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MANUAL FOR MASS WIRE TAGGING OF HATCHLING SEA TURTLES AND THE DETECTION OF INTERNAL WIRE TAGS

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GLOSSARY OF SELECTED TERMS AND ABBREVIATIONS

Carapace	The top shell of a turtle.
Dorsal	Pertaining to the top.
Fecundity	Fruitful in offspring.
Ferric	Containing iron.
Hatchling	A newly hatched sea turtle.
Head start	A feasibility study and experiment involving rearing Kemp's ridley sea turtles in captivity for 7 to 15 months before tagging and releasing them into the wild.
Kemp's Ridley	*Lepidochelys kempii*
Living tag	A piece of light colored plastron tissue is transplanted into the darker carapace leaving a living tissue mark.
Magnetometer	An instrument for used for detecting the presence of a magnetic charge.
NMFS	National Marine Fisheries Service.
Tincture	An active coloring or staining extract.
PIT tag	Passive Integrated Transponder. An internal tag containing an encoded microchip. PIT tags require a special PIT tag reader to retrieve the 10 character alpha-numeric code.
Plastron	The bottom shell of a turtle.
Ventral	Pertaining to the bottom.
Wand type tag detector (magnetometer)	Device for detecting a magnetized wire tag.

1.0 INTRODUCTION

Preparation of this manual was motivated by a need for a comprehensive field guide covering the application of internal wire tags in the mass tagging of sea turtle hatchlings and the detection of those tags later in the turtle's life. This manual is based primarily on the equipment and techniques used in the mass wire tagging of 3,336 Kemp's ridley (*Lepidochelys kempii*) hatchlings on the nesting beach at Rancho Nuevo, Mexico, during August, 1996 (Caillouet *et. al.*, 1997).

Although this illustrated manual thoroughly covers all the procedures necessary to successfully tag hatchlings with internal wire tags, it should not be substituted for formal training. It should be used to supplement formal training. This manual has been written assuming that the person(s) conducting the tagging are right handed. The automatic tag injectors are designed and manufactured for use by right handed persons. Left handed persons may achieve satisfactory results by holding the tagger upside down but this is not recommended.

It is recommended that the entire manual be read thoroughly before any attempt is made to tag hatchlings. Pay special attention to the **CAUTION** and **NOTE** sections listed within the procedure instructions. The **CAUTION** and **NOTE** sections provide valuable information that may mean the difference between successful tagging and non-successful tagging.

The manual is divided into four sections:

1. Background research involving internal wire tags;
2. Illustrated tagging techniques;
3. Illustrated tag detection techniques;
4. Appendices.

2.0 BACKGROUND RESEARCH INVOLVING THE INTERNAL WIRE TAG

2.1 JUSTIFICATION FOR TAGGING HATCHLINGS

Eckert *et al.* (1994) pointed out that evaluation of the Kemp's ridley sea turtle head start experiment involves comparing an experimental group consisting of head started turtles with a control group consisting of wild turtles. Comparisons between head started and wild Kemp's ridleys, based on their survival to maturity, nesting, production of viable young, survival of young to maturity, and fecundity of subsequent generations of adults, require that both head started and wild Kemp's ridleys be tagged or marked in numbers adequate to determine these population vital statistics as well as to distinguish them from one another on nesting beaches. Eckert *et al.* (1994) concluded that enough head started Kemp's ridleys had been marked and released, and recommended that a rigorous program be undertaken to mass mark as many wild hatchling Kemp's ridleys as possible (as a control) during each of two consecutive nesting seasons at Rancho Nuevo,

using the internal wire tag. The internal wire tag is an inexpensive tag which can be detected by portable magnetometer or X-ray.

2.2 PREVIOUS HATCHLING TAGGING WORK

Four different types of sea turtle tags (marking methods) are currently used on Kemp's ridley sea turtles: the metal flipper tag, the living tag, the internal (magnetized) wire tag, and the Passive Integrated Transponder (PIT) tag (Fontaine *et. al.* 1993). Only the internal magnetic wire tag has been tested and approved for marking hatchlings. The author has developed several PIT tag application techniques for hatchlings that are still in the experimental phase.

The internal wire tag has been used on Kemp's ridley yearlings since 1982 (Caillouet *et. al.*, 1997, Appendix A, Table 1). The Galveston laboratory tagged and released 15,011 Kemp's ridleys from 1982 through 1996. Beginning with the 1984 year-class, all head-started Kemp's ridleys were tagged with magnetized wire tags in either the right or left front flipper before release (Appendix A, Table 1).

Hatchling sea turtles were experimentally tagged with the internal wire tags in 1993, 1994 and 1995. 1996 was first year in which hatchling Kemp's ridleys received the internal non-magnetized wire tag, and were immediately released at the nesting beach.

Loggerhead hatchlings were the first to experimentally receive the internal wire tags in 1993. The internal wire tag has also been tested on Kemp's ridley hatchlings of the 1994 and 1995 year-classes, with excellent results (Appendix A, Table 2).

Other experiments on yearling and two year old sea turtles have shown that the wire tag can be magnetized immediately before detection, by passing a magnet over the front flipper where such tags are usually implanted, or before tagging by passing the tags through a magnetized head on the tag injectors (Fontaine *et. al.* 1993).

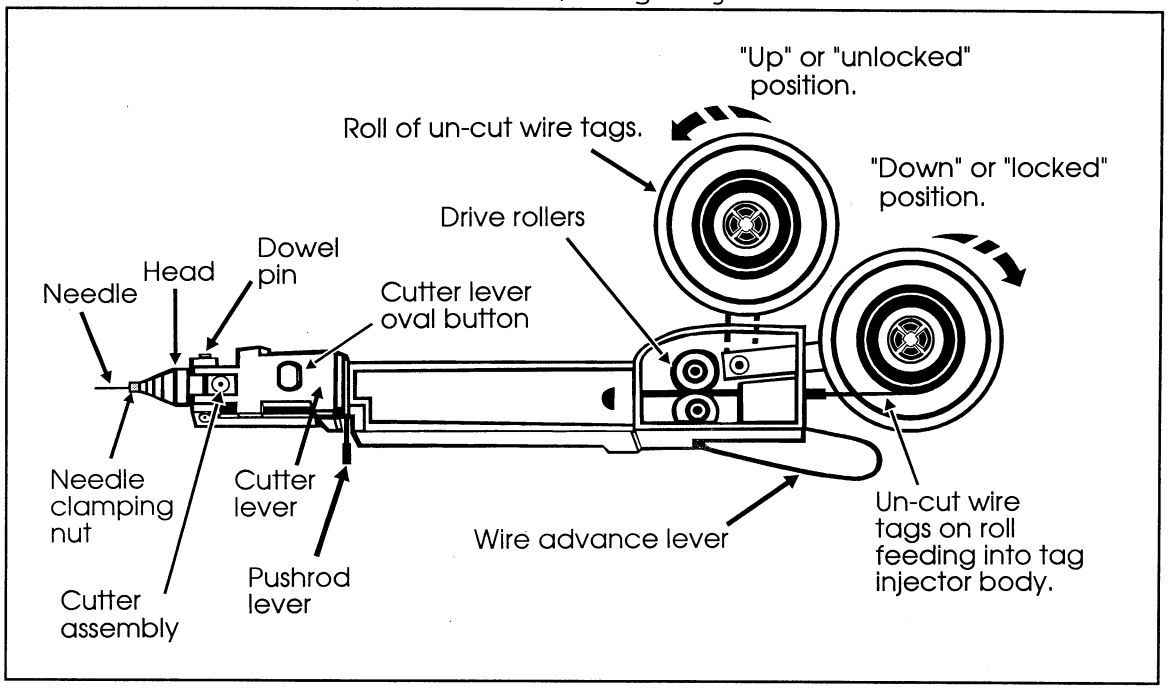
Training was provided in mass-tagging of Kemp's ridley hatchlings with the internal wire tag to Gladys Porter Zoo, Brownsville, Texas and Mexican turtle camp personnel at the Rancho Nuevo nesting beach, Tamaulipas, Mexico, in August 1996. In the first large scale tag and release attempt at the Rancho Nuevo nesting beach, 3,336 Kemp's ridleys were tagged with non-magnetized wire tags in the right front flipper.

3.0 AUTOMATIC (MULTI-SHOT) TAG INJECTOR - ILLUSTRATED TAGGING TECHNIQUES

3.1 GENERAL INSTRUCTIONS

The automatic tag injector is a very expensive piece of precision tagging equipment. Familiarity with it's components and operation will expedite regular maintenance and any necessary repairs. Regular maintenance and cleaning are critical for proper operation of the tag injector. See section 7.0 for cleaning instructions.

FIGURE 1 Automatic (multi-shot) tag injector



3.1.1 All personnel handling hatchlings during the wire tagging procedure must wear disposable surgical style gloves (latex, vinyl or non-latex hypoallergenic (PVC)) on both hands. Gloves should be discarded at the completion of a tagging session. Gloves are worn for two reasons:

(1) To minimize the hatchlings contact with bacteria/contaminants found on human skin; and
(2) To protect hands from staining and potential irritation by antimicrobial agents (iodine, alcohol) and to a lesser degree, from an accidental needle prick.

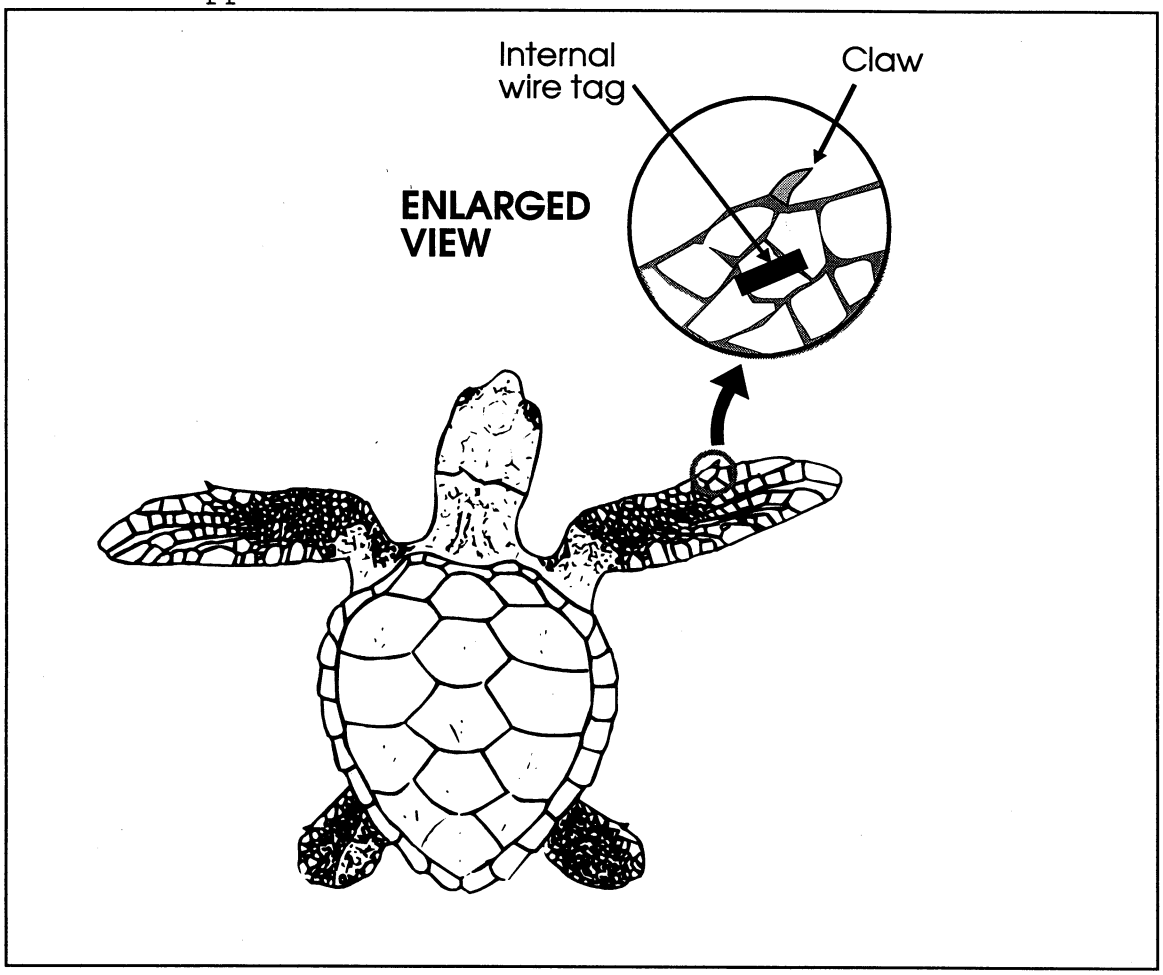
3.1.2 Keep all tagging equipment and supplies away from contact with nesting beach sand and salt water. Beach sand and salt deposits, left by evaporated sea water, will clog the internal moving parts of the tag injector resulting in equipment malfunction.

3.1.3 One person must hold the hatchling while a second person completes the tagging. It is helpful if a third and forth person assist in drying the flipper and applying the antimicrobial agents before and after tagging.

3.1.4 The tag insertion area will be as near to the claw on the dorsal portion of the foreflipper as possible. This area of insertion was chosen for two reasons:

(1) It appears that there is slightly more muscle tissue to hold the tag in this area; and
(2) The claw makes a good reference point for locating the wire tag at a later date.

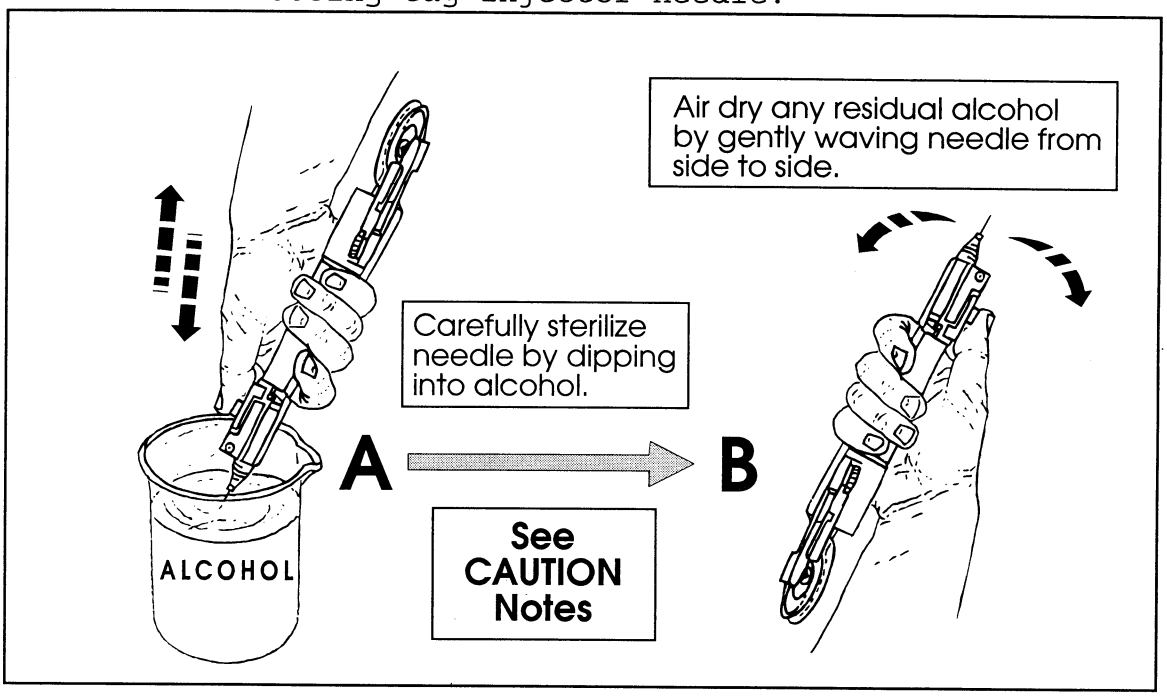
FIGURE 2 Implantation location of internal wire tag in hatchling flipper.



NOTE 1 The internal wire tag is oriented parallel to the leading edge of the flipper.

3.1.5 Disinfect the needle on the tag injector. The needle should be dipped in a container containing 70% isopropyl alcohol. Allow the needle to air dry prior to tagging. Air drying should take less than 15 seconds. Gently waving the needle back and forth will accelerate air drying of the needle. Disinfect the tag injector needle prior to cutting and advancing a wire tag. Sterilization after cutting and advancing a tag may result in loss of the tag into the container of alcohol.

FIGURE 3 Disinfecting tag injector needle.



