the use of mark-recapture (or other statistical sampling) methods to quantify population size, assess individual growth rates, and evaluate residency, time budgets, and habitat use, among others.

Whether on the nesting beach or the foraging ground, a tagging programme *must measure tag loss*. When an animal is found without tags, it is important to be able to tell whether that animal has never been tagged before (in other words, it is new to your tagged population) or whether it has simply lost its tags. Measuring the extent of tag loss is critical to the correct interpretation of the resulting data, and to the adjustment of tagging techniques accordingly.

Double-tagging greatly reduces the statistical chance that an animal will subsequently be found without any tags. Coupling PIT tagging technologies together with flipper-tagging provides an extra measure of security to your database. Finally, keeping accurate records of diagnostic markings and/or injuries can be very helpful in identifying a turtle that has lost its tags.

Monitoring programmes that utilise flipper tagging allow for the gathering of additional data (e.g. changes in size and/or weight, tissue sampling for genetic or other analyses, variables associated with habitat preferences) which go beyond the scope and purpose of this Manual. For further information on these and related topics, such as the purpose and design of sea turtle tagging and monitoring programmes, we refer you to Eckert and Abreu Grobois (2001), Eckert et al. (1999) and, in particular, Balazs (1999) which includes comprehensive information on a variety of tag types and suggestions on how to minimise problems.

Manuals associated with professional projects in Barbados (Beggs et al., 2001) and Bermuda (Meylan et al., 2003) are also very useful, as is Chacón et al. (2000), designed for Central American field projects. Researchers contemplating an in-water tagging program should review Bjorndal and Bolten (2000), as well as the "Report to the Range States on the Development of Hawksbill (*Eretmochelys imbricata*) Population Monitoring Protocols for the Wider Caribbean" (CITES, 2002). The U.S. National Marine Fisheries Service should soon have available a national "Sea Turtle Research Techniques Manual", designed by the Southeast Fisheries Science Center in support of permit requirements under U.S. law and covering a variety of subjects from handling and resuscitation to tagging and tissue sampling (see http://www.sefsc.noaa.gov/seaturtletechmemos.jsp). Finally, seaturtle.org maintains an overview of tag types and tagging protocols, including photos, at http://www.seaturtle.org/tagging/.

Recommendations may vary between sources; those included in this Manual are based on the best judgment of the authors, peer-reviewers, and Caribbean experts.

II. BEFORE YOU BEGIN

We recommend that you read the entire Manual first! It contains important technical information that will help you make informed decisions about your tagging programme. As you read, make a list of field equipment necessary to achieve your particular tagging objectives.

CONSIDERATIONS: TURTLE SIZE AND SPECIES

Any species of sea turtle can be safely and humanely tagged using procedures outlined in this Manual. However, be aware that most tags are not suitable for use on very small animals. While small tags (e.g. Monel style 1005-1) are commercially available, there are no data to evaluate their retention rates or any effect they may have on the movement or survival of very small turtles. Experience with the Monel 1005-1 used on hawksbills 20-30 cm in straight carapace length (SCL) suggests that they corrode quickly, break easily and, therefore, are not well retained. They are only useful in a tagging programme where the animals are likely to be recaptured at intervals of less than six months (J. Horrocks, BSTP, pers. comm., 2004). This tag size is not currently inventoried by the MTTC.

The tagging of turtles less than 35 cm SCL should be discussed with MTTC staff. As a general rule, we recommend that no turtle smaller than 30 cm straight carapace length (SCL) be tagged with an Inconel 1005-681 tag (Figure 1), which is the smallest tag available from the MTTC. Having said that, it is also worth noting that there is variation in the size of the enlarged fleshy scales at the trailing edges of the front flippers. Some hawksbills of 25 cm SCL have relatively large scales that can hold an Inconel 1005-681 tag comfortably, whilst some 30 cm SCL turtles may not. If the tag hangs too far beyond the edge of the flipper (see "How Should a Flipper Tag be Applied?"), it may impede swimming motion and cause drag that will likely result in tag loss.

Hard-shelled turtles larger than 30 cm SCL should be tagged with Inconel style 1005-681 tags. Leatherback turtles (and sometimes adult green and loggerhead turtles) are generally tagged with the larger Monel style 1005-49 (Figure 1).

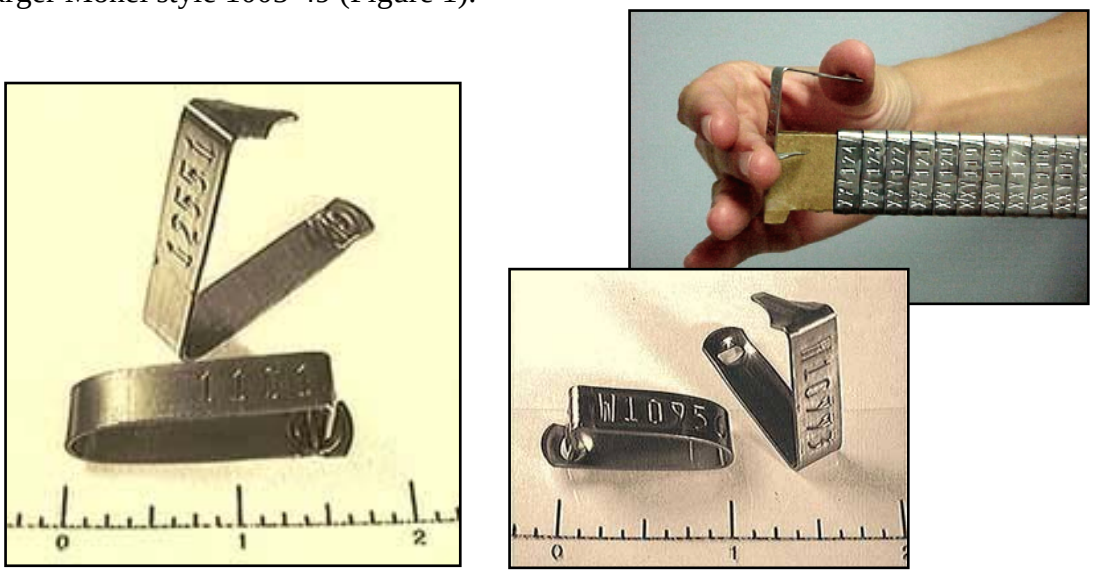


Figure 1. Size and shape of Monel tag style 1005-49 and Inconel style 1005-681, manufactured by National Band and Tag Company (http://www.nationalband.com/nbtear.htm). Tag card photo courtesy NMFS-SEFSC.

The use of Passive Integrated Transponder, or "PIT" tags, in adult sea turtles is well-tested and offers the clear advantage of superior tag retention (at least when compared to metal flipper

tags), but there is less information on the long-term effects of PIT-tagging juvenile turtles. Long-term research projects in Bermuda, Florida, and Mona Island (Puerto Rico) routinely PIT-tag juveniles, but recapture rates to date have been insufficient at most sites to fully document and evaluate tag retention rates. We do not discourage the PIT tagging of small juveniles, but we do urge you to contact colleagues who are experienced with these young size classes. Feel free to contact the MTTC for information on projects currently PIT-tagging small juveniles.

We do not recommend any flipper or PIT tagging of hatchlings or neonates of any species.

REQUESTING TAGS FROM THE MTTC

Once you have determined that you have access to sea turtles suitable for tagging, you have defined a set of research or management questions that can be answered through current tagging technologies (see "Why Tag Sea Turtles?"), and your organisation is committed to orderly and long-term record-keeping, then the first step in acquiring tags from the MTTC is to complete a Tag Application Form (see Appendix A). The MTTC typically limits the distribution of flipper tags to any one project to a maximum of 200 tags per year. There is no lower limit.

The following sections in the Manual are designed to assist you in determining which tag type is best suited for your programme objectives, where and how tags should be applied, etc.

SELECTING A TAG TYPE

Two general types of tags are most used on sea turtles: externally placed metal and plastic flipper tags, and internally placed PIT (Passive Integrated Transponder) tags. See Appendix B for manufacturer addresses.

Flipper Tags- The MTTC currently inventories Monel and Inconel tags (manufactured by National Band and Tag Company in the U.S., see http://www.nationalband.com/nbtear.htm) and the appropriate applicators for each tag type. Monel tags are typically used for leatherbacks, as they are larger and more suitable for the thicker skin of this species. Monel tags can also be used on adult loggerhead and green turtles, but Inconel tags tend to show longer retention rates. Inconel tags are always recommended for hawksbills and ridley turtles, and for use on juveniles of all species.

The MTTC does not inventory plastic tags (Figure 2). Plastic tags, such as the Rototag (http://www.dalton. co.uk/ID/rototag.htm) or the larger Jumbo Tag, are manufactured by Dalton ID Systems, Ltd., England. They can be customised in different colors with numbers and lettering embossed on both the inner and outer surfaces of the tag's plates. Plastic tags can be useful, especially in relatively short-term studies of localised home range and habitat utilisation. The disadvantage is that the embossed numbers can become abraded, with frustrating speed, to the point where they can no longer be read (*Hint*: abrasion is considerably reduced by embossing on the inner surfaces). In addition, they tend to bio-foul (such as with algae, barnacles, etc.) and may increase the likelihood of turtles becoming ensnared incidentally in fishing gear.

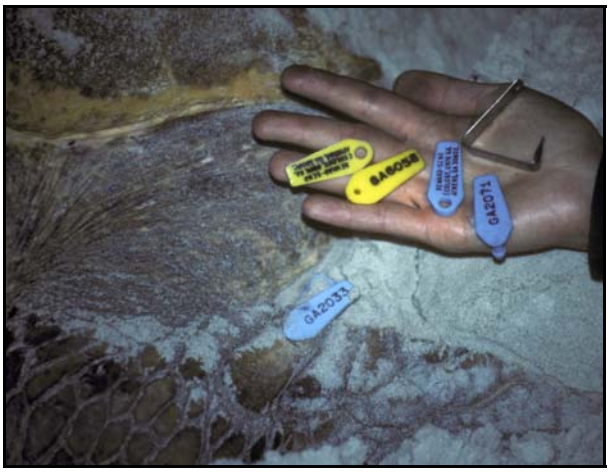


Figure 2. Size and shape of plastic "Jumbo" Rototags and their placement on (a) an adult female loggerhead (Photo: Scott Eckert/ WIDECAST) and (b) a juvenile green turtle (Photo: Bermuda Turtle Project).

Metal tags available from the MTTC are inscribed on both dorsal and ventral sides (Figure 3). The dorsal (upward facing) side is inscribed with a unique alphanumeric code, typically two capital letters (e.g. WC, WE, WH) followed by a four-digit number series.

In addition to the number sequence, all MTTC tags are inscribed with a return address on the ventral side: **REWARD PREMIO SEND**
UWI, DEPT BIOLOGY
BARBADOS

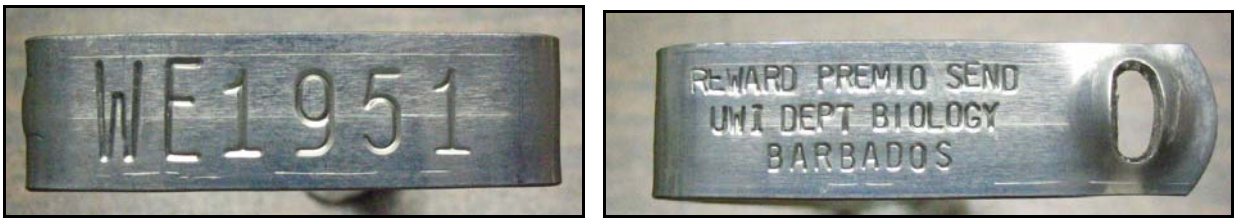


Figure 3. Enlarged view of the dorsal (alphanumeric) and ventral (return address) faces of an Inconel 1005-681 tag available from the Marine Turtle Tagging Centre (MTTC). Photo: Stacy Kubis/ WIDECAST.

PIT Tags- For financial reasons, the MTTC does not inventory or distribute Passive Integrated Transponder (PIT) tags, which typically cost US$ 5-10 per tag. PIT tags are "small inert microprocessors sealed in glass that can transmit a unique identification number to a hand-held reader when the reader briefly activates the tag with a low frequency radio signal at close range" (Balazs, 1999). A PIT tag is cylindrical in shape, about the size of a grain of rice, and is injected under the skin or into the muscle (see Figure 4 for an example of an applicator system). When a specialized reader is passed over the tag, the reader generates a low energy radio signal that energizes the tag to transmit its number. The turtle feels nothing as the reader (scanner) is passed over it. The received number, typically 9-15 digits arranged in a unique unalterable alphanumeric code (i.e. a combination of numbers and letters), is displayed in the reader's viewing window.

To date there has been very little standardisation among sea turtle scientists with regard to brand, excitement frequency, placement (i.e. tagging site on the turtle), or record-keeping. In keeping with MTTC's goal to standardise tagging methodologies in the Caribbean, members of the WIDECAST network are collaborating with the U.S. National Marine Fisheries Service (NMFS) and other colleagues to comprehensively lab- and field-test a variety of PIT tag brands, styles, and readers/ scanners. The results to date have documented a complex array of performance characteristics between AVID, Destron and Trovan technologies. The results confirm that any of the major brands will perform well on hard-shelled turtles. The biggest challenge is with leather-backs, the tag is inserted more deeply into the flesh and thus a greater "read distance" is required.

The most serious problems from a data collection standpoint arise when the reader is not "matched" to the excitement frequency of the tag, and thus cannot de-code its identity. Standardising brand use across geographic regions would assist in ensuring that turtles PIT-tagged at one site could be de-coded and read at other project sites. The NMFS analysis should be complete during the 2005-2006 biennium, and recommendations and guidelines should result. Visit http://www.widecast.org/tagging for updates on this and other aspects of turtle tagging.

For now we recommend that projects intending to begin PIT tagging collaborate directly with experienced colleagues; that **un**encrypted tags be used so that they can be read by other scanning technologies (or brands) should your tagged turtle nest or be captured in a distant country; that you select a weatherproof reader (or place it in a durable clear plastic bag when in the field; the plastic will not interfere with performance); and that you select a reader capable of detecting PIT tags made by different manufacturers. Different PIT tags operate on different frequencies – for example Trovan emits128 kHz, while AVID and Destron-Fearing emit 125 kHz. If your reader is unable to detect these different frequencies, the tag will be "invisible" to you.

Figure 4. Tag delivery systems vary, even within manufacturers (in this case, AVID). The Disposable Needle Assembly (DNA) (left) is a sterile preloaded needle assembly designed to snap into the DNA applicator gun. The Single Use Disposable Syringe (SUDS) (right) is a sterile syringe pre-loaded with the PIT tag (microchip). The protective cover is snapped off prior to injection. (*Note*: SUDS is arguably the simplest method, but it produces a lot of waste because components are used only once.) Source: http://www.ezidavid.com/prod01.htm

PREPARING FLIPPER TAGS FOR FIELD APPLICATION

Wash- During the manufacturing process the tags are covered in a lubricating oil comprised of an animal-based oil and mineral spirits, and therefore *must* be washed prior to being applied to a turtle. Unwashed tags quickly cause infection at the point of application. One option is to wash your tags in hot soapy water; another option is to use a biodegradable solvent or cleaning solution such as Simple Green® or BioChem SolSafe 245®. After cleaning, thoroughly dry the tags and store them in sealed plastic food storage boxes or Ziploc™ type bags.

Bend- If you consistently encounter problems in the field with tags that do not fully cinch closed, give extra care to loading each tag correctly; that is, with the base plate flush against the plier (see Figure 9). You may also find it useful to adjust/bend the tag to help ensure that the point of the tag enters the hole during the application process. This is best done in the light, and should be part of the preparation phase. Bend the tag so that the pointed end meets up with the hole, but be careful not to bend the tag too frequently as this may affect the integrity of the metal (this is particularly true with the softer Monel tags). Once you have bent the tag to ensure a fit, re-open the tag so that it will be retained snugly in the tag applicator.

Record- Record all the tags numbers allotted to the tagging kit(s) at the time they are distributed from storage. Tags can be easily lost, misapplied, or misread. Knowing the tag numbers in each individual kit assists in accurate record keeping of tag fate data. *Hint*: For accessibility in the field at night, keep tags in a small bag in your field kit, or strung together on wire or fishing line.

III. TAGGING PROTOCOLS

WHERE SHOULD A FLIPPER TAG BE APPLIED?

Hard-shelled turtles- Two tags, one in the trailing edge of each front flipper, should be applied to every turtle. The secure placement of two tags, referred to as "double-tagging", increases the likelihood that a turtle will retain her unique identification over several years.

Metal (or plastic) flipper tags can be applied in one of two ways: either through (Figure 5a) or between (Figure 5b) the enlarged fleshy scales located at the trailing edge of the flipper. If through the scale, we recommend placement in the center of the first or second scale proximal to (closest to) the body of the turtle (meaning closest to the axilla or "armpit") on both the left and the right front flippers. If between the scales, we recommend placing the tag between the first and second scales.