***CAUTION* Even small quantities of alcohol (like a drop on the tip of a needle) are toxic to small animals and can lead to blindness if too much is absorbed into the blood stream. Extreme care should be taken to ensure that as little alcohol as possible remains on and in the needle after sterilization. Complete air drying of the needle eliminates any risk.**

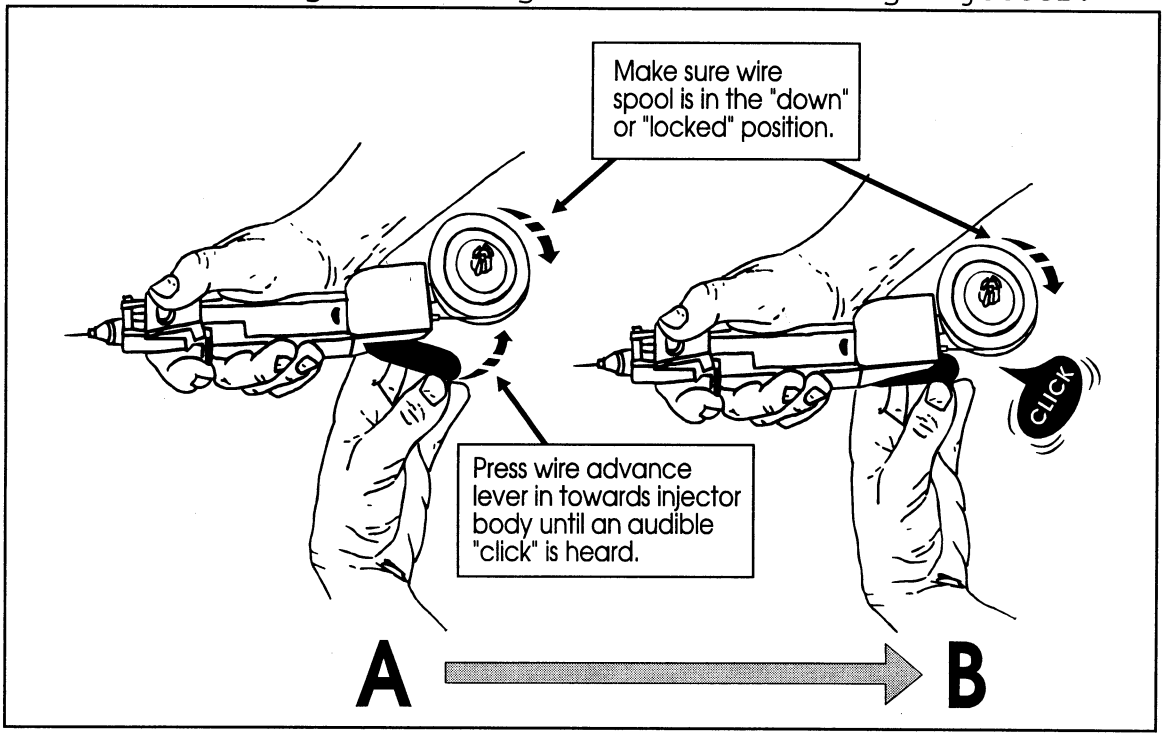
***CAUTION* Be very careful not to damage the needle when dipping it into the container of alcohol. The needles are very fragile and may bend or dull if brushed or banged against the container.**

3.2 AUTOMATIC (MULTI-SHOT) TAG INJECTOR PREPARATION

3.2.1 Comfortably grasp the middle of the automatic tag injector with your right hand so that the thumb is on the top of the tag injector and the fingers are curled under the tag injector.

Advance the wire one click/position by pressing the long lever on the left rear of the tag injector with your left thumb. Press in on the lever until an audible "click" is heard then release the lever. The lever will spring back to the open position. See FIGURE 4.

FIGURE 4 Advancing a wire tag with automatic tag injector.

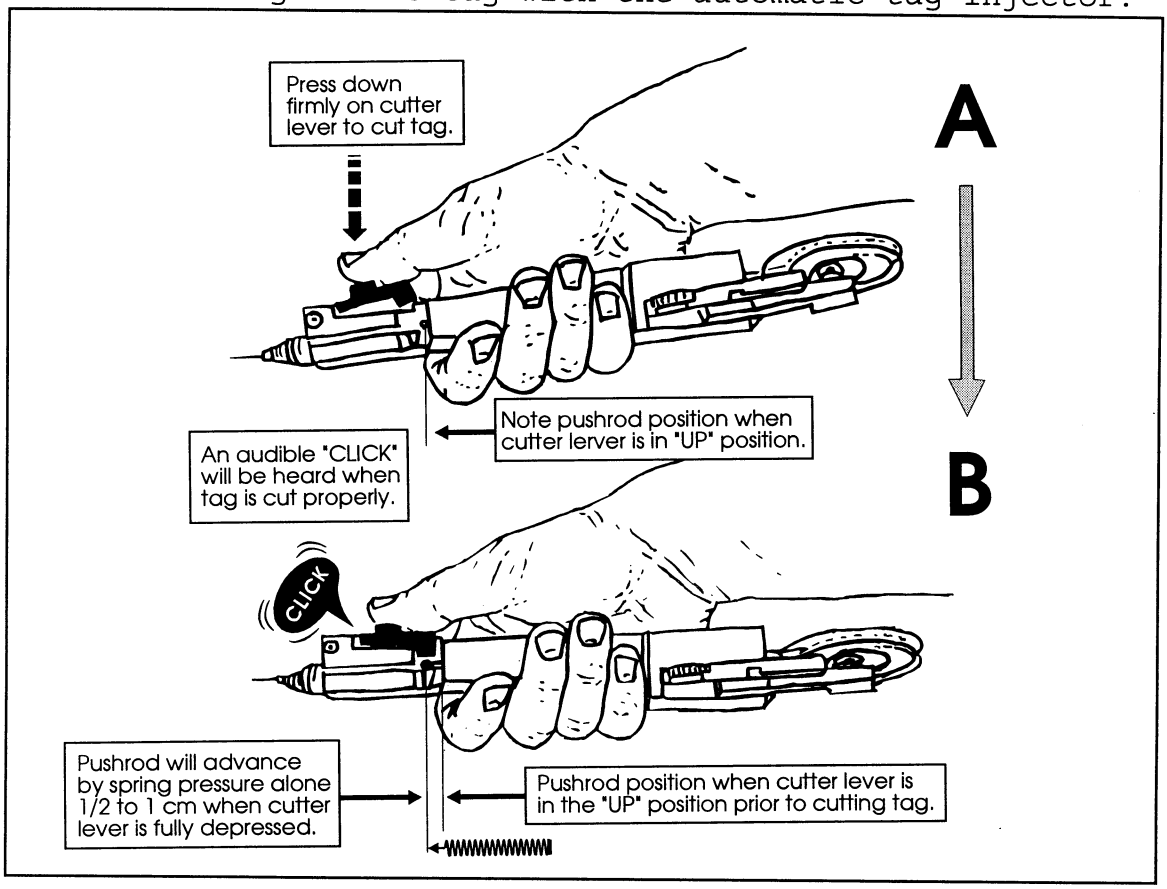


NOTE 1 The wire will not advance if the wire spool holder is in the "up" or "unlocked" position. Make sure the wire spool holder is in the "down" or "locked" position before attempting to advance wire. See FIGURE 1.

NOTE 2 The wire will not advance if the cutter lever is depressed. Make sure the pushrod lever is fully retracted back into the tag injector. When the pushrod lever is fully retracted into the tag injector spring pressure alone will return the cutter lever to the "up" position. See FIGURE 5, DIAGRAM A.

3.2.2 Cut the wire to make a tag by pressing down on the cutter lever using the thumb on the right hand. The cutter lever is located just behind the needle at the front of the tag injector. Press down on the cutter lever until an audible "click" is heard then release the lever. The lever will stay down when the tag is properly cut (i.e. the lever will not spring back). See FIGURE 5.

FIGURE 5 Cutting a wire tag with the automatic tag injector.

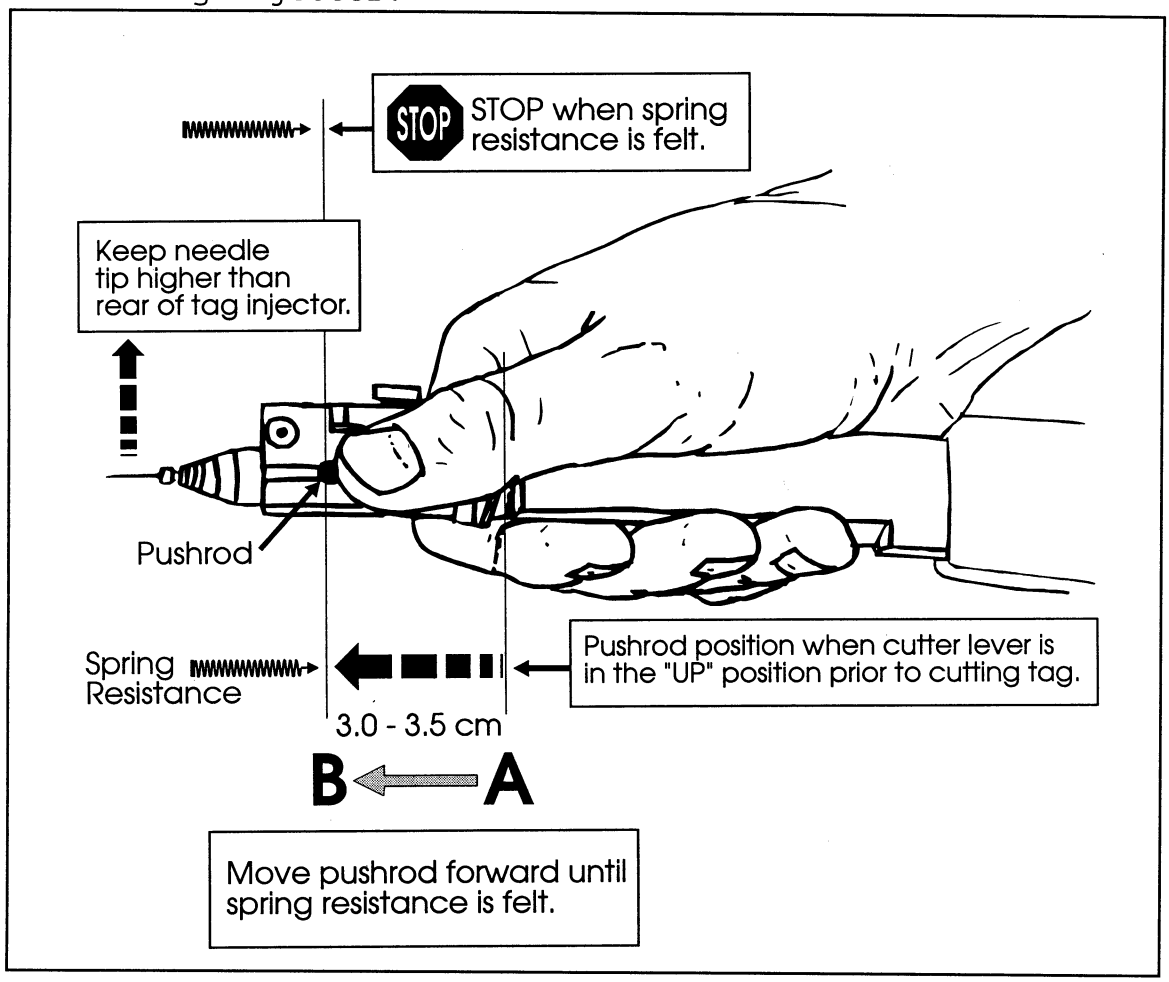


NOTE 1 The pushrod will not move forward until the cutter lever is fully depressed.

3.2.3 Push the cut tag into the needle barrel using the pushrod lever. The pushrod lever is located on the left side of the tag injector. Use the right thumb to move the pushrod lever forward. The pushrod will move freely forward about 3.0 - 3.5 cm at which time a spring inside the tag injector will create back pressure resulting in a significant increase in resistance. See FIGURE 6.

Stop and hold the pushrod in place when spring resistance is felt. **Do not remove your thumb from the pushrod** and keep slight and constant pressure on the spring until the needle is withdrawn from the flipper after the tag is inserted.

FIGURE 6 Advancing a wire tag into the barrel of the automatic tag injector.



***CAUTION* After cutting a wire tag and extending the pushrod, keep the tip of the needle elevated higher than the rear of the tag injector. This will help ensure the tag does not fall out of the tip of the needle.**

3.2.4 **TEST PROCEDURE**

Each time a tag injector is loaded with wire and prior to starting each tagging session a test tag should be run through the tag injector. It is also a good idea to periodically run the test procedure during a tagging session to ensure the tag injector is functioning properly (i.e. one test tag every 15-20 turtles).

(1) Complete steps 3.2.1 through 3.2.3 above.

NOTE 1 Prior **to starting** a tagging session, check a tag cut from each roll to confirm the tags magnetic/non-magnetic charge (See section **6.0** for procedure).

(2) Place the left hand open and flat below the needle to catch the tag. Be careful not to stick youself with the needle. Push the pushrod as far forward as it will travel to expel a tag from the tip of the needle. Visually locate the tag to ensure the tag injector is functioning properly. The tag may stick to the underside of the needle from static electricity.

NOTE 2 The wire tag is very small (3 mm long and 0.25 mm in diameter) and may be very difficult to see without good lighting.

NOTE 3 **AUTOMATIC TAG INJECTOR WITH TAG COUNTER**
Reset the counter before starting a tagging session. Resetting is accomplished by pressing the reset button with a narrow pointed object. The tips of a pair of tweezers works well. The counter is used to keep track of the number of tags cut and used during each tagging session. The tagged hatchlings should be physically counted prior to release to determine the total number tagged during each session.

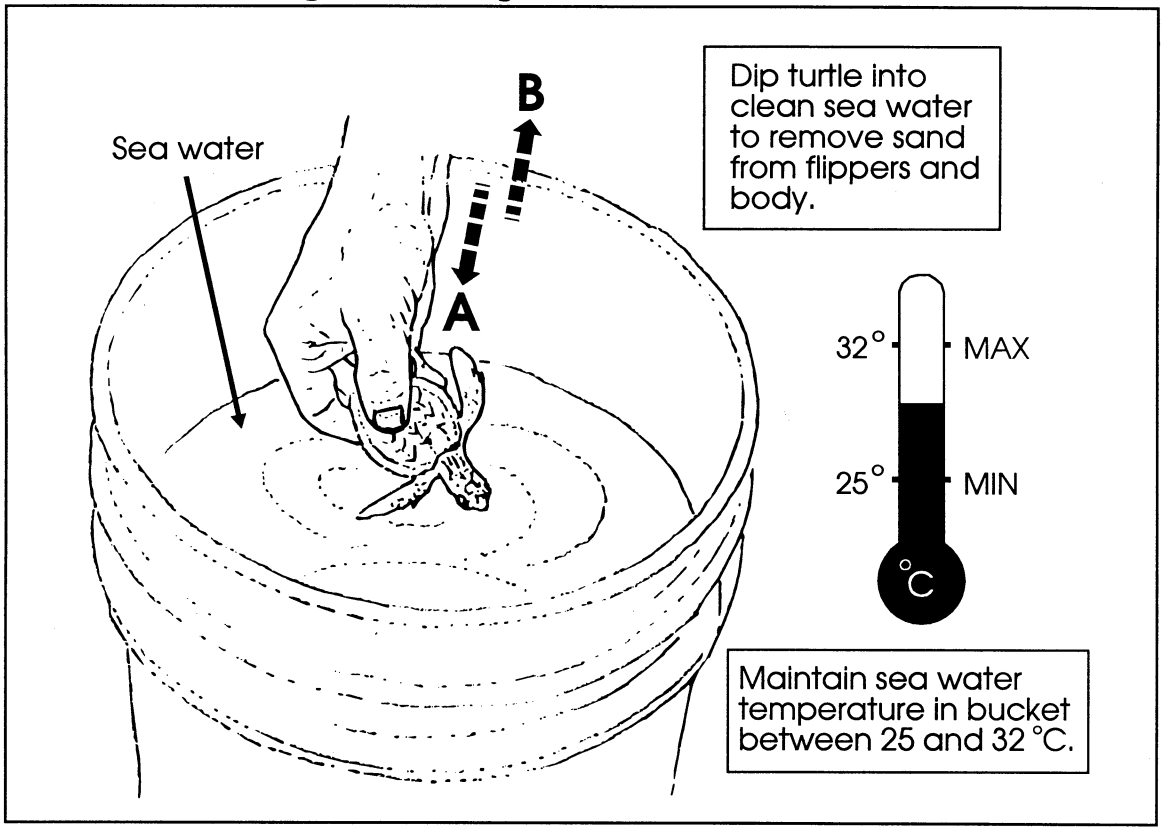
(3) Repeat the **TEST PROCEDURE** until a tag is seen and you are confident that the tag injector is operational.

If a tag is not seen after completing the test procedure either the wire was loaded incorrectly, the tag was lost and/or one or more of steps 3.2.1 through 3.2.3 were not completed properly. See trouble-shooting section in Appendix B.

3.3 HATCHLING PREPARATION FOR THE AUTOMATIC (MULTI-SHOT) TAG INJECTOR

3.3.1 Immerse each hatchling in a bucket of sea water to clean all sand from the flippers and body. Sea water should be clean and at ambient ocean temperature. If tagging is carried out during daylight hours, periodically check water temperature and replace with new sea water if necessary. See FIGURE 7.

FIGURE 7 Immersing hatchling in saltwater to remove sand.