There is debate among experienced field scientists whether tags are retained longer when placed through or between scales. Some observe that a callous forms in the scale, creating a thickening at the site of tagging that eventually pops the tag open and results in its loss. Others counter that the scale provides a solid grip for the tag, and that tags placed in the softer skin between the scales are more likely to be lost. There is no definitive answer to this debate, and we encourage

you to experiment with tag placement and to identify the tagging location that works best for you and for your population of sea turtles.

Regardless of whether your tag is placed through or between scales, it is important to remember that with increasing distance away from the body, tag retention is compromised. The further the tag is placed from the body, the more likely it is to be lost due to hydrodynamic forces, biting during courtship (or from fish), ensnarement in a fishing net, etc.

The tag should be applied so that there is approximately 3-5 mm of open space between the trailing edge of the flipper and the inside curve of the tag. Experience with the tagging of juvenile turtles in Barbados has shown that tags may "grow out" quite quickly in some species. Juveniles vary greatly in their growth rates at different size classes, and some size classes may be more vulnerable than others to losing tags through scale growth above the tag insertion point. Some juveniles are recaptured after only a few months of freedom with their tags barely hanging on! The holes have not increased in size, suggesting scale growth above (as opposed to below) the tag insertion point (Julia Horrocks, BSTP, pers. observ.).

The Inconel tag in Figure 5b is instructive in that it illustrates the challenge of tagging small juveniles. The tag has too much overhang, and would likely be better retained with about half as much space between the flipper edge and the inside curve of the tag. However, given the size of the turtle, placement further into the flipper would have been impossible. The photo is also instructive in illustrating that the tag is correctly cinched, but note that it was placed "upside-down" which is not the usual orientation.

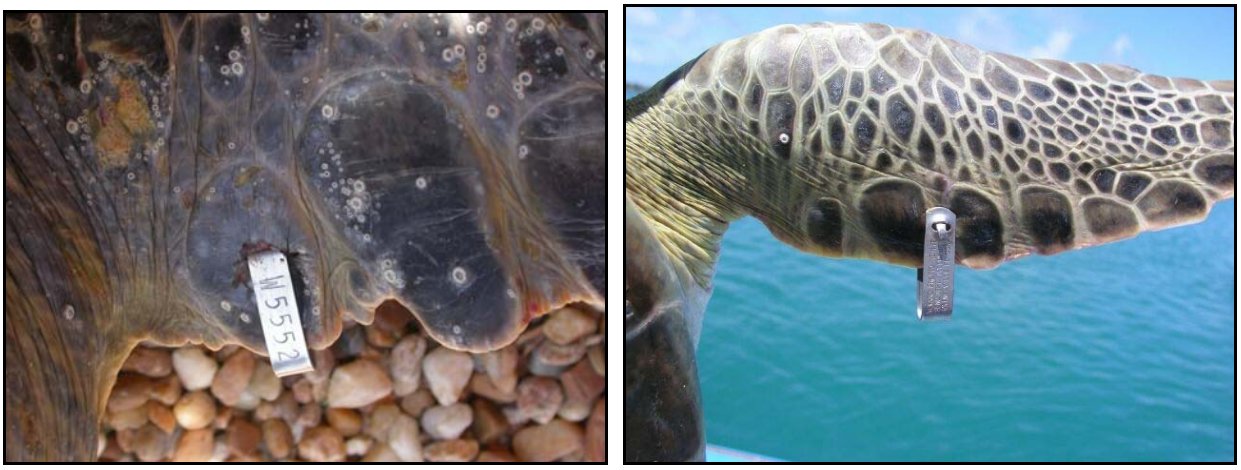


Figure 5. Metal Inconel style flipper tag placed (a) <u>through</u> the scale in the front flipper of a juvenile green turtle (Photo: Stacy Kubis/WIDECAST) and (b) <u>between</u> scales on the front flipper of a juvenile green turtle (Photo: Bermuda Turtle Project).

It is noteworthy that placing a metal tag, especially a Monel style tag, through a scale in a large hard-shelled adult or into a leatherback turtle's flipper may require the pre-punching of an insertion hole for the tag. The insertion should be made quickly and cleanly with a small blade

(such as a Swiss Army® knife blade) inserted perpendicular to the scale. The knife should be sterilised after each use with an alcohol wipe or dipped in a small field bottle of disinfectant.

Rear flipper placement is also an option for hard-shelled species, and is routine for leatherbacks. Some experts contend that rear flipper placement reduces the chance that the tag will cause entanglement in nets. Notwithstanding, the long history of front flipper tagging means that a rear-placed tag is less likely to be found and read during later encounters. If, however, injury or other circumstances significantly reduce the likelihood of successful tagging on the front flipper, a rear flipper tag is best placed through (or adjacent to) the first large scale (Figure 6).

Figure 6. Metal flipper tag placed adjacent to the first large scale in the rear flipper of a green turtle. Source: Balazs (1999).

Leatherback turtles- Experience has shown that tags applied to the front flippers of leatherback sea turtles show lower retention rates than tags applied to rear flippers. The reasons for this are related to swimming dynamics and epidermal characteristics. We recommend that leatherbacks be tagged with Monel tags in the "baggy pants area"; that is, in the fold of skin that connects the tail to the rear flipper (Figure 7a). Two tags, one in each rear flipper, should be applied. Note that application of Monel tags will typically require the pre-punching of an insertion hole (see "Where Should a Flipper Tag be Applied?").

To find the optimal location, run your finger along the edge of the rear flipper, feeling the thickness of the skin. Place the tag where the skin is thinnest; if the skin is too thick, the tag will not cinch completely. Leave at least 1 cm of open space between the flipper edge and the inside curve of the tag. Occasionally the skin is too thick for the tag to penetrate and lock securely (such a condition is especially prevalent in leatherbacks that have already lost a tag from this location). If this is the case, it is best to move the tag location distally (i.e. *away* from the tail) until a suitable location can be found. If you conclude there is no place that a tag can be applied, the placement of two tags on the same flipper is acceptable -- of prime importance is that every turtle be double-tagged.

Note: If you place the tag too close to the tail you risk a painful experience, and ongoing discomfort for the turtle. If you place the tag too far along the flipper edge, the flesh becomes too thick and tough to retain the tag and/or it is likely to be lost to abrasion during the next nesting.

Inconel style 1005-681 tags are not recommended for leatherbacks, but if their occasional use is unavoidable they should be placed where the skin is thinnest and a small gap left between the edge of the flipper and the inside curve of the tag (to allow for temporary swelling).

If tagging a leatherback on a front flipper is unavoidable, place tags "upside down" so that each tag inserts UP through the flipper. This will position the sharp tab on the upper surface of the flipper, thus preventing the sharp tine from scoring and bloodying the leathery carapace during nesting. The tag should be placed just distal of the soft "armpit" region. This can be discovered by feeling along the edge of the flipper from the body outwards. The point at which you feel a distinct hardening of the flipper edge is the recommended tag site.

A slight gap should remain between the edge of the flipper and the inside curve of the closed tag (Figure 7b).

Figure 7. Correct placement of a Monel style tag to the (a) rear flipper of an adult leatherback (Photo: P. Dutton/ NOAA) and (b) front flipper of an adult leatherback (Photo: Scott A. Eckert/ WIDECAST).

In summary-

- always double-tag – providing each turtle two unique identifying tags, typically one on each front (or one on each rear) flipper,
- every turtle should carry two good flipper tags, meaning, for example, that if an animal arrives on the nesting beach (or is captured at sea) carrying two well-placed and readable tags (but not your own), *do not apply additional tags*, simply record the tag type, number and return address on your data sheet; alternatively, if s/he is carrying a single tag or one or more poorly placed or unreadable tags, tags should be added and/or removed as necessary (return all removed tags to their project of origin!),
- be consistent in your choice of tag site (through or between scales, through the first or second scale, etc.),

- always *check all four flippers* (running your fingers very gently along all edges) because you are likely to see tagged turtles from other places, and their preferred tag site may not be the same as yours!,
- follow the instructions in this Manual so that the application of the tag is clean and quick, and the tag is correctly and securely cinched, and
- leave a small (but not too small) space between the tag and the flipper edge.

Hint: Practice tagging technique on a sheet of corrugated cardboard. It is important to become comfortable and confident with the quick, decisive action needed to penetrate the flesh and cinch the tag correctly. Slow or imprecise movements can cause discomfort to the turtle. Moreover, if the animal moves (especially in a startle response) during tag placement, the application may be ruined. See "How Should a Flipper be Applied?", below.

Cautionary Statement: Unfortunately, fibropapilloma tumors have been documented in Caribbean sea turtles, particularly green turtles. Turtles with obvious fibropapilloma disease should not be tagged anywhere near a potential tumor site, as the tagging may be painful for the turtle, may result in premature tag loss, and may expose turtles subsequently tagged with the same tagging pliers to a potentially fatal infection (see Appendix C for further detail). For background information and photos, visit http://www.vetmed.ufl.edu/sacs/wildlife/fibpap.html. For a full bibliography on this disease, see http://www.turtles.org/nmfsbib.htm.

HOW SHOULD A FLIPPER TAG BE APPLIED?

Before applying a tag, examine the area for tag scars. Scars are difficult to confirm, but can appear as rips in the flipper scales or skin, or lumps of scar tissue in the same areas in both front flippers. Feel along the edges of all flippers, and gently squeeze the first and second scales to identify any lumps (check that you're not feeling a small barnacle!). Record the presence of tag scars, or potential tag scars, on the datasheet and avoid placing new tags in these areas. Apply new tags as described below.

1. Rinse the tip of the tagging pliers and the tags (and a field knife, if used) in alcohol.

2. Cleanse tagging site on the turtle with Betadine© or rubbing alcohol before tag insertion.

3. Pull the tag through the grooved guides in the jaws of the applicator (pliers) until it "snaps" into place. Make sure that the base plate of the tag is flat against the bottom jaw and the "bubble" is seated in the hole. Marking one jaw of the pliers with white paint can assist in loading the tags correctly at night. *Be sure to check that the tag is seated securely* before proceeding to the next step.
4. Position the tag and pliers so that the tag number is facing upwards, is at the proper location on the flipper, and will result in an appropriate gap between the trailing edge of the flipper and the inside curve of the tag

Figure 8. A Monel 1005-49 style metal flipper tag correctly loaded (left) and cinched (right) in the application pliers. ALWAYS align the base plate of the tag flat against the pliers. Note the tine bent over and completely through the stirrup. Source: http://www.nationalband.com/nbt.pdf

5. Squeeze the pliers with a firm, smooth action. Squeezing too lightly will not allow the tine to bend and lock into place, while squeezing too hard may cause the tag to flatten and pinch the flipper. *Either mistake will result in tag loss, and the latter (squeezing too tightly) can cause unnecessary and unacceptable discomfort to the turtle.* Topical anesthetics, such as for human sunburn, are sometimes recommended but should not be necessary; if tags are applied properly, the typical reaction is one of only mild discomfort.

6. Confirm that the tag is properly applied and cinched. For Inconel tags, turn the flipper over and examine the bottom of the tag to confirm that the tag has penetrated and that the tip (tine) is completely bent over and secure. An Inconel tag that is not secure can often be re-crimped with the tagging pliers. If this fails, remove the tag carefully and try again with a new tag, using the same puncture hole if possible.

   In the case of a stirrup-style Monel tag (Figure 8) where the bent tine is not visible, place your thumb and index finger on either side of the tag and gently attempt to wedge your fingers under the tag; if the tag pops open, it is not secure and must be replaced.

7. RECORD THE TAG NUMBER. It is only after you have confirmed the proper and secure placement of the tag(s) that the tag numbers are recorded on the datasheet. Record the numbers carefully, and indicate the placement site (e.g. left front flipper) if required by the datasheet. Take **GREAT CARE** in reading and transcribing the numbers. Check and *double-check* that you have read and recorded the numbers correctly (it is helpful if a second person reads the numbers to the data recorder). Always record zeros.

Hint: As noted earlier, you might want to consider practicing the technique for applying flipper tags through a piece of corrugated cardboard until you are comfortable with decisive and successful tag insertion. "Successful" tag insertion is defined as a secure clasp (the tip of the tag is completely bent over and fastened), correct spacing between the flipper edge and the inside curve of the tag, and no pinching of the flipper flesh.

WHEN SHOULD A FLIPPER TAG BE APPLIED?

The timing of tag placement becomes important when tagging a nesting female. To minimise disturbance to a nesting hard-shelled turtle, it is recommended that tagging (whether flipper or PIT tagging) occur during the late stages of egg-laying, or during the early stages of nest tamping and covering. Some researchers argue that the surprise or agitation that sometimes accompanies tagging may cause the female to abort her egg-laying (or fail to cover the nest) if tagging takes place during egg-laying. The truth is that sea turtle populations differ in their response to tagging, so take care to establish a field procedure that consistently works best in your situation.

For ease of placement, rear flipper tagging of nesting leatherbacks is done during the latter stages of egg-laying, before the rear flippers become engaged in nest filling.

A successful saturation tagging programme is defined by the application of two tags to every turtle encountered in the study area. A gravid female should be given every opportunity to successfully complete a nest, and should not be interfered with until it is clear she is returning to the sea. At this point, she can be respectfully restrained long enough to apply at least one tag. Such restraint is also called for if project personnel encounter a turtle *after* a successful nesting and during her return to the sea. Covering (not touching) her eyes with your hands is often sufficient to stop her long enough to insert a tag. Alternatively, straddle her, facing the same direction, and pull back on the nuchal scute (the edge of the shell, just behind the head) sufficiently to stop her forward movement or kneel very gently on a foreflipper to bring her to a halt. A partner should complete the tagging at this point.

In the case of a leatherback, which may weigh in excess of 500 kg, ordinary restraint procedures do not apply. Experience has shown that gravid females can be "steered" by placing a leg or a stout, smooth stick against the animal's shoulder. She will turn away from the obstruction, and thus the direction of her movement can be controlled (directed away from the water, for example) if more time is needed for tagging.

WHEN SHOULD A FLIPPER TAG BE REMOVED?

A tag should be removed and replaced if it is causing swelling or disfigurement to the surrounding tissue, or if it is corroded or fouled (such as by algae or barnacles) to the point where it can no longer be read clearly. Remember to FIRST apply a new tag (or tags) to the turtle *before* the fouled tags are removed. On a nesting beach this reduces the chance that a turtle will depart untagged.

To easily remove a damaged or corroded Inconel tag, two needle-nose pliers are useful: one to hold the tag firm and stable and one to snap open the tightly clinched locking end. Monel tags must be cut near the locking end of the tag with a pair of strong wire cutters.

RECORD the tag number and the reason for removal, and store the tag for future reference. If the tag was applied by another project, please return it to the address embossed on the tag with a note documenting when, where and how the animal was encountered and why the tag was removed. NEVER remove a tag unless it is unreadable or causing discomfort to the turtle.

WHAT ABOUT PIT TAGS?

Applying PIT (Passive Integrated Transponder) tags is considered to be more invasive than applying flipper tags and should be done only under the guidance of workers experienced with the technique. Before embarking on a programme of PIT tagging, please consult with MTTC staff and seek advice from experienced PIT tagging colleagues in the region. PIT tagging is not a substitute for flipper tagging, but is best used together with flipper tagging.

A PIT tag is injected under the skin, generally into muscle, using a needle applicator provided by the manufacturer. Most PIT tags and applicators are pre-sterilized and packaged for field use. If the PIT tag style you select is not pre-sterilized, it is important that each tag be soaked in a non-toxic sterilizing solution (such as alcohol) prior to use.

We recommend that only one PIT tag be applied per animal. We recommend that turtles smaller than 30 cm SCL not be PIT tagged. Finally, we recommend that novice taggers do not try to PIT tag animals smaller than 35 cm SCL.

Before applying a PIT tag- Make sure that the turtle has not already been PIT tagged! Sea turtles encountered in the Wider Caribbean Region may have already have been tagged in the USA, South America, West Africa or the Mediterranean during an earlier life phase, or during a nesting or non-nesting encounter with another research project. With flipper tagging this is easy to confirm, but with PIT tags you need a reader that can give you accurate information (review "Selecting a Tag Type: PIT Tags").

There is no consensus on the placement of PIT tags, and for this reason project personnel should examine all possible sites (i.e. left and right shoulder muscle, left and right fore flippers, left and right rear flippers, neck) for existing tags before a new tag is inserted. Be sure to scan all areas, even if a PIT tag is found, because some turtles may already have more than one PIT tag.

Protect the reader under field conditions by placing it in a clear and durable plastic bag. To scan for an existing tag: turn the reader ON (see Figure 9), place the reader (in the bag) directly on the skin of the turtle to decrease the "read distance", and then press and hold the READ button. Continue to hold the READ button while moving over the area to be scanned in a circular motion. Be sure to use the entire reading surface of the scanner when trying to detect the tag.