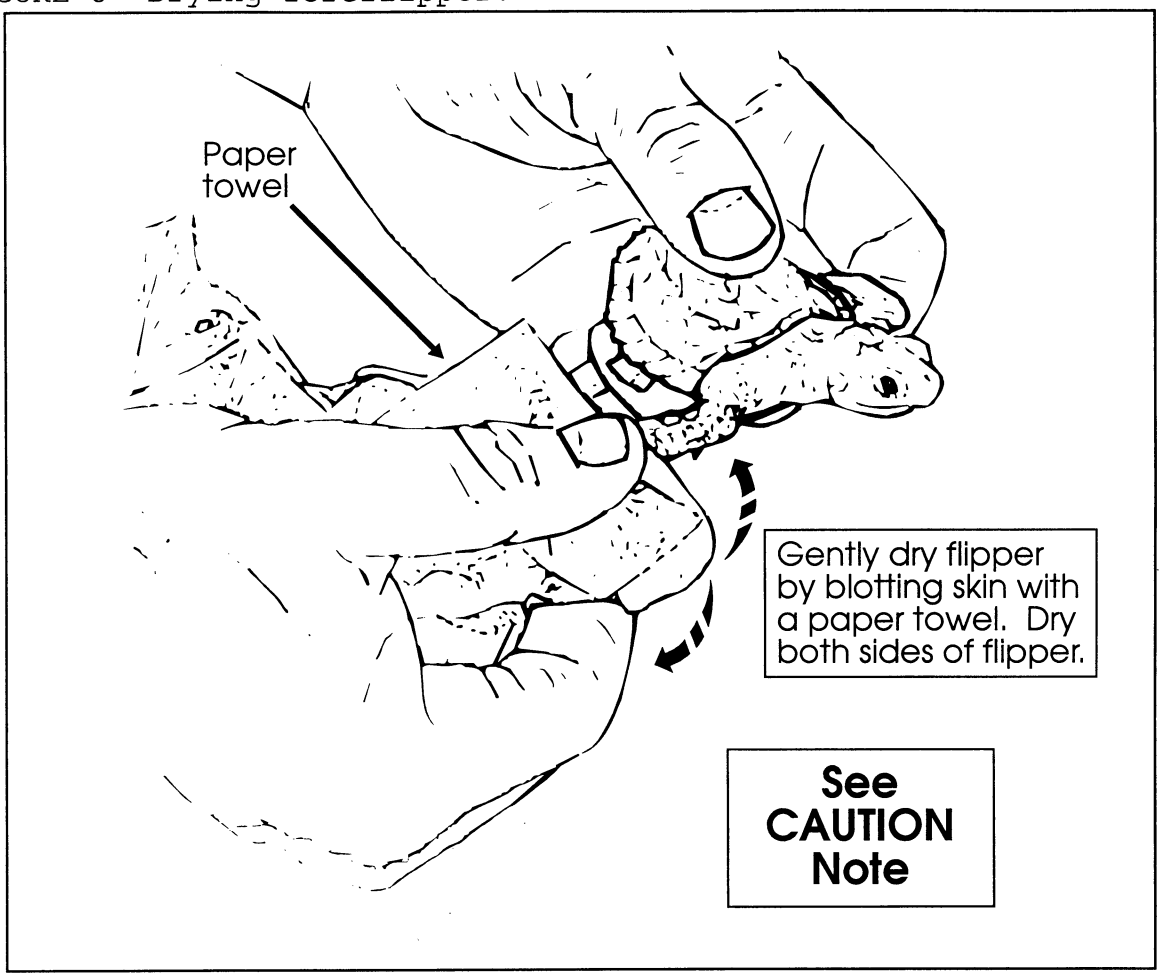
***CAUTION* Any sand remaining on the hatchling will eventually get into the tag injector and cause a malfunction.**

***CAUTION* Maintain water temperature between 25° and 32°C (77° to 90° F).**

3.3.2 Dry the entire foreflipper, both dorsally and ventrally, using a clean paper towel. Make sure the tag insertion area is completely clean and dry. Water left on the flipper will dilute and contaminate the antimicrobial

agents and cause them to drip off the flipper staining everything it contacts. See FIGURE 8.

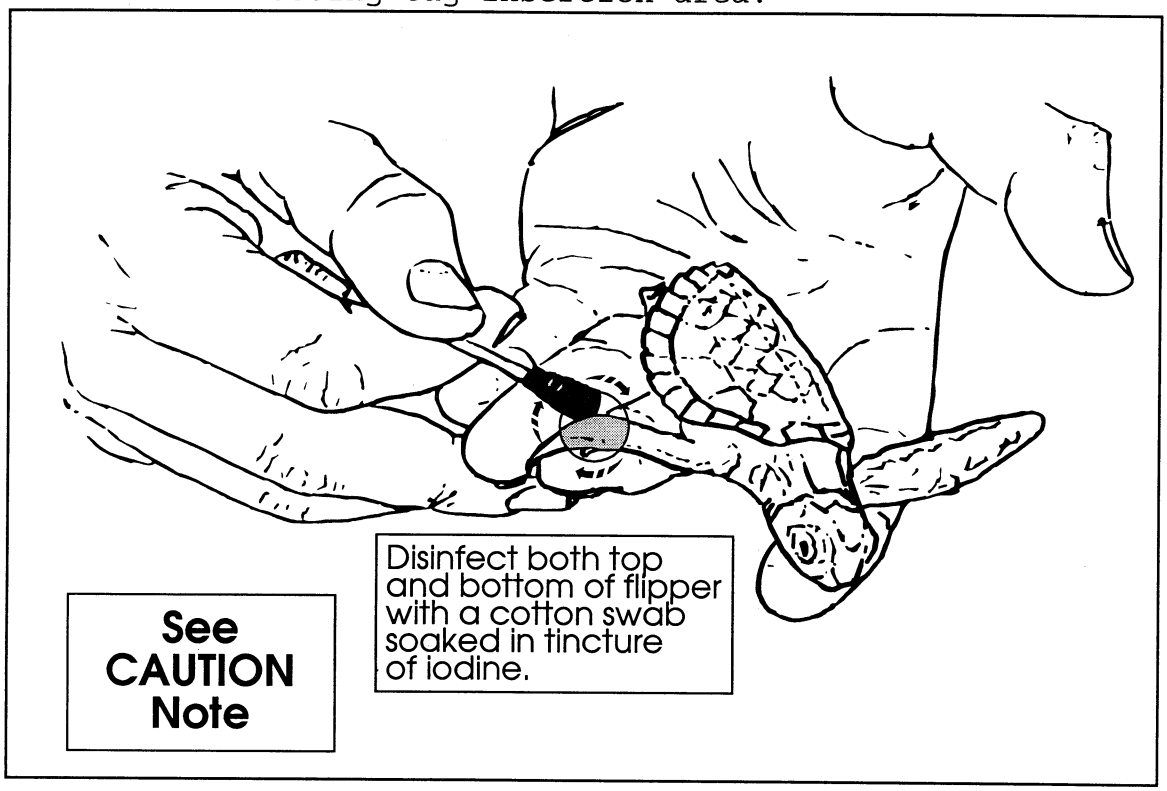
FIGURE 8 Drying foreflipper.



CAUTION **Gently blot the water from the turtles skin. Rubbing may damage or irritate the delicate skin and scales on the flipper. Excessive pressure on the tiny foreflipper may also fracture bones. Replace the paper towel with a new one when it becomes damp or soiled.**

3.3.3 Disinfect the tag insertion area by swabbing with a disposable cotton swab soaked with tincture of iodine. Lightly scrub the tag insertion area on the dorsal and ventral surfaces of the flipper directly above and below the tag insertion area. The ventral surface is disinfected to guard against infection in the event the tag injector penetrates through the ventral flipper surface. See FIGURE 9.

FIGURE 9 Disinfecting tag insertion area.



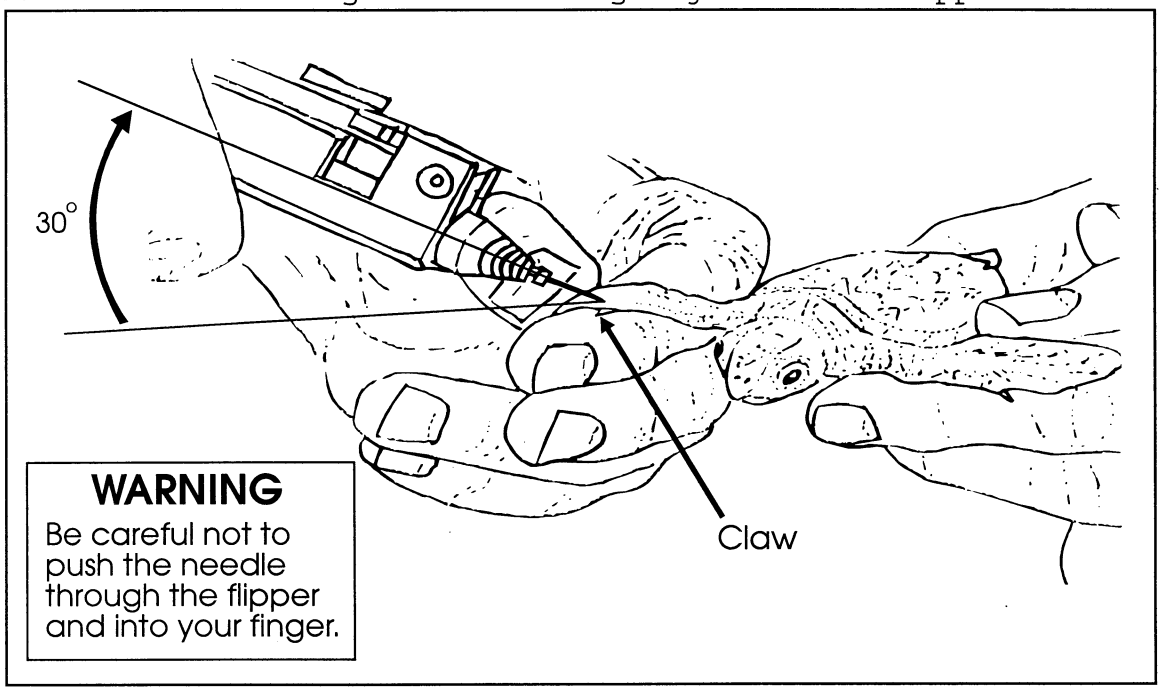
***CAUTION* Anti-microbial agents like tincture of iodine may be toxic to small animals if absorbed into the bloodstream. Do not use any more iodine than is necessary to sterilize the flipper. When applied the iodine should just stain the flipper leaving a moist spot. Iodine dripping or running off the flipper is too much.**

3.4 TAG INSERTION USING THE AUTOMATIC (MULTI-SHOT) TAG INJECTOR

Complete procedures 3.2.1 through 3.3.3. before proceeding.

3.4.1 An assistant must gently but firmly hold the hatchling so that the foreflipper being tagged is extended towards the tagger. With the front flipper gently bent over the index finger of the tagger's left hand and held firmly in place with the left thumb, position the needle tip at a 30° angle to the flipper in the area of the claw. Hold the tag injector parallel to the leading edge of the flipper with the needle pointing towards the hatchlings body. See FIGURES 10 and 11.

FIGURE 10 Positioning automatic tag injector on flipper.



***CAUTION* An insertion angle of 30° is necessary to penetrate the skin. Angles less than 30° will result in the needle sliding along the skin and scratching of the flipper without proper needle penetration.**

***CAUTION* Excercise extreme caution when penetrating the flipper to ensure the needle does not go through the ventral surface and into your finger.**

3.4.2 Firmly but carefully push the needle tip just through the skin on the flipper. A slight twisting motion of the tag injector helps penetration of the skin. A sharp needle also facilitates skin penetration. Sharpen or replace the needle when there is a noticable change in sharpness (See section 7.0 cleaning and maintenance).

FIGURE 11 Penetration of skin with automatic tag injector.

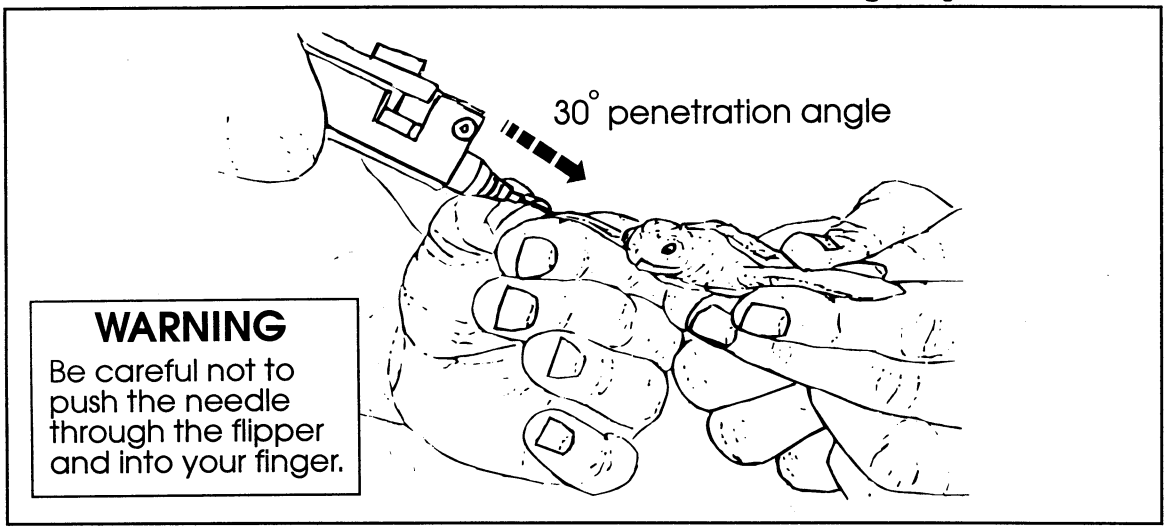
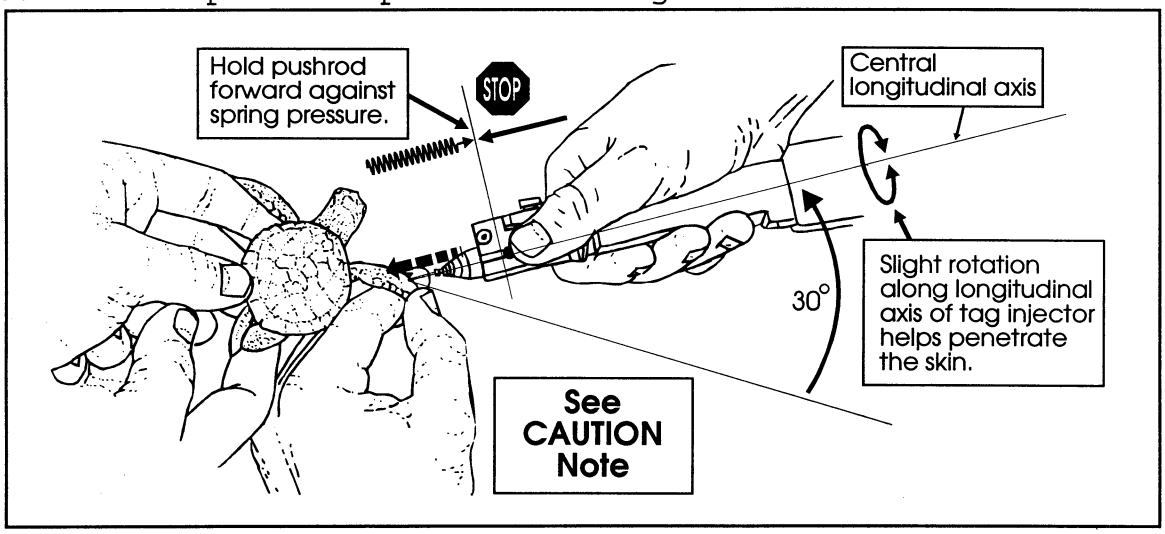


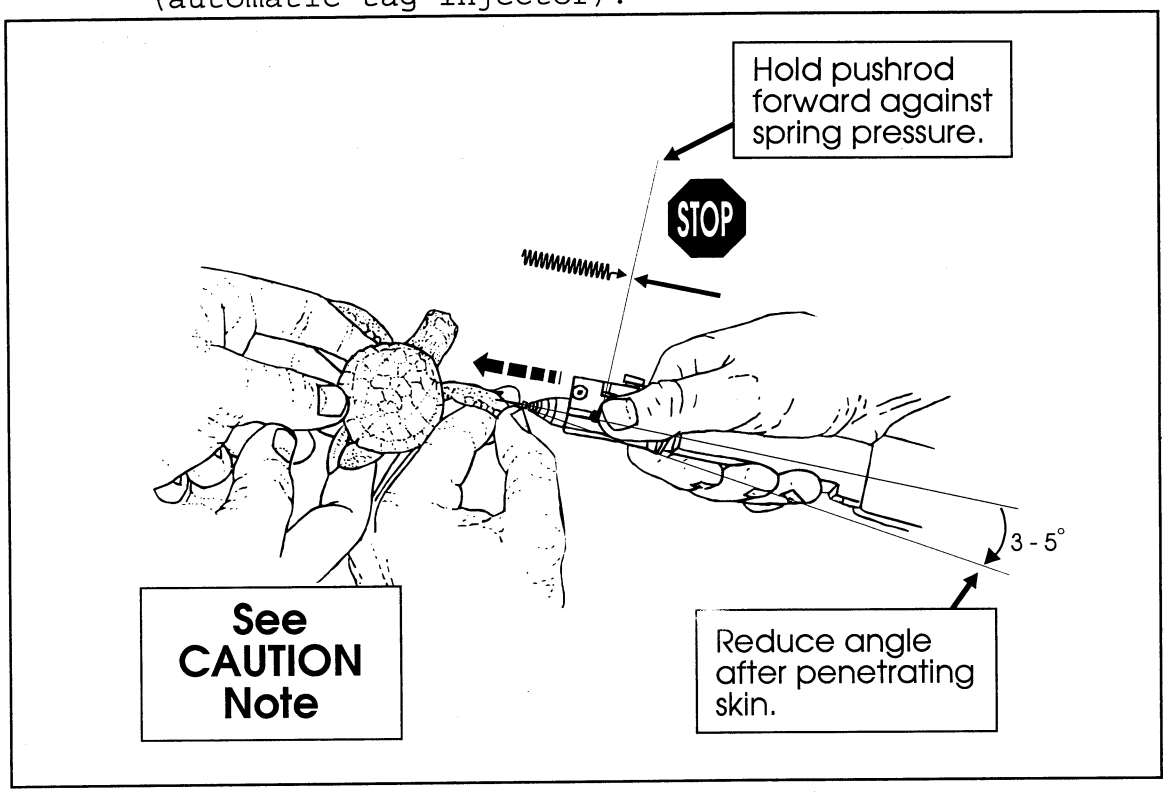
FIGURE 12 Proper skin penetration angle.