After you have made a number of scans of the area, re-scan the area while tilting the scanner at various angles. PIT tags read best when the tag is pointing with the small end (picture the tip of a grain of rice) pointed directly toward the scanner, but the tag is not always oriented optimally under the skin. By tilting the reading surface at different angles during a sweep, you improve your chances of detecting a tag that may be angled away from the skin.

Remember that read distance is a big issue with leatherbacks, meaning that the tag may be too far away to be detected and read accurately. There is no easy solution to this, but be as thorough as possible in scanning for any pre-existing tags before the decision is made to insert a new tag.

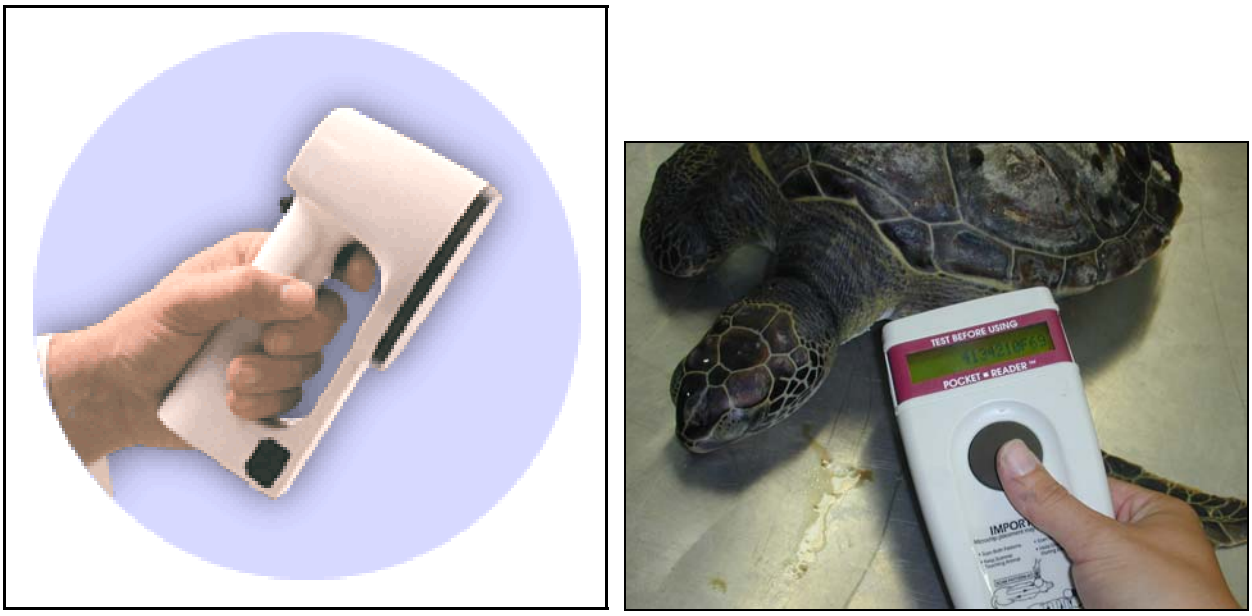


Figure 9. Several brands, including the (a) AVID reader (http://www.ezidavid. com/avid_technology.htm) and (b) Destron Pocket Reader (Photo: NOAA/NMFS/SEFSC), utilise "multi-mode technology" that enables them to read ID coded devices from various manufacturers.

If a PIT tag number is identified by the reader, the number should be entered on the data sheet in the space allocated for this type of tag, and should be documented EXACTLY as it appears on the scanner display, including any hyphens that may appear as part of the code. The tag "number" is usually hexadecimal (digits 0-9 and letters A-F) and 10 bytes (125, 128, or 400 kHz tags) or 15 bytes (134.2 kHz tags) long. Double-check to make sure you have recorded the tag "number" exactly as it appears on the reader display, taking care concerning letters and numbers that can easily be confused, e.g. the letter O and the number 0 (or, Ø). If the scanner display reads "AVID" or reads inconsistently, you may have detected an encrypted AVID tag. Encrypted tags may display a 16 byte alphanumeric code (0-9 and A-Z) on non-AVID reader displays.

Hint: If your reader has a low battery, or if you are attempting to read an encrypted tag that is not recognised by your reader, some readers will give bogus or "ghost" numbers. An example might be an excessively long alphanumeric code or nonsense symbols. If this occurs, turn the reader OFF, turn it back ON, and re-scan. If nonsense readings persist, try another reader or replace the batteries. If nonsense readings still persist, record them for later evaluation and make relevant notes on the data sheet. Remember also that if the turtle, or flipper, is resting on anything iron (such as the bed of a truck), you should lift it up a few inches before reading. Iron (and certain neon lighting and electrical motors nearby) can neutralize the ability of the reader to detect a tag.

Once you confirm that the turtle is not already carrying a PIT tag, prepare a new tag for insertion.

ALWAYS SCAN (AND RECORD) THE NEW TAG BEFORE YOU INSERT IT TO VERIFY THAT IT IS FUNCTIONAL.

Hard-shelled turtles- In hard-shelled turtles a PIT tag is typically placed in either a front or rear flipper). There is no clear consensus amongst scientists about the "correct" placement of a PIT tag in a hard-shelled turtle. The Bermuda Turtle Project, one of a handful of projects in the WIDECAST region with years of experience in PIT tagging (typically with foraging juveniles), favors tag insertion into the front flipper between the radius and ulna (Figure 10). The major joint in the flipper is between the humerus bone and the radius and ulna bones. You should be able to feel a depression between the radius and ulna bones. This is where the PIT tag is applied.

Before application, the area where the tag will be injected should be cleaned with a Betadine® (or Povodine®) saturated swab.

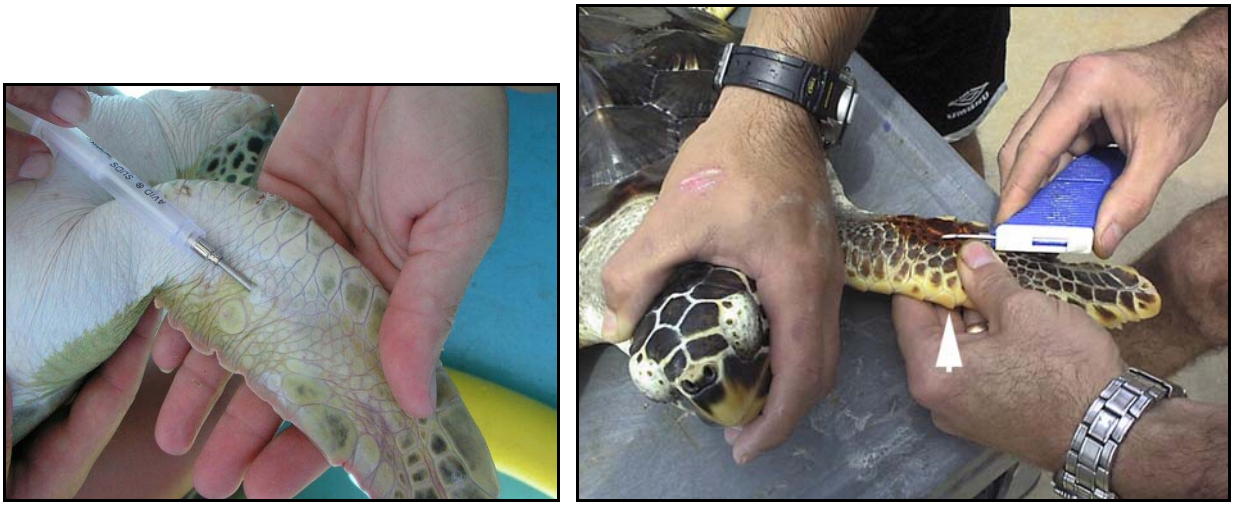


Figure 10. Inserting a PIT tag into the front flipper of a juvenile sea turtle, showing both (a) ventral and (b) dorsal insertion points. Note the angle of the applicator to ensure that the tag is inserted just beneath the skin, not too deep into the flipper. Note, as well, that taggers *should* be wearing gloves! Photos: (a) Bermuda Turtle Project; (b) Jeanette Wyneken/ Florida Atlantic University.

The tag in Figure 10(a) is injected proximal to distal (i.e. point the syringe toward the fin tip) into the connective tissue of the forearm between the radius and ulna, parallel to the bone, by inserting the syringe under the skin between the radius and ulna and pushing the plunger to move the tag out of the applicator and into the connective tissue. Watch for bleeding after injection. If blood flows from the wound, apply pressure with swab soaked in a broad-based topical microbicide, such as a povidine-iodine antiseptic solution (e.g. Betadine®), until the flow stops. It may be necessary, especially in small juveniles, to apply a small amount of surgical glue to close the opening. In contrast, the juvenile loggerhead in Figure 10(b) is being injected adjacent to (as opposed to just distil to) the radius and ulna. The landmark for the distil ends of the radius and ulna is the end of the three large scales on the leading edge of the flipper; see arrow.