***CAUTION* Do not change the angle of the tag injector while twisting. Twisting is accomplished by rolling the tagger's wrist slightly away from and towards the tagger's body. Twisting is done along the central longitudinal axis of the tag injector.**

3.4.3 Once the skin has been penetrated, adjust the tag injector angle to 3 - 5° and continue to push the needle into the muscle tissue of the flipper about 1/3 to 1/2 the length of the needle in a direction parallel to the claw (i.e. towards the body). See FIGURES 13 and 14.

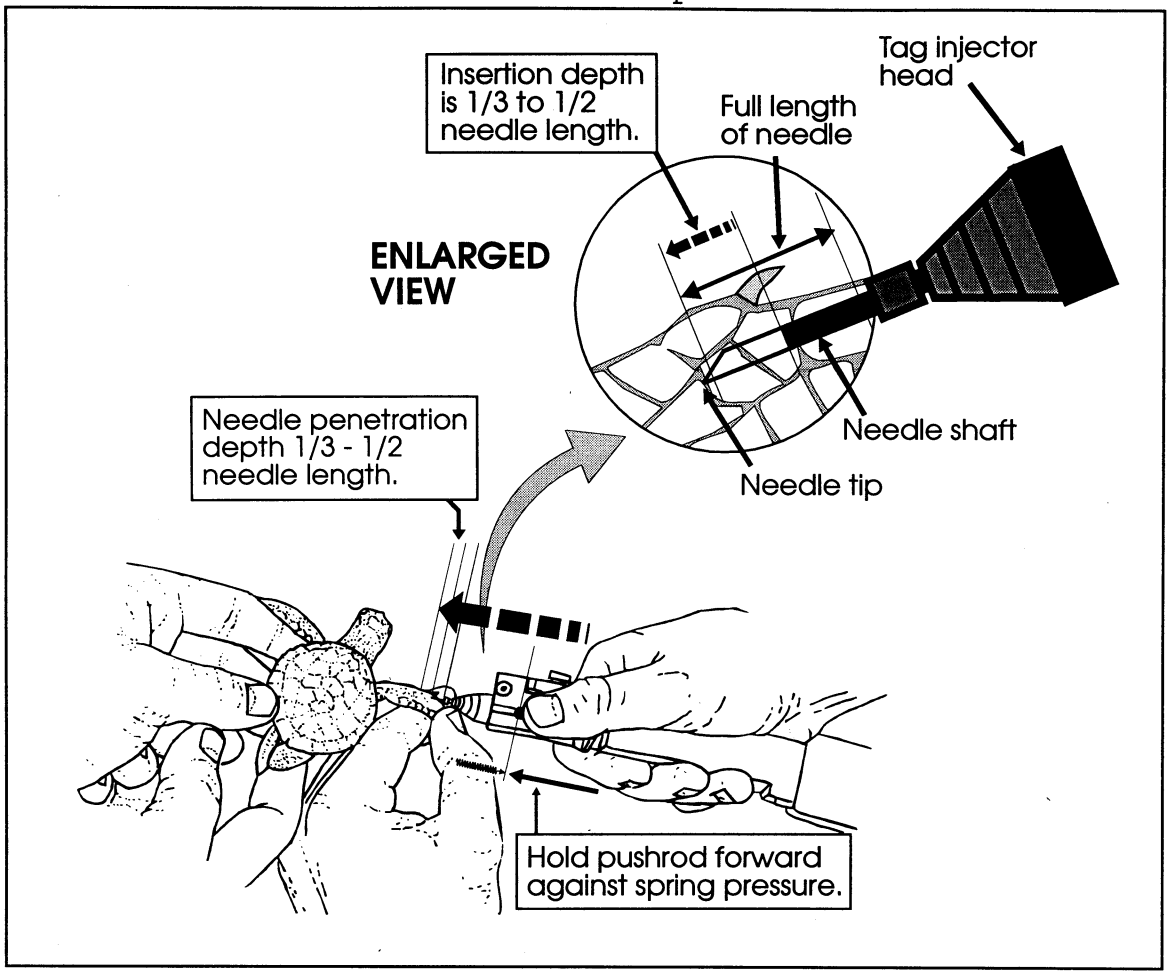
FIGURE 13 Correct insertion angle of needle into flipper (automatic tag injector).



***CAUTION* The flipper is very thin (< 3 mm thick) and extreme care must be used to ensure the needle is not pushed through the bottom surface of the flipper and into your finger. The needle should lie just below the skin on the dorsal surface of the flipper.**

Correct needle penetration depth is required to ensure the tag remains in the flipper as the needle is removed and to lessen the chance of wire tag migration out of the tag insertion wound prior to healing.

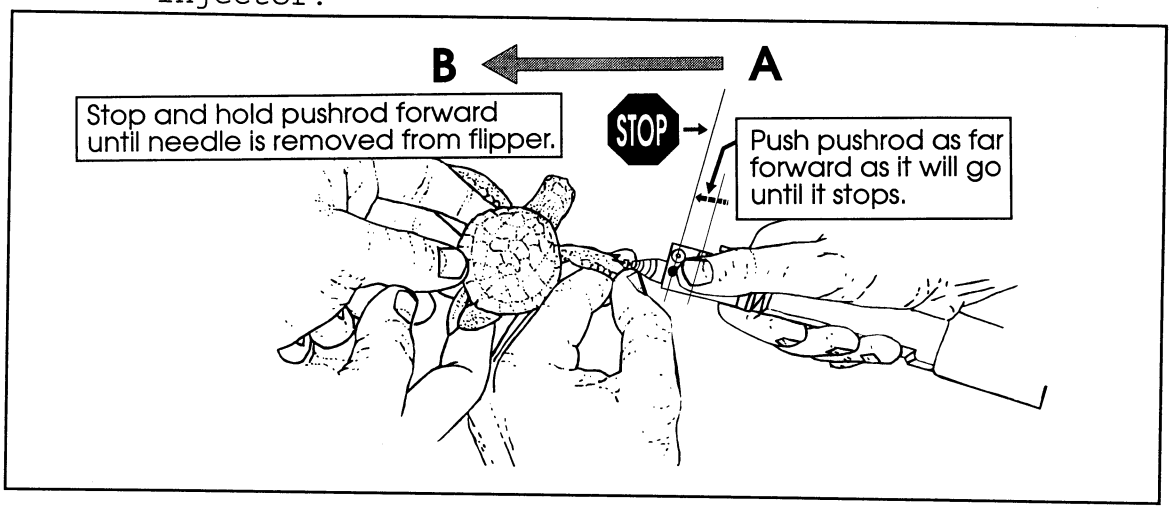
FIGURE 14 Correct needle insertion depth.



***CAUTION* It is extremely important that the needle be inserted exactly parallel to the leading edge of the flipper. Failure to orient the tag in this position may result in difficulty magnetizing the tag at a later date. A wire tag accepts a magnetic charge best when the magnet is passed perpendicular to the tag's longitudinal axis. Passing a magnet perpendicular to the latitudinal axis may un-magnetize a wire tag. Read SECTION 5.0 DETECTION OF INTERNAL WIRE TAGS for more details.**

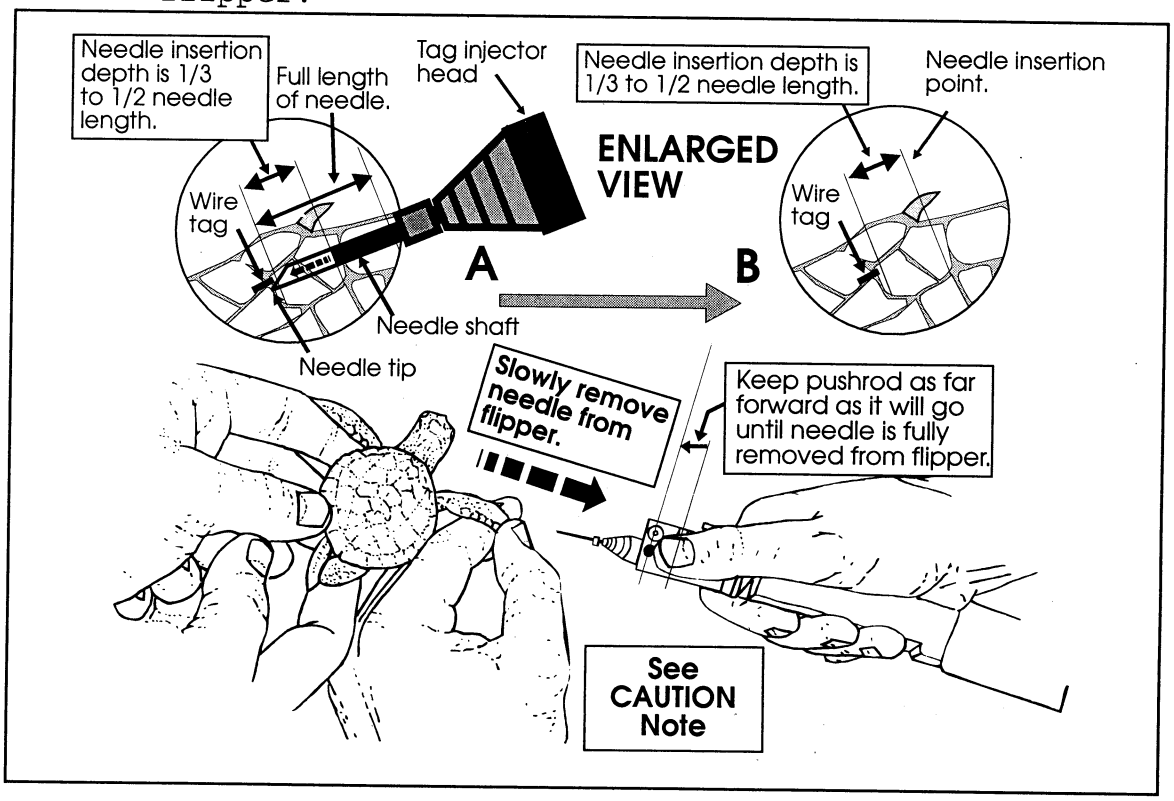
3.4.4 Push the pushrod as far forward as it will travel to expel a tag from the tip of the needle and into the flipper muscle. Use the right thumb to move the pushrod. Keeping the pushrod plunger lever fully extended, slowly withdraw the needle from the flipper. See FIGURES 15 and 16.

FIGURE 15 Ejection of wire tag into flipper using automatic tag injector.



CAUTION **It is extremely important that the pushrod be held as far forward as it will travel until the needle is completely withdrawn from the flipper. Failure to hold the pushrod all the way forward may result in the tag being "sucked" back into the needle and the tag being withdrawn from the flipper when the needle is removed.**

FIGURE 16 Proper pushrod position during removal of needle from flipper.

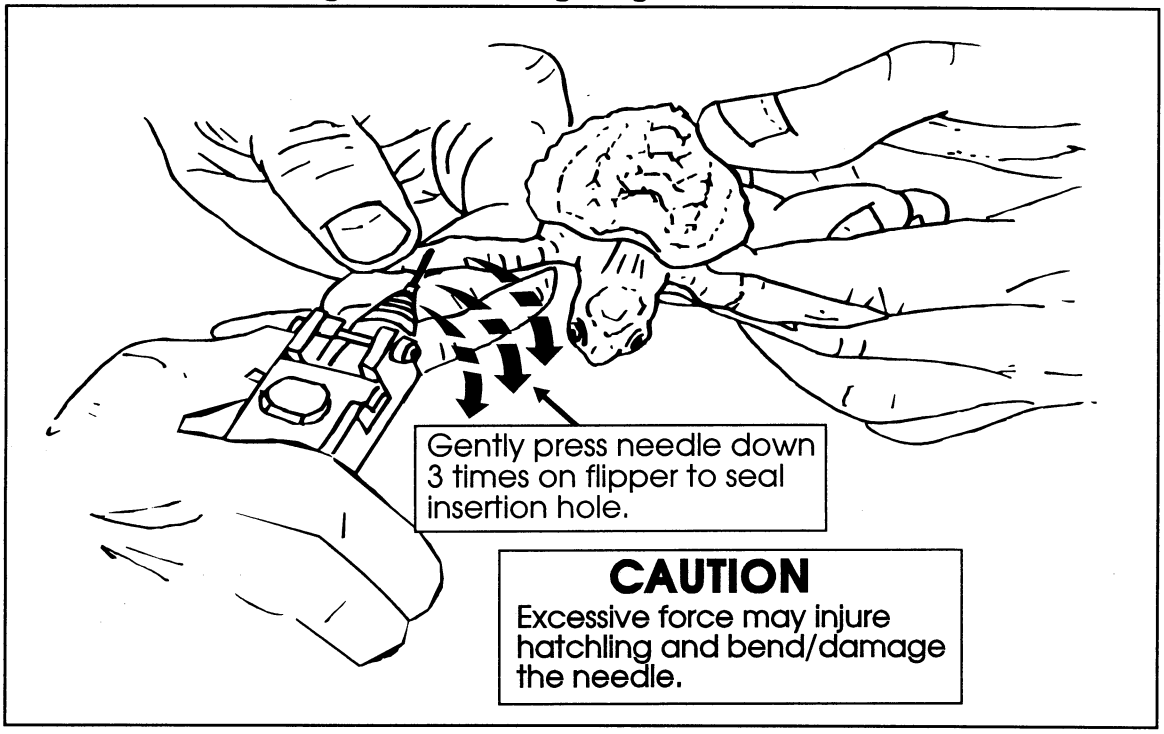


3.4.5 Visually inspect the area adjacent to the needle hole in the flipper to ensure that the tag remained in the flipper when the needle was withdrawn. If the tag came out, go back to **Step 3.0** and repeat tagging procedure.

3.4.6 After the tag has been inserted into the flipper, take the barrel of the needle and flatten the tag insertion hole by gently pressing down on the skin laying over the tag. The needle should be held perpendicular to the leading edge of the flipper with the needle pointing towards the rear flipper.

Press the needle barrel down onto the flipper in the area of the hole pressing down once at the mouth of the hole and again once or twice over the area of the tag. Press the needle straight down then lift straight up. Do not rub the needle from side to side as this may push the tag out of the insertion hole. Flattening the skin over the tag helps close and seal the hole made by the needle and prevents the tag from sliding out of the flipper. See FIGURE 17.

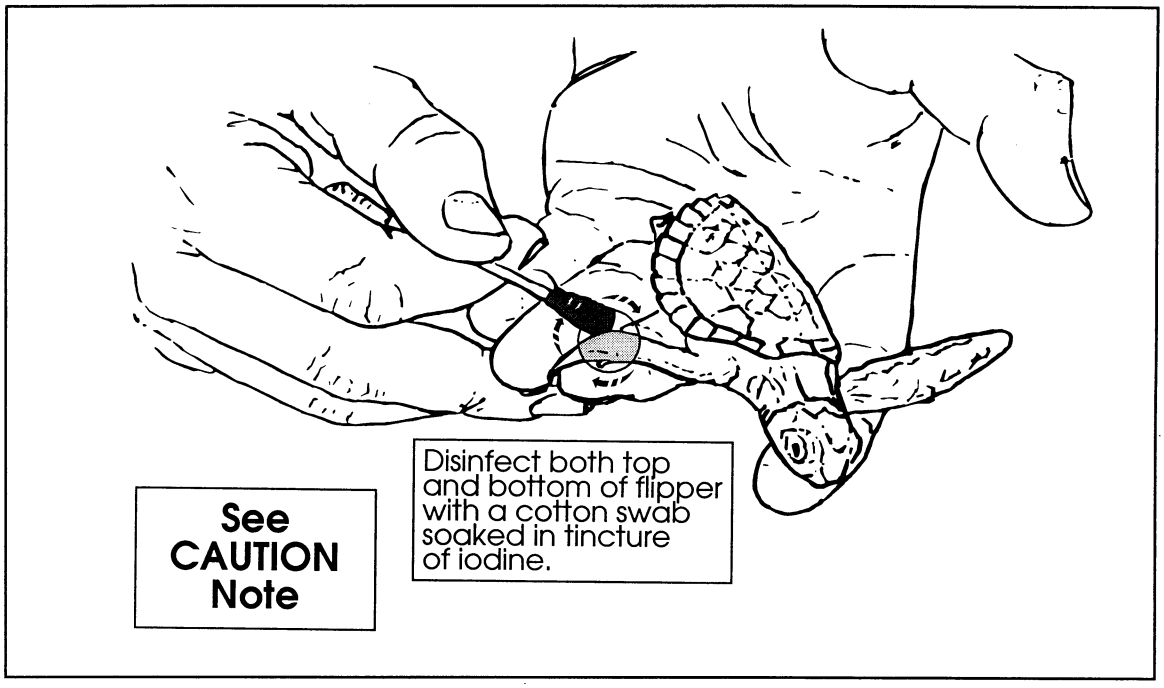
FIGURE 17 Flattening and sealing tag insertion hole.



3.4.7 Retract the pushrod back into the body of the tag injector using the pushrod lever. When the pushrod is properly retracted the cutter lever spring will "pop" the cutter lever up. You should hear an audible "click" when the cutter lever "pops" up.

3.4.8 Disinfect the tag insertion hole by swabbing with a disposable cotton swab soaked with tincture of iodine. Tagged hatchlings should be kept separate from un-tagged ones and should be released as soon after tagging as is possible.

FIGURE 18 Disinfecting tag insertion area with tincture of iodine.

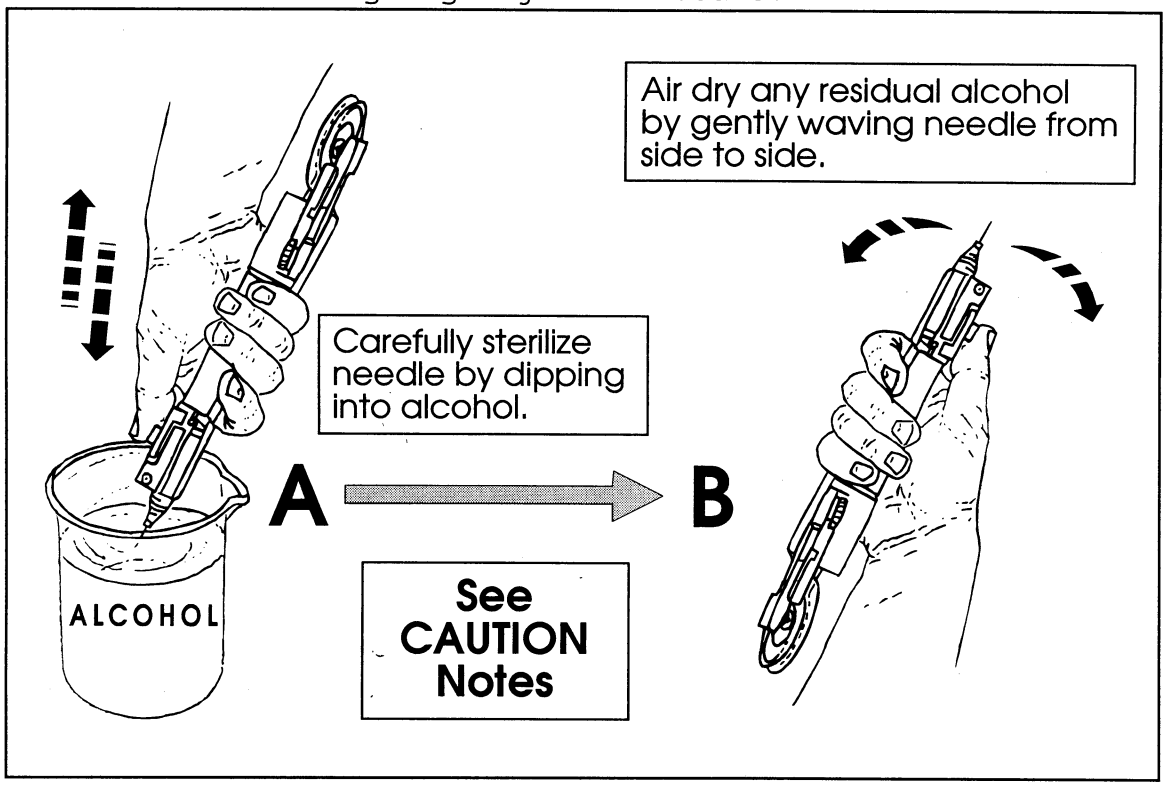


***CAUTION* Anti-microbial agents like tincture of iodine may be toxic to small animals if absorbed into the bloodstream. Do not use any more iodine than is necessary to sterilize the flipper. When applied the iodine should just stain the flipper leaving a moist spot. Iodine dripping or running off the flipper is too much.**

NOTE 1 If any bleeding is observed from the tag insertion wound the hatchling should be placed immediately into clean salt water to help coagulate tissues around the wound opening. Sea turtle blood and tissues coagulate better in contact with sea water than air. Bleeding is extremely rare and if it occurs the tagger should carefully re-read the tagging instructions and seek the assistance of a more experienced tagger.

3.4.9 Periodically disinfect the needle on the tag injector. After every 5 - 10 turtles tagged, the needle should be dipped in a container containing 70% isopropyl alcohol. Allow the needle to air dry before resuming tagging. Air drying should take less than 15 seconds. Gently waving the needle back and forth will accelerate air drying of the needle.

FIGURE 19 Disinfecting tag injector needle.



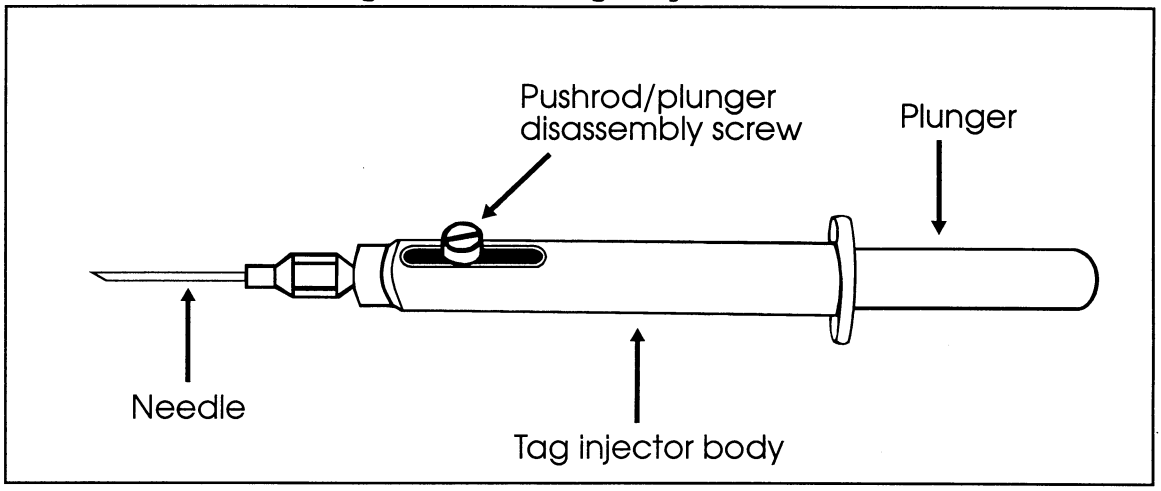
***CAUTION* Even small quantities of alcohol (like a drop on the tip of a needle) is toxic to small animals and can lead to blindness if too much is absorbed into the blood stream. Extreme care should be taken to ensure that as little alcohol as possible remains on and in the needle after sterilization. Complete air drying of the needle eliminates any risk.**

***CAUTION* Be very careful not to damage the needle when dipping into the container of alcohol. The needles are very fragile and may bend or dull if brushed or banged against the container.**

4.0 MANUAL (SINGLE-SHOT) TAG INJECTOR - ILLUSTRATED TAGGING TECHNIQUES

The manual tag injector is a low cost piece of precision tagging equipment. Care must be taken to prevent damage to the needle. Refer to cleaning instructions in section 7.0.

FIGURE 20 Manual (single-shot) tag injector.



4.1 GENERAL INSTRUCTIONS

4.1.1 All personnel handling hatchlings during the wire tagging procedure must wear disposable surgical style gloves (latex, vinyl, or non-latex hypoallergenic (PVC)) on both hands. Gloves should be discarded at the completion of a tagging session. Gloves are worn for two reasons:

(1) To minimize the hatchlings contact with bacteria/contaminants found on human skin; and

(2) To protect hands from staining and potential irritation by antimicrobial agents (iodine, alcohol) and to a lesser degree, from an accidental needle prick.

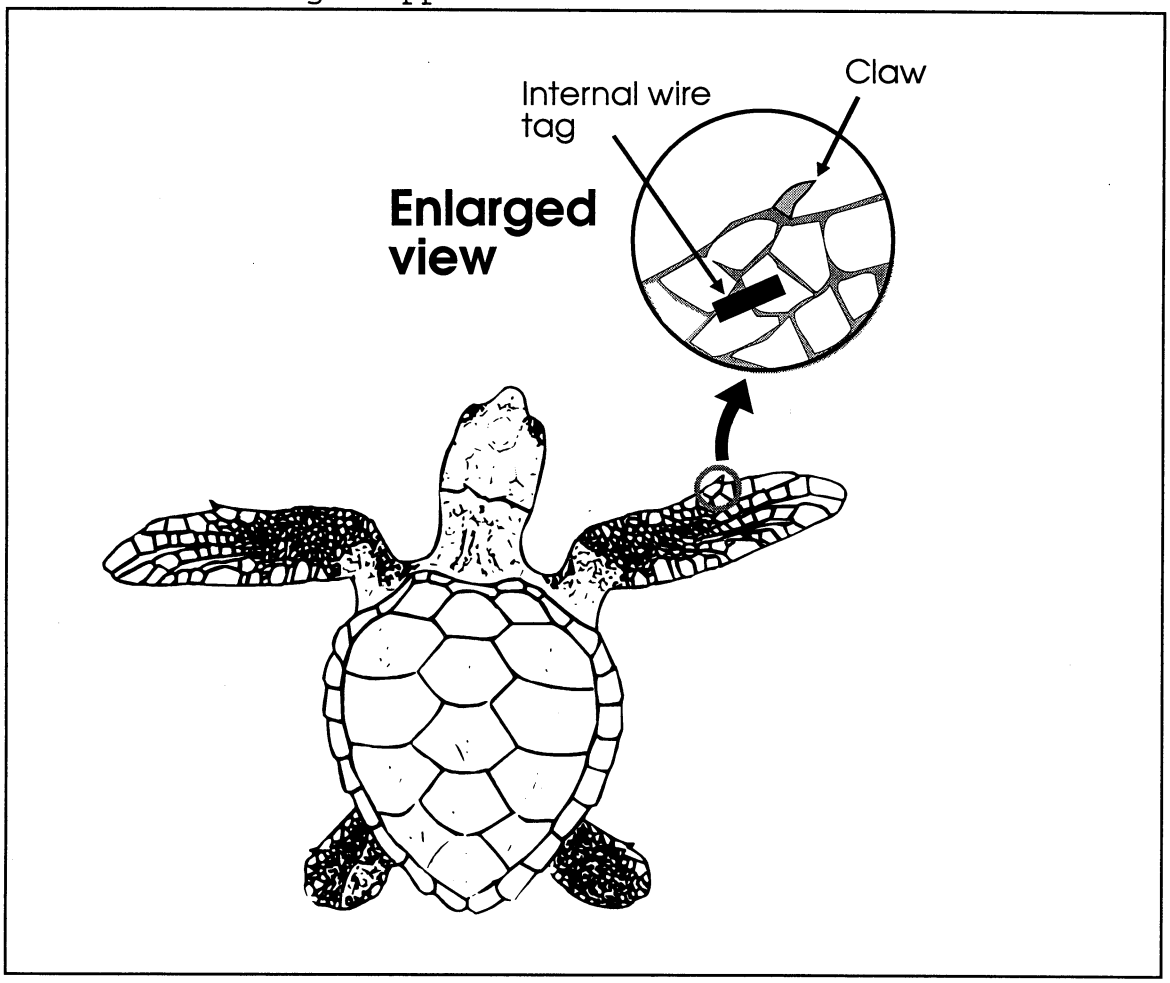
4.1.2 Keep all tagging equipment and supplies away from contact with nesting beach sand and salt water. Beach sand and salt deposits, left by evaporated sea water, will clog the internal moving parts of the tag injector resulting in equipment malfunction.

4.1.3 One person must hold the hatchling while a second person completes the tagging. It is helpful if a third and forth person assist in drying the flipper and applying the anti-microbial agents before and after tagging.

4.1.4 The tag insertion area will be as near to the claw on the upper portion of the front flipper as possible. This area of insertion was chosen for two reasons:

(1) It appears that there is slightly more muscle tissue to hold the tag in this area; and
(2) The claw makes a good reference point for locating the wire tag at a later date.

FIGURE 21 Implantation location of the internal wire tag in hatchling flipper.



NOTE 1 The internal wire tag is oriented parallel to the leading edge of the flipper in the area of the claw.

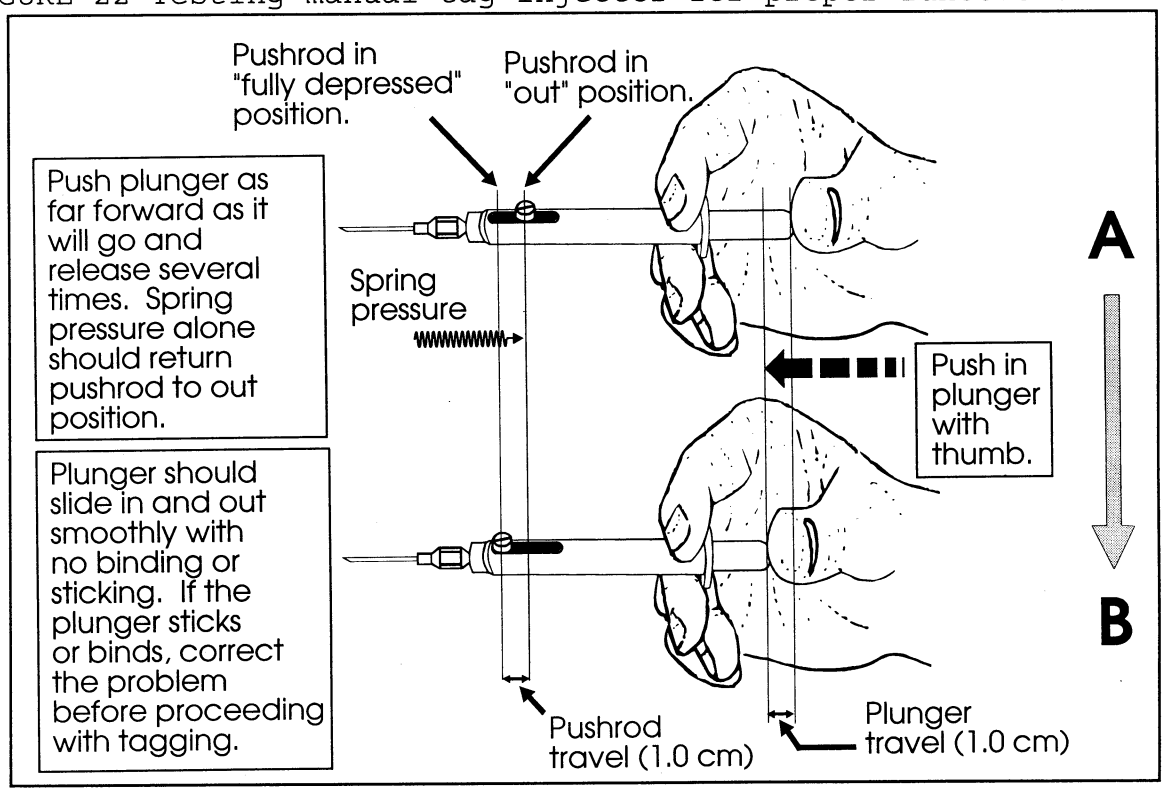
4.2 MANUAL (SINGLE-SHOT) TAG INJECTOR PREPARATION

4.2.1 TEST PROCEDURE

Grasp the manual tagger in your right hand. The body of the injector should be held firmly between the index finger and the middle finger with the right thumb gently resting on the plunger at the rear of the tag injector. Visually inspect the needle for signs of damage. Repair or replace damaged needle.

Fully depress the plunger several times and release. Spring action alone should promptly return the plunger to the "out" position. Failure of the plunger to return to the "out" position by spring pressure alone indicates a malfunction. The plunger should slide smoothly. Any binding or sticking indicates a malfunction. Repair or replace the injector if it is malfunctioning.