An alternative, well-tested methodology for tagging in the front flipper recommends using the triceps muscle complex on the front and top of the humerus. This muscle mass is easy to isolate by pinching it next to the anterior or dorsal humerus (Figures 11 and 12). The muscle is active

during part of the swimming stroke, but no lameness has been detected in animals receiving a PIT tag in this location (J. Wyneken, Florida Atlantic University, pers. comm., 2005).

Whatever location you choose, remember that PIT tags are designed to become encapsulated with fibrous connective tissue in muscle. When the tag is encapsulated, it will not migrate away from the insertion point. Experience has shown that the tags do not encapsulate as reliably in skin, tendon, ligament, connective tissue or fat (J. Wyneken, pers. comm., 2004).

Figure 11. Inserting a PIT tag into the front flipper of a juvenile sea turtle, illustrating the technique of pinching the triceps muscle complex on the front and top of the humerus bone. The leading edge of the flipper is facing the photographer.

Note the angle of the applicator to ensure that the tag is inserted into the muscle complex, but not too deep into the flipper.

Photo: NOAA/NMFS/SEFSC.

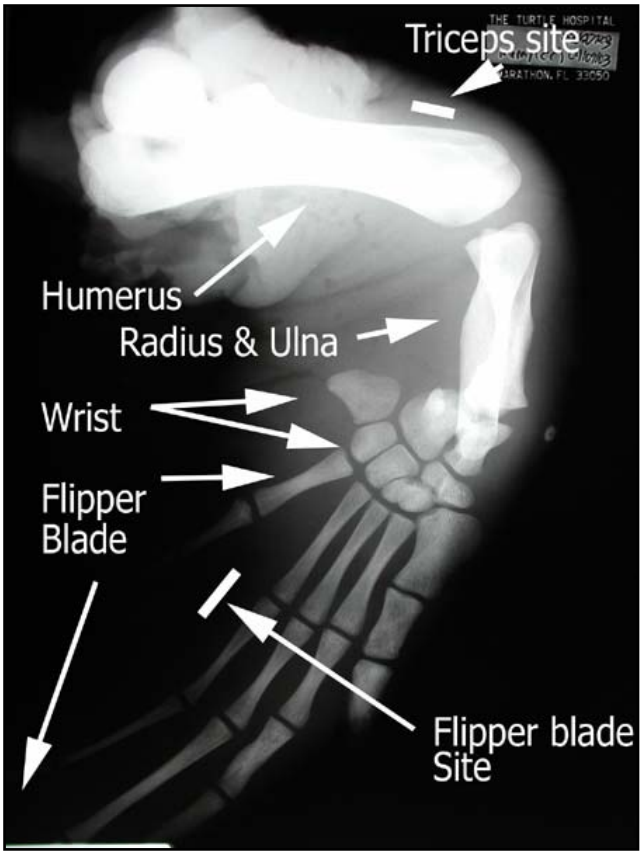


Figure 12. A labeled radiograph illustrating the successful placement of a PIT tag in the triceps muscle complex of the fore flipper, parallel to the humerus bone (insertion shown in Fig. 11).

Another option, not discussed in the text, is to place the PIT tag in the flipper blade.

Source: Image courtesy of The Turtle Hospital, annotated by Jeanette Wyneken, Florida Atlantic University.

In the case of nesting females, many experts recommend rear flipper placement of the PIT tag. This ensures that application occurs away from the head (reducing chances of disturbance), typically results in less associated bleeding than in the front flipper, less discomfort is exhibited by the turtle during the procedure, and there is less chance of injury to the researcher. Rear flipper PIT tag placement, as shown in Figure 13, is 1-2 scales up from the claw scale and about one-third flipper distance medial. The location of insertion is between the scales into the seam. The injection angle is under the skin, i.e. not deep into the flipper or toward bones (G. Balazs, NOAA Hawai'i, pers. comm., 2004).

Figure 13. Inserting a PIT tag into the rear flipper of an adult green turtle. Note the angle of the applicator to ensure that the tag is inserted just beneath the skin, not deep into the flipper. Photo: George Balazs/ NOAA Hawai'i.

We recommend that tagging of nesting females occur during the mid- to late-stages of egg-laying when all flippers are relatively stationary. If the flippers are flailing or the turtle is moving, the chance of injury to the turtle and/or the tagger is much greater.

As soon as the PIT tag is successfully applied, the adhesive strip with the tag number and bar code that comes with each applicator package should be transferred to the data sheet. The person applying the PIT tag should then read the injected tag again with the reader and confirm the number with the data recorder.

Leatherback turtles- Leatherbacks should be PIT tagged in the muscle of the front right or left shoulder (Figure 14). The tag should always be injected perpendicular to the dermis (not at an angle, as is sometimes suggested), and embedded to the full depth of the needle so as to penetrate beyond the thick layer of blubber into the underlying muscle. Assuming the tag retains that orientation, this insertion protocol best facilitates accurate scanning.

Tagging of nesting females should occur during the mid to late egg-laying phase, while the turtle is still motionless. Before application, the area where the tag will be injected should be cleaned

with a swab soaked in a broad-based topical microbicide, such as a povidine-iodine antiseptic solution (e.g. Betadine®). Watch for bleeding after injection. If blood flows from the wound, apply pressure with a clean gauze pad until the flow stops. If necessary, apply a small amount of surgical glue to close the opening.

Figure 14. Recommended PIT tagging site for Caribbean leatherback turtles. Photo: Matthew Godfrey, with schematic from Dutton and McDonald (1994).

Shoulder placement (Figure 14) is preferred because (i) the area is exposed, making it relatively easy to apply and read the tag without disturbing the turtle; (ii) the area is relatively well protected, since more distal portions can be lost or disfigured during predator attacks; and (iii) stranded animals and carcasses are often missing flippers, making it impossible to verify the presence of traditional flipper tags (Dutton and McDonald, 1994). ***Warning***: Don't place the tag too high on the shoulder, where there is a nerve bundle. Always practice your technique first with mentoring from an experienced colleague.

As soon as the PIT tag is successfully applied, the adhesive strip with the tag number and bar code that comes with each applicator package should be transferred to the data sheet. The person applying the PIT tag should then read the injected tag <u>again</u> with the reader and <u>confirm</u> the number with the data recorder.

In all cases, the <u>needle should be re-sheathed and discarded safely, ideally into a hazard bin</u>. It is essential that used needles not become litter.

A NOTE ABOUT "LIVING TAGS"

"Living" tags have occasionally been used to identify cohorts of hatchlings or yearlings released in a given year. Contrasting pigmented marks are created by the surgical exchange (referred to as "autografting") of small pieces of tissue between the carapace and plastron (Figure 15). These marks are retained and increase in size as the animal grows (Balazs, 1999).

Head-started Kemp's ridleys were often "living tagged" before their release into the Gulf of Mexico in the 1980s (Fontaine et al., 1988; Shaver, 1996). Green sea turtles so marked by certain projects in Mexico (see Zurita et al., 1994) have subsequently been encountered in distant waters, such as the Bahamas (Bjorndal et al., 2003) and Barbados (Julia Horrocks, BSTP, pers. comm., 2004).

Figure 15. A green turtle with a living tag. On the plastron the tag appears as a dark spot (or streak) and on the carapace, as a light spot (or streak). Photos: Julia Horrocks/BSTP.

The U.S. National Marine Fisheries Service's national "Sea Turtle Research Techniques Manual", not yet publicly available, will feature a comprehensive and well-illustrated chapter on how to mark a sea turtle with a "living tag". When complete, the manual will be posted to http://www.sefsc.noaa.gov/seaturtletechmemos.jsp. Watch http://www.widecast.org/tagging for a link to this important new resource.

IV. RECORD-KEEPING

An accurate and up-to-date log of the project's tags and tag fate should be kept at all times. As tags are taken into the field, it is useful to document how many tags are taken out and by whom. It is important that *all* tags are accounted for at *all* times, i.e. whether they are applied to turtles, in inventory for future use, in a tagging kit, destroyed (e.g. removed by project staff due to failed placement, excessive fouling), or lost. If a tag is destroyed, the tag must be archived and kept for future reference. A tag documented as "destroyed" should *always* be straightened (flat) to ensure that there will never be any attempt to place it on a turtle.