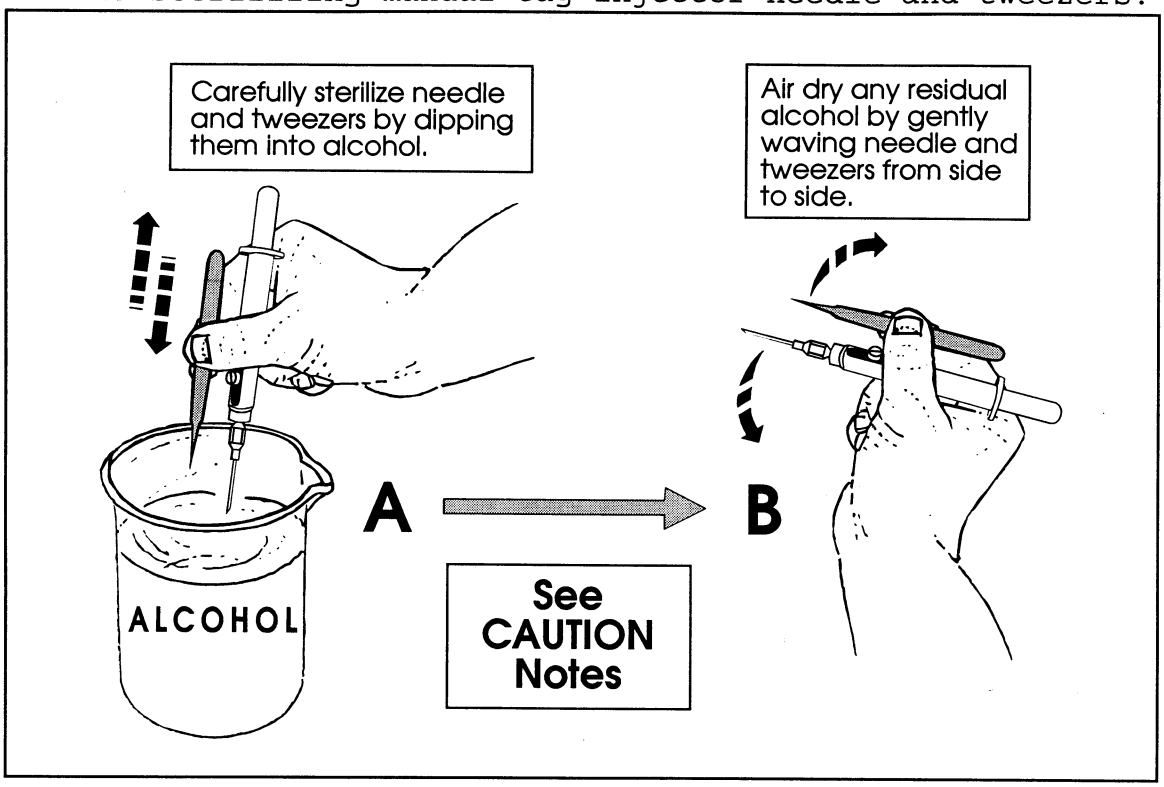
FIGURE 22 Testing manual tag injector for proper function.



NOTE 1 Proceed only when you are confident the injector is functioning properly.

4.2.2 Sterilizing the needle and the tips of the tweezers by dipping them in 70% isopropyl alcohol.

FIGURE 23 Sterilizing manual tag injector needle and tweezers.



CAUTION Even small quantities of alcohol (like a drop on the tip of a needle) is toxic to small animals and can lead to blindness if too much is absorbed into the blood stream. Extreme care should be taken to ensure that as little alcohol as possible remains on and in the needle and tweezers after sterilization. Complete air drying of instruments eliminates any risk.

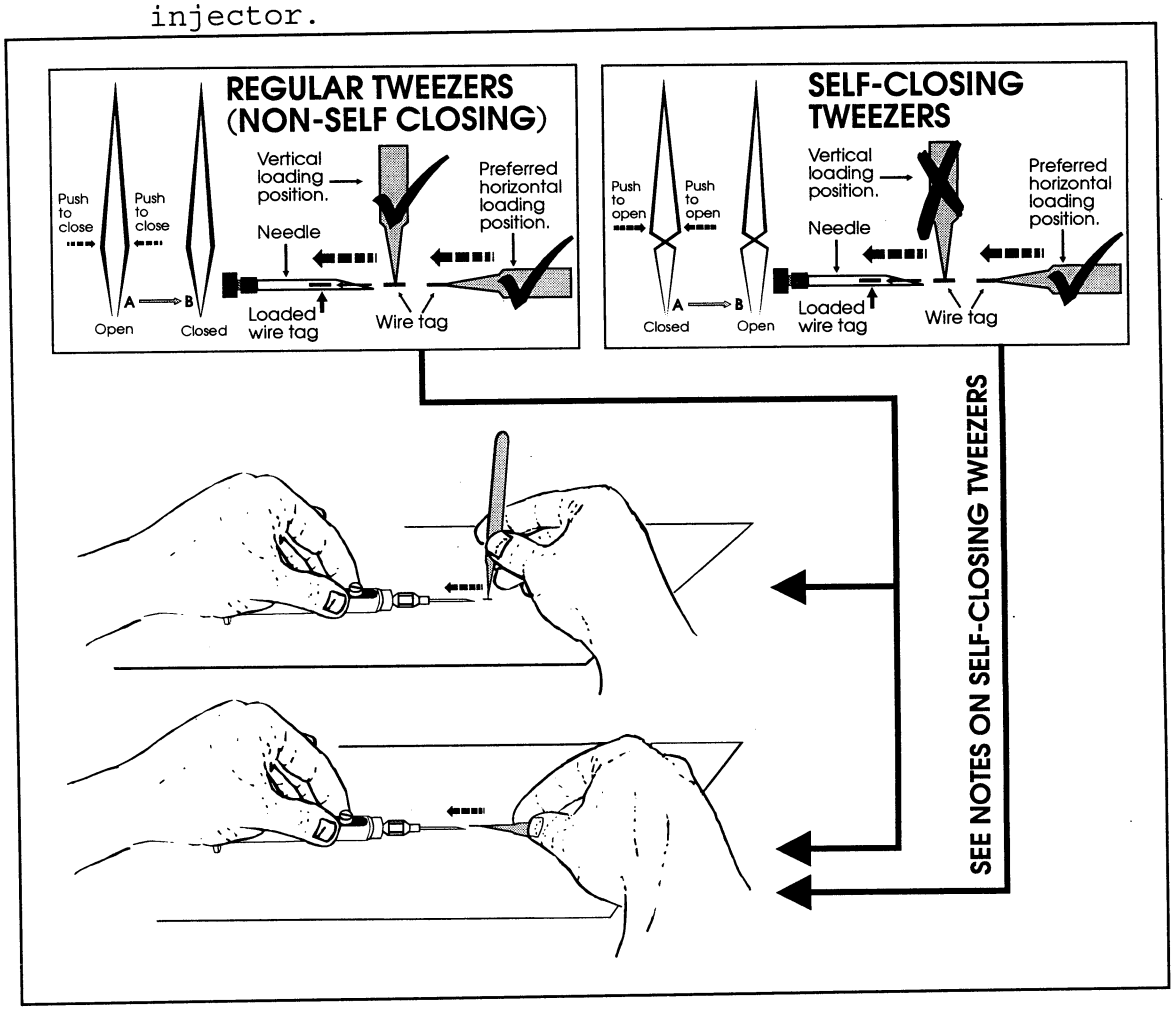
CAUTION Be very careful not to damage the needle or tweezers ends when dipping into the container of alcohol. The needles are very fragile and may bend or dull if brushed or banged against the container.

4.2.3 Comfortably grasp the manual tag injector with your left hand. The injector is easiest to load if it is held flat against a table or other immovable object.

With the tweezers in your right hand, carefully pick up one pre-cut wire tag from the sheet of tags and insert the tag into the tip of the needle. Be sure to push the tag all the way inside the tip of the needle.

Loading wire tags into manual tag injectors takes patience and practice. Each person will undoubtedly develop their own personal protocol for getting the wire tag into the needle.

FIGURE 24 Loading a pre-cut wire tag into the manual tag injector.

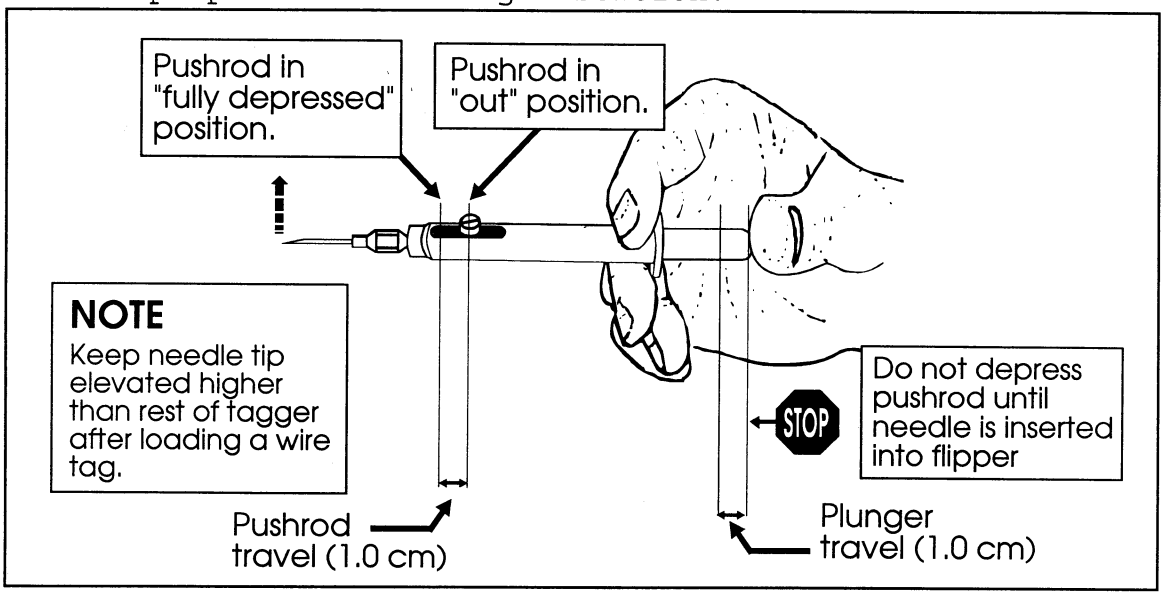


NOTE 1 Do not apply any more pressure than is absolutely necessary to grasp the wire tag. Too much pressure will cause the tag to "pop" out of the tweezers tips resulting in tag loss.

NOTE 2 **VERY FINE TIPPED AND SELF CLOSING TWEEZERS**
Very fine tipped and self closing tweezers may require that the wire tag be grasped along the tag's parallel axis and not picked up by the perpendicular axis. The tweezers should be held parallel to the surface on which the tag lies and the tag should be picked up lengthwise. Loss of tag can occur if an attempt is made to pick up the tag along the perpendicular axis. See FIGURE 24.

4.2.4 Grasp the manual tagger in your right hand. The body of the injector should be held firmly between the index finger and the middle finger with the right thumb gently resting on the plunger at the rear of the tag injector.

FIGURE 25 Proper holding position of the manual tag injector in preparation for tag insertion.

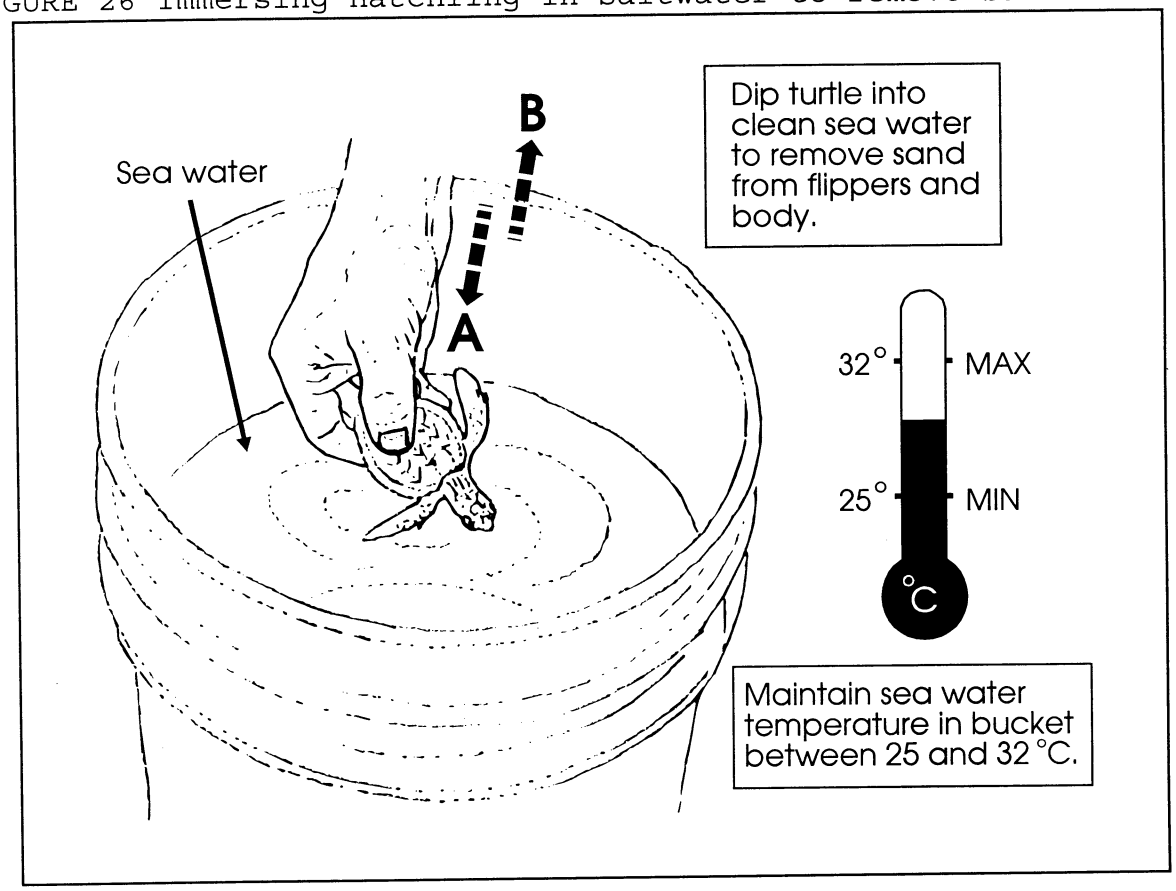


NOTE 1 After loading a wire tag, keep the tip of the needle elevated higher than the rear of the tag injector. This will help ensure the tag does not fall out of the end of the needle.

4.3 HATCHLING PREPARATION FOR THE MANUAL (SINGLE-SHOT) TAG INJECTOR

4.3.1 Immerse each hatchling in a bucket of sea water to clean all sand from the flippers and body. Sea water should be clean and at ambient ocean temperature. If tagging is carried out during daylight hours, periodically check water temperature and replace with new sea water if necessary.

FIGURE 26 Immersing hatchling in saltwater to remove sand.

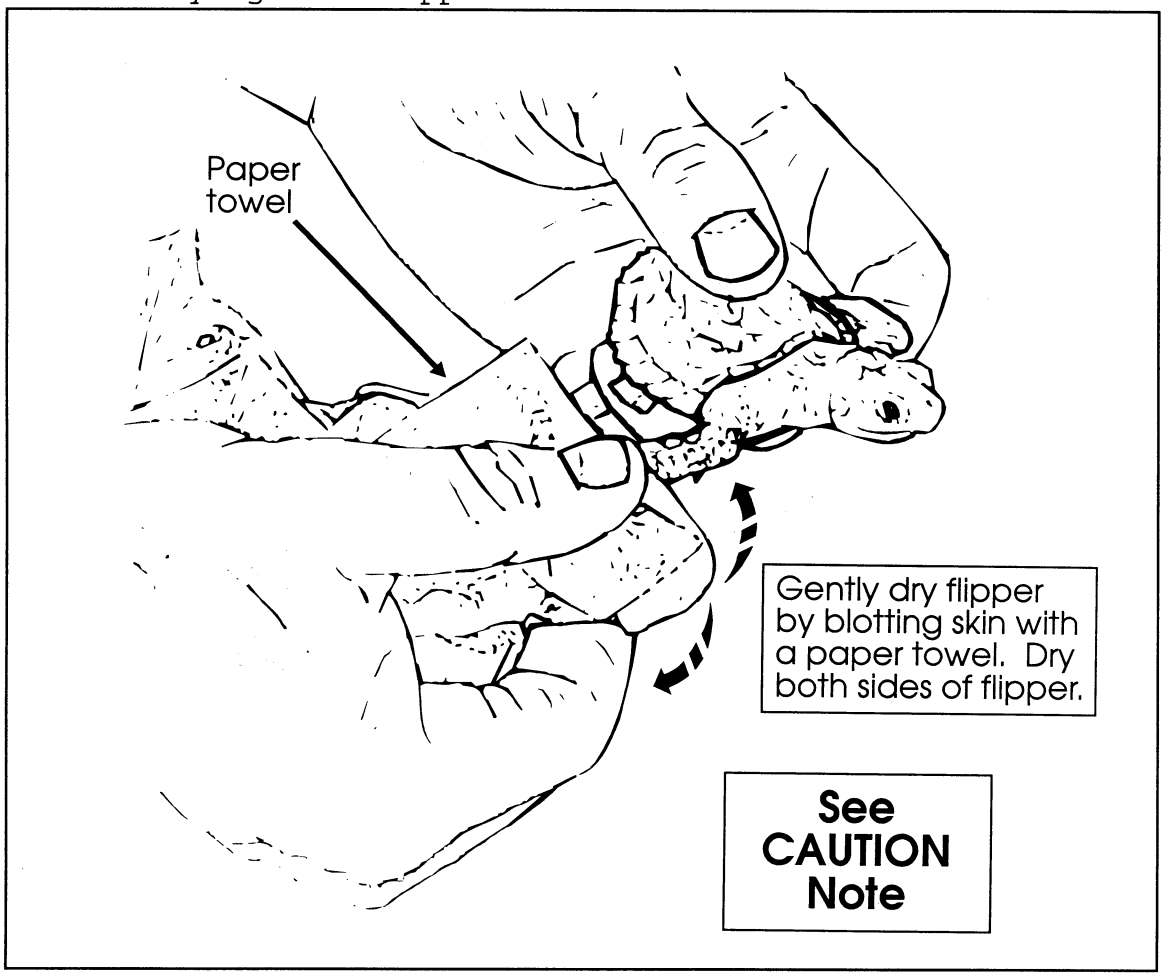


***CAUTION* Any sand remaining on the hatchling will eventually get into the tag injector and cause a malfunction.**

***CAUTION* Maintain water temperature between 25° and 32°C (77° to 90° F).**

4.3.2 Dry the entire foreflipper, both dorsally and ventrally, using a clean paper towel. Make sure the tag insertion area is completely clean and dry. Water left on the flipper will dilute and contaminate the antimicrobial agents and cause them to drip off the flipper staining everything it contacts. See FIGURE 27.