Record-keeping tools are provided by the MTTC. For example, Access-based relational database management software is available through the MTTC upon request (Eckert and Sammy, 2005). The software allows entry of Nesting, Hatching, Capture, Sighting, and Stranding events and provides a selection of standardised datasheets.

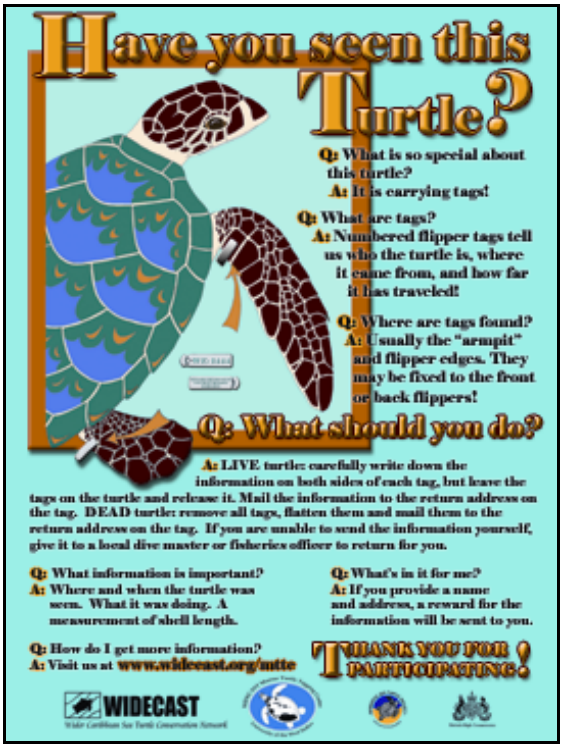
V. TAG RECOVERY: RETURNING A TAG TO THE MTTC

Tag recovery and reporting is important! Tags removed from dead turtles or numbers recorded from live turtles should be sent by mail to the return address on the tag: UWI, Dept. Biology, Barbados. A functional tag should *never* be removed from a live turtle (see "When Should a Flipper Tag be Removed?"). All reports of tagged turtles received by the MTTC are immediately forwarded to a contact person associated with the field project that originally applied the tag(s). Such notification includes all details reported to the MTTC and a contact address for the person recovering/ returning the tag.

The MTTC provides a reward in the form of a cap or T-shirt to any person who returns a tag, along with information on where the turtle was tagged, when and by whom. If more information is required, the person/organisation who recovered the tag can follow up directly with the Project who applied it. Colourful posters (below) are available from the MTTC to encourage fishermen, yachters, divers, and others to report tag numbers read from live turtles and to document and return tags removed from dead turtles to the MTTC in Barbados.

Plastic and metal flipper tags not distributed through the MTTC can be traced through various online databases, including:

- **TAGFINDER** http://www.seaturtle.org/tagfinder/
- **Cooperative Marine Turtle Tagging Program** (a global database) http://accstr.ufl.edu/cmttp.html
- **Marine Turtles of French Guiana** http://www.ese.u-sud.fr/epc/conservation/pages/TortumarE.html



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APPENDIX A

APPLYING FOR TAGS FROM THE MTTC

The application process can be completed via mail or email. You may download the Tag Application Form from http://www.widecast.org or, if you do not have access to the Internet, you may photocopy the form from this appendix or request a copy from:

Dr. Julia A. Horrocks
Coordinator
WIDECAST Marine Turtle Tagging Centre
University of the West Indies-Cave Hill Campus
P. O. Box 64
Bridgetown, Barbados
Tel: (246) 417-4320
Fax: (246) 417-4325
horrocks@uwichill.edu.bb
http://www.barbadosseaturtles.org

The following documents are required to complete your application:

- An Application Form,
- A permit (or official letter), which states that the Government of the country in which the turtles are to be tagged has given permission for tagging to occur,
- A WIDECAST/MTTC Tag Training workshop completion certificate, and
- A signed Letter of Agreement specifying obligations, restrictions, and proprietary protections related to reporting and data-sharing.

Please ensure that your completed Tag Application Form and accompanying documentation reaches the MTTC at least three (3) weeks before you need the tags. After an application has been received, and all permits and related documents are supplied, your order will be packaged and sent by courier or airmail to the address supplied on your Tag Application Form. The MTTC appreciates a refund on mailing costs.

If you have questions concerning how to obtain tags and tagging equipment, how to participate in the regional tag registry, where to receive training in tagging or general field procedures, or how to take advantage of the many other services offered by the Centre, please contact the MTTC Coordinator at horrocks@uwichill.edu.bb or visit us online at http://www.widecast.org/tagging.

Application Form

Marine Turtle Tags and Tagging Equipment

WIDECAST Marine Turtle Tagging Centre (MTTC)

Applicant Name:_____

Applicant Position: _____

Applicant Address:_____

Applicant Tel/Fax/Email: _____

Project Name: _____

Project Location (e.g., beach name): _____

Primary Objective(s): [ ] Research [ ] Conservation [ ] Management

Project Type: [ ] New [ ] Ongoing

Species to be Tagged: [ ] Leatherback [ ] Green [ ] Loggerhead
[ ] Hawksbill [ ] Olive Ridley [ ] Kemp's Ridley

Life Stages Involved: [ ] adults [ ] juveniles [ ] both

Tagging Location: [ ] nesting beach [ ] at sea [ ] both

Tagging History: [ ] Regular tagging since _____
[ ] Irregular tagging since _____
[ ] The project has not included tagging in the past

If tags have been used in the past, please indicate:

Tag Type: [ ] Monel 1005-49 [ ] Monel 1005-6 [ ] Inconel 681
[ ] Titanium [ ] Other

Tag Number Series: _____
Tag Return Address: _____
_____

How many tags do you need (based on 2 tags per turtle) on an annual basis? _____

How many tags are you requesting from the MTTC? _____

What type of tag are you requesting? [ ] Monel 1005-49 [ ] Inconel 681

Are you requesting tagging applicators (tag pliers)? [ ] Yes [ ] No

If yes, how many tagging applicators do you need? _____

Adherence to regulatory conditions is important. In many countries, a government Fisheries or Forestry permit is required for handling sea turtles, gaining access to the nesting beach or marine research site, and/or conducting a wildlife field project. Have you applied for such a permit, and do you have it on file?

[ ] Yes (please attach copies) [ ] No

If No, please explain: _____
_____
_____

Has a member of the Project staff attended a WIDECAST tagging training workshop? [ ] Yes (please attach a copy of the Course Certificate) [ ] No

Have you obtained tags from the MTTC in the past? [ ] Yes [ ] No

Do you agree to submit an Annual Tag Fate Report to MTTC* ? [ ] Yes [ ] No

Where should tags/pliers be shipped? _____
_____
_____
_____

*Annual tag fate reports should preferably be in Excel and provide the following information at minimum: Left flipper tag number, Right flipper tag number, Species, Location, Latitude/ Longitude, In-water or Nesting beach project.

Thank you! Please submit to:

Dr. Julia A. Horrocks, Coordinator
WIDECAST Marine Turtle Tagging Centre
University of the West Indies-Cave Hill
P. O. Box 64, Bridgetown, BARBADOS
Tel: (246) 417-4320, Fax: (246) 417-4325
Email: horrocks@uwichill.edu.bb
cc: keckert@widecast.org

For office use only: Date of Application: _____

MTTC Shipment Confirmation:
Tag Type: _____
Number of Tags: _____
Tag Series: _____

Tag Type: _____
Number of Tags: _____
Tag Series: _____

Number of Applicators: _____

Date Shipped: _____
Shipping Method: _____

Customs Letter Enclosed: [ ] Yes [ ] No

APPENDIX B

FLIPPER TAG MANUFACTURERS

At the time of writing, WIDECAST's Marine Turtle Tagging Centre (MTTC) inventories Inconel and Monel flipper tags manufactured by National Bank and Tag Company. Neither titanium tags nor plastic tags are currently inventoried; however, under some circumstances and for certain research objectives, plastic tags can be quite useful. For additional information about the various types of flipper tags (sold commercially as livestock ear tags), contact:

Dalton ID Systems (UK) Limited
Dalton House, Newtown Road
Henley-on-Thames, Oxon RG9 1HG
ENGLAND
http://www.dalton.co.uk/index.htm

National Band and Tag Company
721 York Street (P.O. Box 72430)
Newport, Kentucky 41072 USA
http://www.nationalband.com/nbtear.htm

Stockbrands Co. Pty. Ltd.
53 Edward Street, Osborne Park
Western Australia 6017
AUSTRALIA
http://www.fmb.com.au/index.html?target=dept_87.html&lang=en-gb