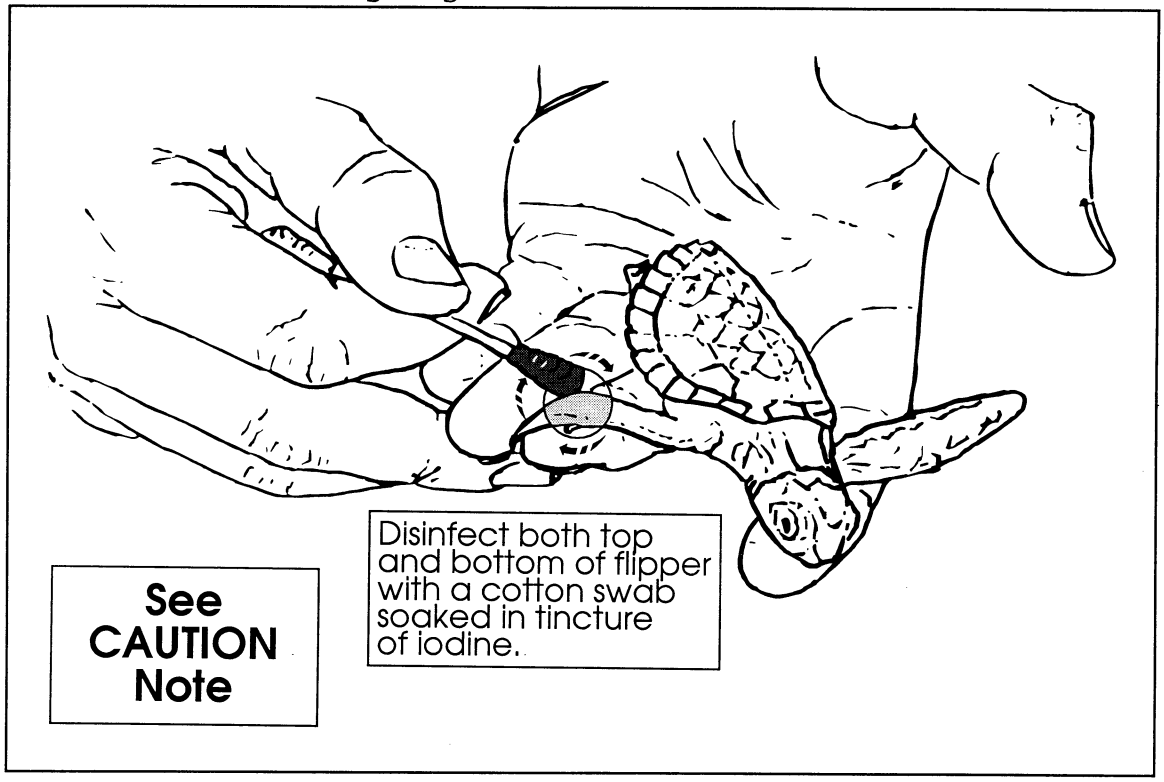
FIGURE 27 Drying foreflipper.



***CAUTION* Gently blot the water from the turtles skin. Rubbing may damage or irritate the delicate skin and scales on the flipper. Excessive pressure on the tiny foreflipper may also fracture bones. Replace the paper towel with a new one when it becomes damp or soiled.**

4.3.3 Disinfect the tag insertion area by swabbing with a disposable cotton swab soaked with tincture of iodine. Lightly scrub the tag insertion area on the dorsal and ventral surfaces of the flipper directly above and below the tag insertion area. The ventral surface is disinfected to guard against infection in the event the tag injector penetrates through the ventral flipper surface.

FIGURE 28 Disinfecting tag insertion area.



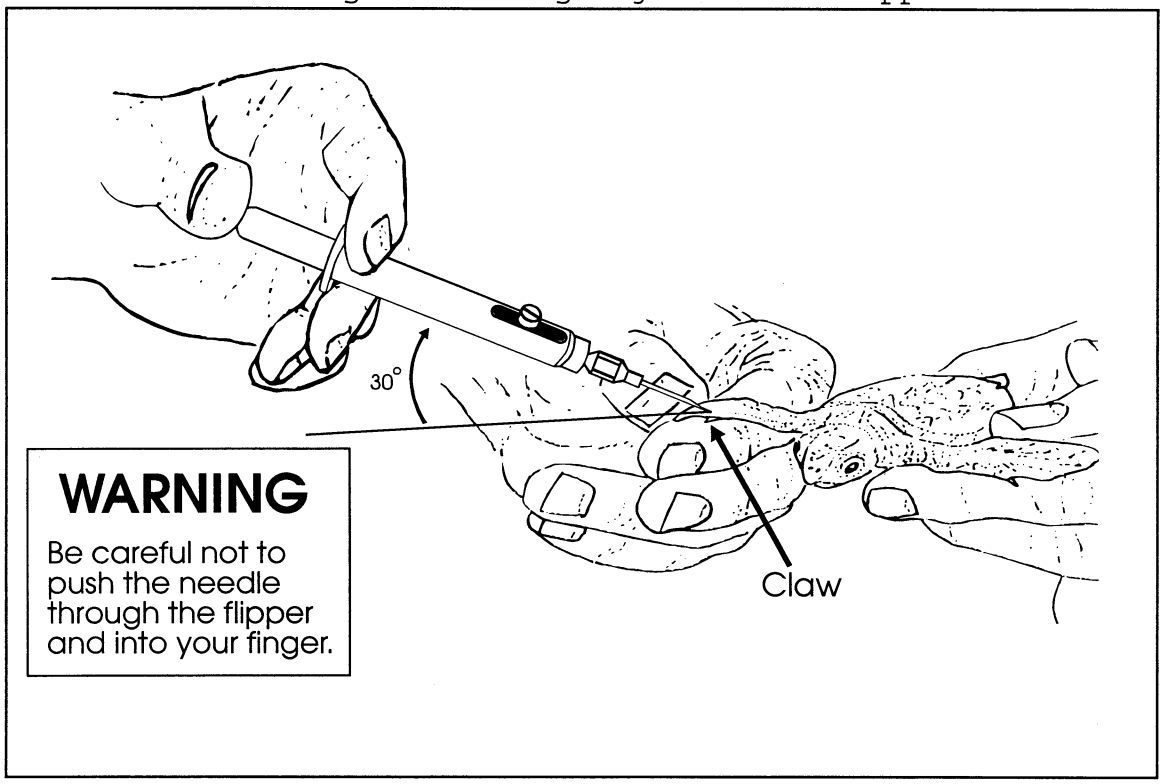
CAUTION **Anti-microbial agents like tincture of iodine may be toxic to small animals if absorbed into the bloodstream. Do not use any more iodine than is necessary to sterilize the flipper. When applied the iodine should just stain the flipper leaving a miost spot. Iodine dripping or running off the flipper is too much.**

4.4 TAG INSERTION USING THE MANUAL (SINGLE-SHOT) TAG INJECTOR

Complete procedures 4.2.1 through 4.3.3 before proceeding.

4.4.1 An assistant must gently but firmly hold the hatchling so that the foreflipper to be tagged is extended towards the tagger. With the foreflipper gently bent over the index finger of the tagger's left hand and held firmly in place with the left thumb, position the needle tip at a 30° angle to the flipper in the area of the claw. Hold the tag injector parallel to the leading edge of the flipper with the needle pointing towards the hatchlings body;

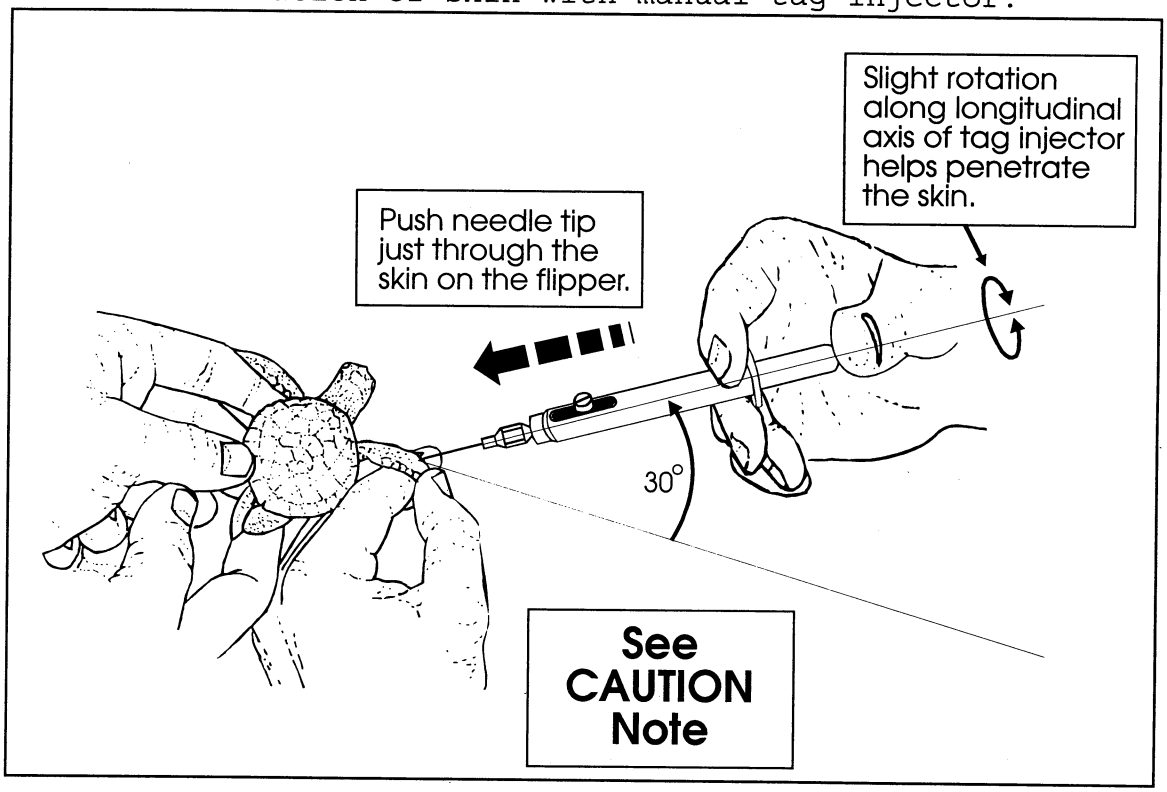
FIGURE 29 Positioning manual tag injector on flipper.



***CAUTION* An insertion angle of 30° is necessary to penetrate the skin. Angles less than 30° will result in the needle sliding along the skin and scratching of the flipper without proper needle penetration.**

4.4.2 Firmly but carefully push the needle tip just through the skin on the flipper. A slight twisting motion of the tag injector helps penetration of the skin. A sharp needle also facilitates skin penetration. Sharpen or replace the needle when there is a noticable change in sharpness (See section 7.0 Cleaning and maintenance).

FIGURE 30 Penetration of skin with manual tag injector.

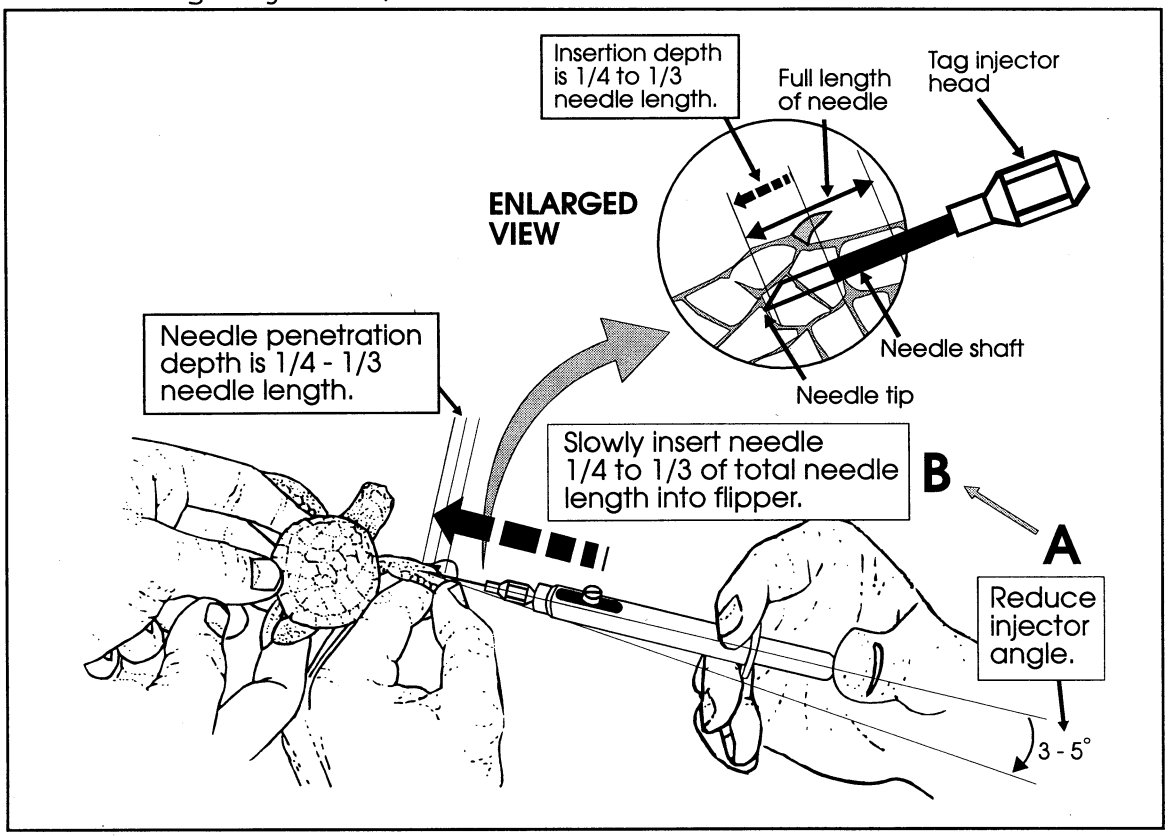


CAUTION Do not change the angle of the tag injector while twisting. Twisting is accomplished by rolling the wrist slightly away from and towards the tagger's body. Twisting is done along the central longitudinal plane of the tag injector. See FIGURE 30.

CAUTION Excercise extreme caution when penetrating the flipper to ensure the needle does not go through the ventral surface and into your finger.

4.4.3 Once the skin has been penetrated, adjust the tag injector angle to 3 - 5° and continue to push the needle into the muscle tissue of the flipper about 1/4 the length of the needle in a direction parallel to the claw (i.e. towards the body). The flipper is very thin (< 3 mm thick) and extreme care must be used to ensure the needle is not pushed through the bottom surface of the flipper. The needle should lie just below the skin on the ventral surface of the flipper.

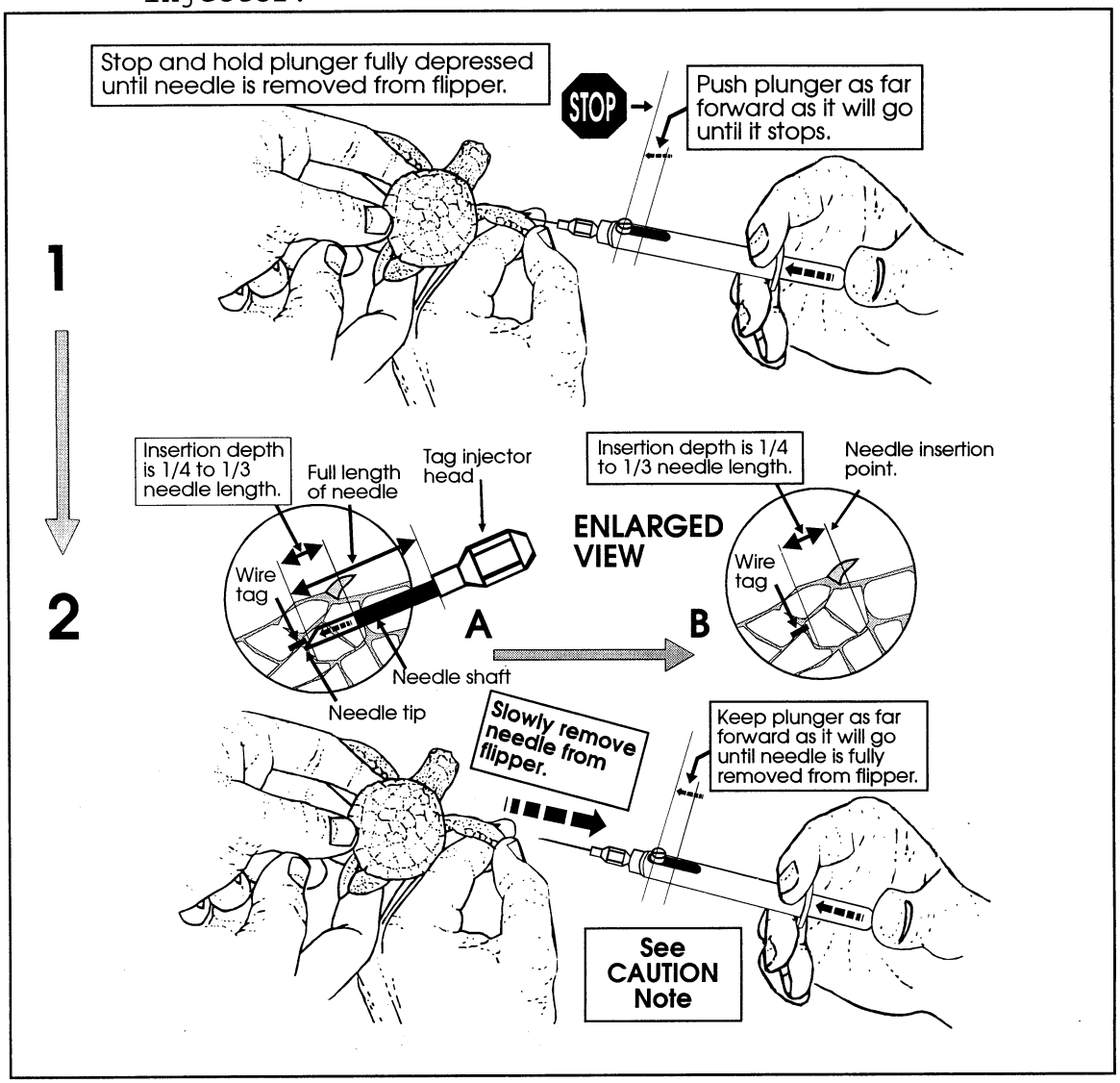
FIGURE 31 Correct insertion angle of needle into flipper (manual tag injector).