PIT TAG MANUFACTURERS

Avid Identification Systems, Inc.
3185 Hamner Ave.
Norco, California 92860 USA
http://www.AvidID.comhttp://www.ezidavid.com/products.htm

Biomark, Inc.
7615 West Riverside Drive
Boise, Idaho 83714 USA
http://www.biomark.com/

Trovan Electronic Identification Systems
See http://www.trovan.com/contacts.htm for national offices
See http://www.trovan.com/productsuni.htm for product information

APPENDIX C

FIBROPAPILLOMA DISEASE: WHAT TO DO WITH A FIBROPAPILLOMA-BEARING SEA TURTLE (1)

SAMPLE PROTOCOL: BERMUDA TURTLE PROJECT

Sea turtle fibropapilloma disease (FP) is a debilitating and sometimes fatal disease of sea turtles. It is seen most often in green turtles but is also known to occur in loggerheads and ridleys. It is currently unknown from Bermuda. However, because so little is known about the natural routes of transmission of FP, it is best at this time to work on the assumption that it is highly communicable and take appropriate precautions. A presentation given at the 19th Annual Sea Turtle Symposium recommends that researchers make every attempt to keep the disease out of populations where it does not now occur. The following protocol has been developed to reduce the possibility of fibropapilloma becoming established in Bermuda.

Recognizing fibropapilloma disease: Fibropapilloma disease is most easily recognized by the external tumor-like growths that it produces. These can occur on any of the soft tissues of the turtle but are most commonly seen on the softest areas of the head and neck, especially around the eyes, and at the base of the fore and hind flippers. They will appear as pea-sized to grape-fruit-sized growths, variable in color but usually pink to red, or gray to black. They often have a floral appearance, with a surface texture like a head of cauliflower, but may also be smooth. These tumors are well vascularized and will bleed readily when cut or abraded by the net

Preventing the spread of fibropapilloma disease: Healthy turtles with no evidence of the external tumor-like growths can carry the virus that apparently causes FP as well as other pathogenic agents of sea turtles. Thus, we must continue to use extreme caution with the body fluids of the sea turtles we handle. The tagging punch must be cleared of tissue and the punch and tag applicators disinfected with mild bleach solution after every turtle. Blood or other body fluids from one turtle should not be allowed to get on another turtle during sampling or at any other time. Do not use syringe needles or other instruments that break the skin (e.g.., PIT tag applicators, tagging punch) on multiple animals without disinfecting them thoroughly between animals. Frequent hand wiping with sanitizing hand wipes is recommended.

Capture of a papilloma-bearing turtle in the entrapment net: A turtle with obvious FP should not be placed directly in the catch boat, especially with other turtles. It seems likely that if we see FP it will appear in newly arrived, smaller turtles. We should handle the turtle with gloves and put the turtle (and used gloves) into the equipment bucket (removing the GPS and other equipment first) in order to isolate the turtle. The bucket should be scrubbed thoroughly with a 10% Clorox solution before being used again.

Turtles with obvious FP should not be taken on board [the research vessel] *Calamus* or to the Aquarium. The virus that is associated with the disease may survive for long periods outside of the host, especially if it is kept wet or moist. Thus, thorough treatment of all possibly infected surfaces with detergents, disinfectants, or prolonged drying would be required to make certain

that the disease would not be transmitted. Thus, all possibly infected turtles should be kept away from all areas where turtles are kept, including the decks of the catch-boat and *Calamus*, and the Aquarium, its tanks, and its water system.

A live turtle with FP should not be tagged, weighed or measured. It should be photo-documented, appropriate samples of the tumors should be taken and preserved directly in 10% buffered formalin without being frozen, and the animal should be removed from contact with all other sea turtles and kept out of any facility that houses sea turtles. If the affected turtle has a heavy tumor burden that seems clearly to be FP and the animal is seriously debilitated, euthanization should be considered by the government veterinarian. Samples of several tumors should be preserved in 10% buffered formalin. If the tumor burden is small or there is suspicion that the tumor is not FP, them the animal should be isolated and appropriate samples taken for assessment. If found to have FP, the diseased animal could be sent to an appropriate facility (i.e. Turtle Hospital in the Florida Keys) for further observation and possible rehabilitation.

It will be very important to confirm any possible cases of FP. This can best be done by collecting biopsies for complete pathological evaluation. Thus, a biopsy kit with gloves, 10% buffered formalin, appropriate-sized vials, scalpels, a small plastic ruler, and Clorox for clean up, should be assembled. This could be used for taking samples from a badly infected individual after it was euthanized, a mildly affected individual that would remain in isolation until the samples could be examined, or a dead stranded animal with suspicious tumors.

Stranding of a papilloma-bearing turtle: If a papilloma-bearing turtle is dead when it strands, it should be photo-documented at the stranding site. Photographs should be made of all surfaces, and a description recorded of the tumors, including measurements. If the turtle is fresh enough, a necropsy should be performed provided that the necropsy can be done under isolation conditions to avoid contaminating facilities where turtles are kept. If a complete necropsy cannot be performed, then a sample of the suspect tumor should be preserved in formalin for pathologic evaluation and the carcass disposed of (incinerated or buried on land). Even if the carcass is too poor to necropsy, get a sample of suspect tissue and dispose of the rest.

Any time that a suspect turtle is handled, all equipment used during handling and necropsy should be disinfected with 10% Clorox before being returned to the Aquarium. Gloves must be worn at all times. Do not transport the carcass using Aquarium vehicles and do not transport to the Aquarium for necropsy or freezing.

If a papilloma-bearing turtle strands alive, isolate it in a suitable-sized container at an appropriate location and take biopsies of suspect tissue for evaluation. The turtle should remain in isolation until the evaluation of the biopsy is complete. Based on the biopsies and the extent of any infection, a decision will be made as to whether the turtle should be euthanized or sent to an outside facility for rehabilitation.

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(1) *Source*: excerpted from Meylan, P., A. Meylan and J. Gray. 2003. Procedures Manual for the Bermuda Turtle Project. Bermuda Aquarium, Museum and Zoo. 37 pp.

APPENDIX D

SELECTED PEER-REVIEWED LITERATURE ON SEA TURTLE TAGGING

(Does *not* include references already listed in the Literature Cited section of this manual.)

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Bellini, C., M. H. Godfrey and T. M. Sanches. 2001. Metal tag loss in wild juvenile hawksbill sea turtles (*Eretmochelys imbricata*). Herpetological Review 32(3):172-174.

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NOTES

NOTES

WIDECAST

Wider Caribbean Sea Turtle Conservation Network

"Working together to build a future where all inhabitants of the Wider Caribbean Region, human and sea turtle alike, can live together in balance."

The Wider Caribbean Sea Turtle Conservation Network (WIDECAST) is a volunteer expert network and Partner Organization to the U.N. Environment Programme's Caribbean Environment Programme. WIDECAST was founded in 1981 in response to a recommendation by the IUCN/CCA Meeting of Non-Governmental Caribbean Organizations on Living Resources Conservation for Sustainable Development in the Wider Caribbean (Santo Domingo, 26-29 August 1981) that a "Wider Caribbean Sea Turtle Recovery Action Plan should be prepared ... consistent with the Action Plan for the Caribbean Environment Programme."

WIDECAST's vision for achieving a regional recovery action plan has focused on bringing the best available science to bear on sea turtle management and conservation, empowering stakeholders to make effective use of that science in the policy-making process, and providing a mechanism and a framework for cooperation within and among nations. By involving stakeholders at all levels and encouraging policy-oriented research, WIDECAST puts science to practical use in conserving biodiversity and advocates for grassroots involvement in decision-making and project implementation.

Through information exchange and training, WIDECAST promotes strong linkages between science, policy, and public participation in the design and implementation of conservation actions. The network recommends standards for range state adoption, develops pilot projects, provides technical assistance, supports initiatives that build capacity within participating countries and institutions, and promotes coordination among Caribbean countries in the collection, sharing and use of biodiversity data. Working closely with local communities and resource managers, the network has developed standard management guidelines and criteria that emphasize best practices and sustainability, ensuring that current utilization practices, whether consumptive or non-consumptive, do not undermine sea turtle survival over the long term.

With Country Coordinators in more than 40 Caribbean States and territories, WIDECAST has been instrumental in facilitating complementary conservation action across range states, strengthening and harmonizing legislation, encouraging community involvement, and raising public awareness of the endangered status of the region's six species of migratory sea turtles. Country Coordinators are drawn from both the governmental and non-governmental sectors, and must have sea turtle research and/or management experience and responsibility.

WWW.WIDECAST.ORG