***CAUTION* It is extremely important that the needle be inserted exactly parallel to the leading edge of the flipper. Failure to orient the tag in this position may result in difficulty magnetizing the tag at a later date. A wire tag accepts a magnetic charge best when the magnet is passed perpendicular to the tag's longitudinal axis. Passing a magnet perpendicular to the latitudinal axis may un-magnetize a wire tag. Read SECTION 5.0 DETECTION OF INTERNAL WIRE TAGS for more details.**

4.4.4 Push the plunger as far forward as it will travel to expel a tag from the tip of the needle and into the muscle. Use the right thumb to move the plunger. Keeping the plunger lever fully extended, slowly withdraw the needle from the flipper.

FIGURE 32 Ejection of wire tag into flipper using the manual tag injector.



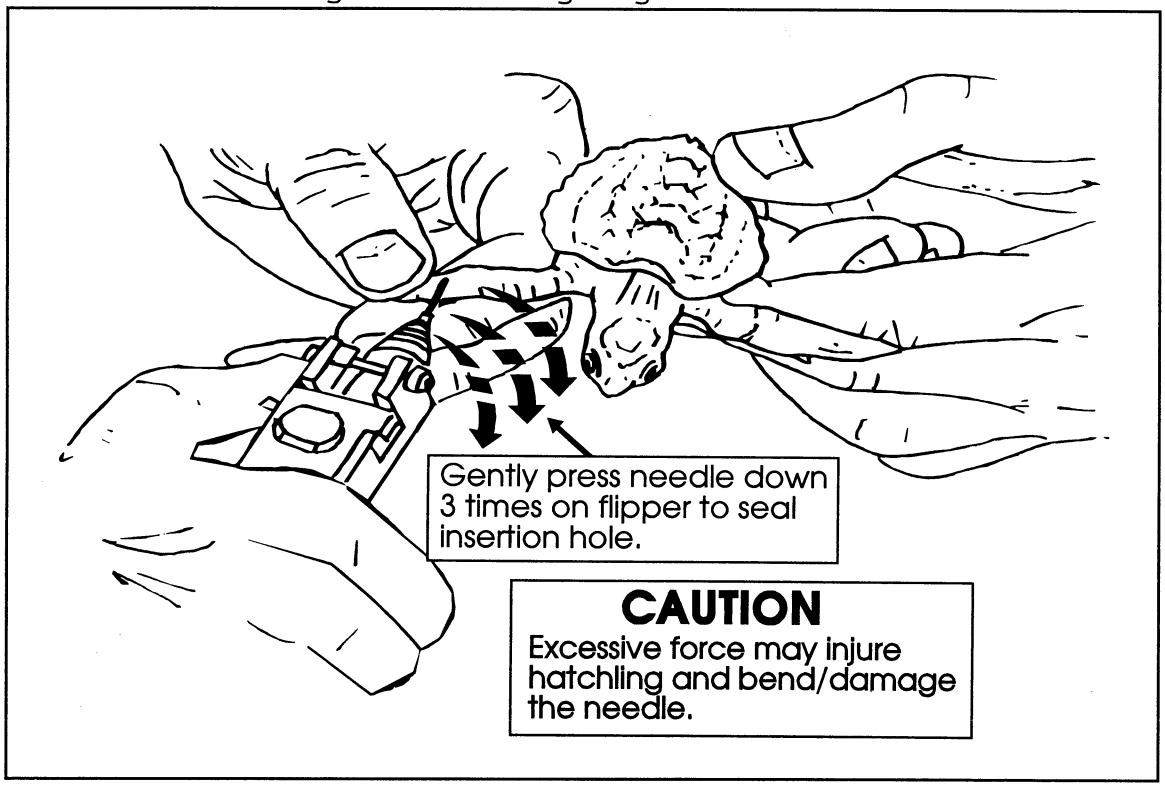
CAUTION **It is extremely important that the plunger be held as far forward as it will travel until the needle is completely withdrawn from the flipper. Failure to hold the plunger all the way forward may result in the tag being "sucked" back into the needle and the tag being withdrawn from the flipper when the needle is removed.**

4.4.5 Visually inspect the area adjacent to the needle hole in the flipper to ensure that the tag remained in the flipper when the needle was withdrawn. If the tag came out - go back to **Step 4.0** and continue.

4.4.6 After the tag has been inserted into the flipper, take the barrel of the needle and flatten the tag insertion hole by gently pressing down on the skin laying over the tag. The needle should be held perpendicular to the leading edge of the flipper with the needle pointing towards the rear flipper.

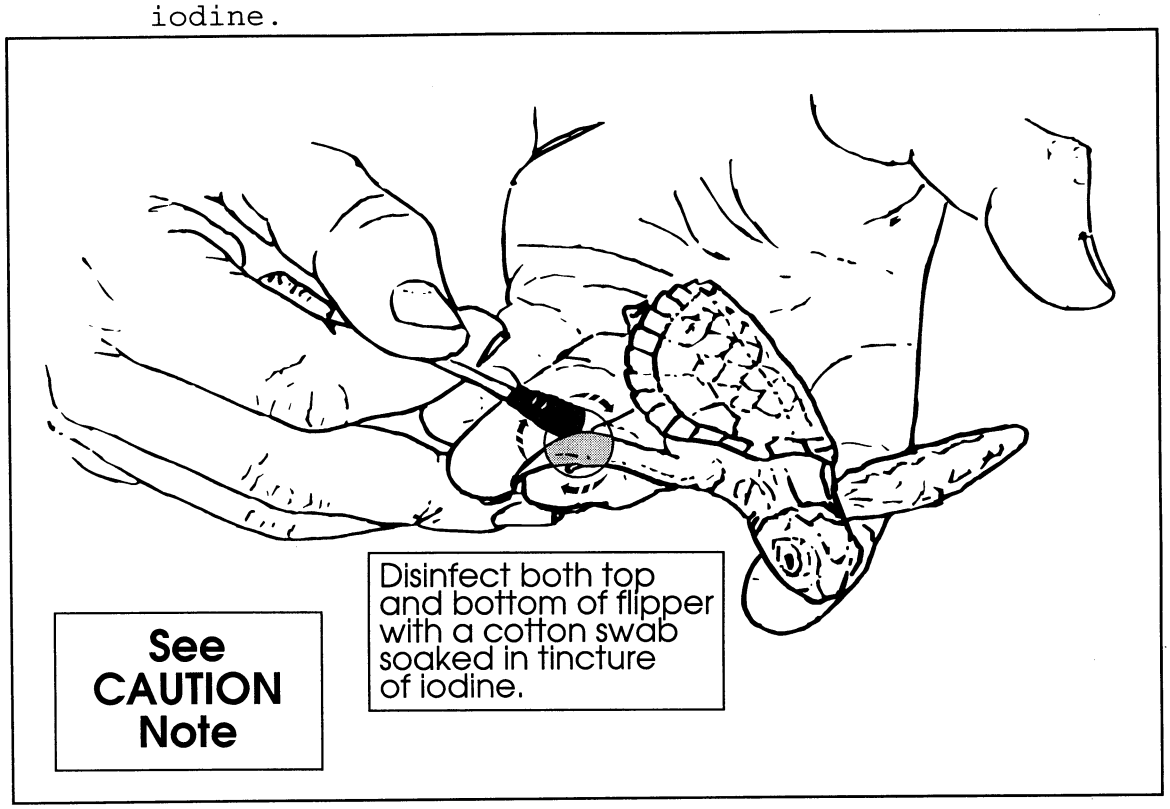
Press the needle barrel down onto the flipper in the area of the hole pressing down once at the mouth of the hole and again once or twice over the area of the tag. Press the needle straight down then lift straight up. Do not rub the needle from side to side as this may push the tag out of the insertion hole. Flattening the skin over the tag helps close and seal the hole made by the needle and prevents the tag from sliding out of the flipper.

FIGURE 33 Flattening and sealing tag insertion hole.



4.4.7 Disinfect the tag insertion hole by swabbing with a disposable cotton swab soaked with tincture of iodine. Tagged hatchlings should be kept separate from un-tagged ones and should be released as soon after tagging as possible.

FIGURE 34 Disinfecting tag insertion area with tincture of iodine.

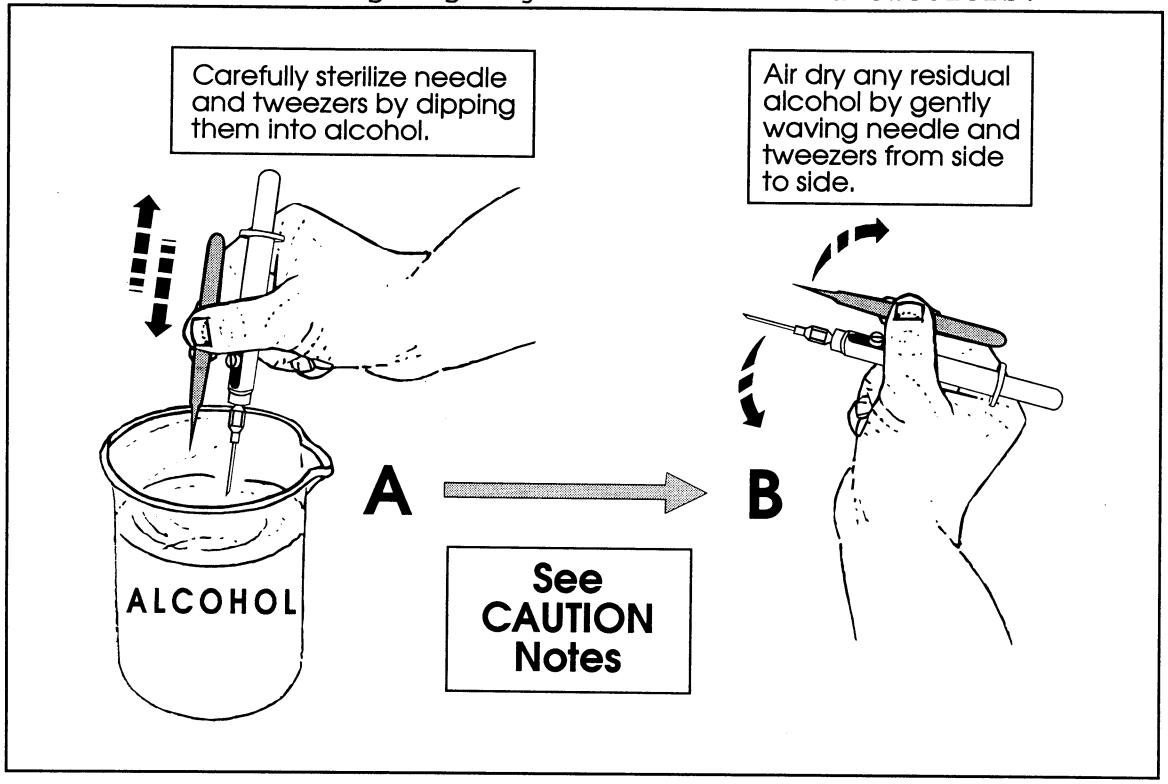


***CAUTION* Anti-microbial agents like tincture of iodine may be toxic to small animals if absorbed into the bloodstream. Do not use any more iodine than is necessary to sterilize the flipper.**

NOTE 1 If any bleeding is observed from the tag insertion wound the hatchling should be placed immediately into clean salt water to help coagulate tissues around the wound opening. Sea turtle blood and tissues coagulate better in contact with sea water than air. Bleeding is extremely rare and if it occurs the tagger should carefully re-read the tagging instructions and seek the assistance of a more experienced tagger.

4.4.8 Periodically disinfect the tag injector needle and tweezers after every 5 - 10 turtles tagged in a container containing 70% isopropyl alcohol. Allow the needle to air dry before resuming tagging. Air drying should take less than 15 seconds. Gently waving the needle back and forth will accelerate air drying of the needle.

FIGURE 35 Disinfecting tag injector needle and tweezers.



CAUTION Even small quantities of alcohol (like a drop on the tip of a needle) is toxic to small animals and can lead to blindness if too much is absorbed into the blood stream. Extreme care should be taken to ensure that as little alcohol as possible remains on and in the needle after sterilization. Complete air drying of the needle eliminates any risk.

CAUTION Be very careful not to damage the needle when dipping into the container of alcohol. The needles are very fragile and may bend or dull if brushed or banged against the container.

5.0 DETECTION OF INTERNAL WIRE TAGS

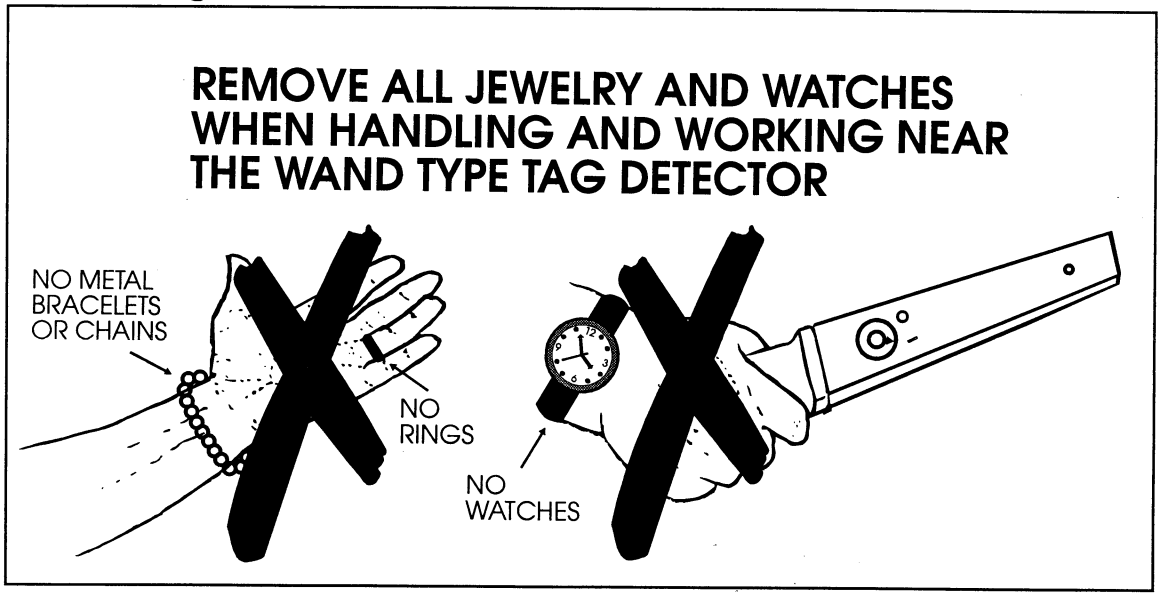
5.1 GENERAL INFORMATION AND PREPARATION OF EQUIPMENT FOR TAG DETECTION

5.1.1 At least two people are required to properly examine a sea turtle for the presence of an internal wire tag. The second person is required to immobilize the flipper during examination. Large sea turtles will require more than two people. A third person assisting would be helpful for all sized sea turtles. A flipper slapping the wand type tag detector can cause damage and also result in a false positive reading. All persons involved in detecting wire tags must remove all watches and jewelry from hands and arms.

NOTE 1 Neither the person holding the wand type tag detector nor the assistant holding the flipper should have the magnet for magnetizing the tag on their person when actively examining the turtle. It helps to have a third person assist by holding the magnet away from the persons examining the turtle.

NOTE 2 Metal belt buckles, some rims of eye glasses and sunglasses, hair restraining devices (barettes), earrings, and necklaces, etc. might cause interference with the wand type tag detector.

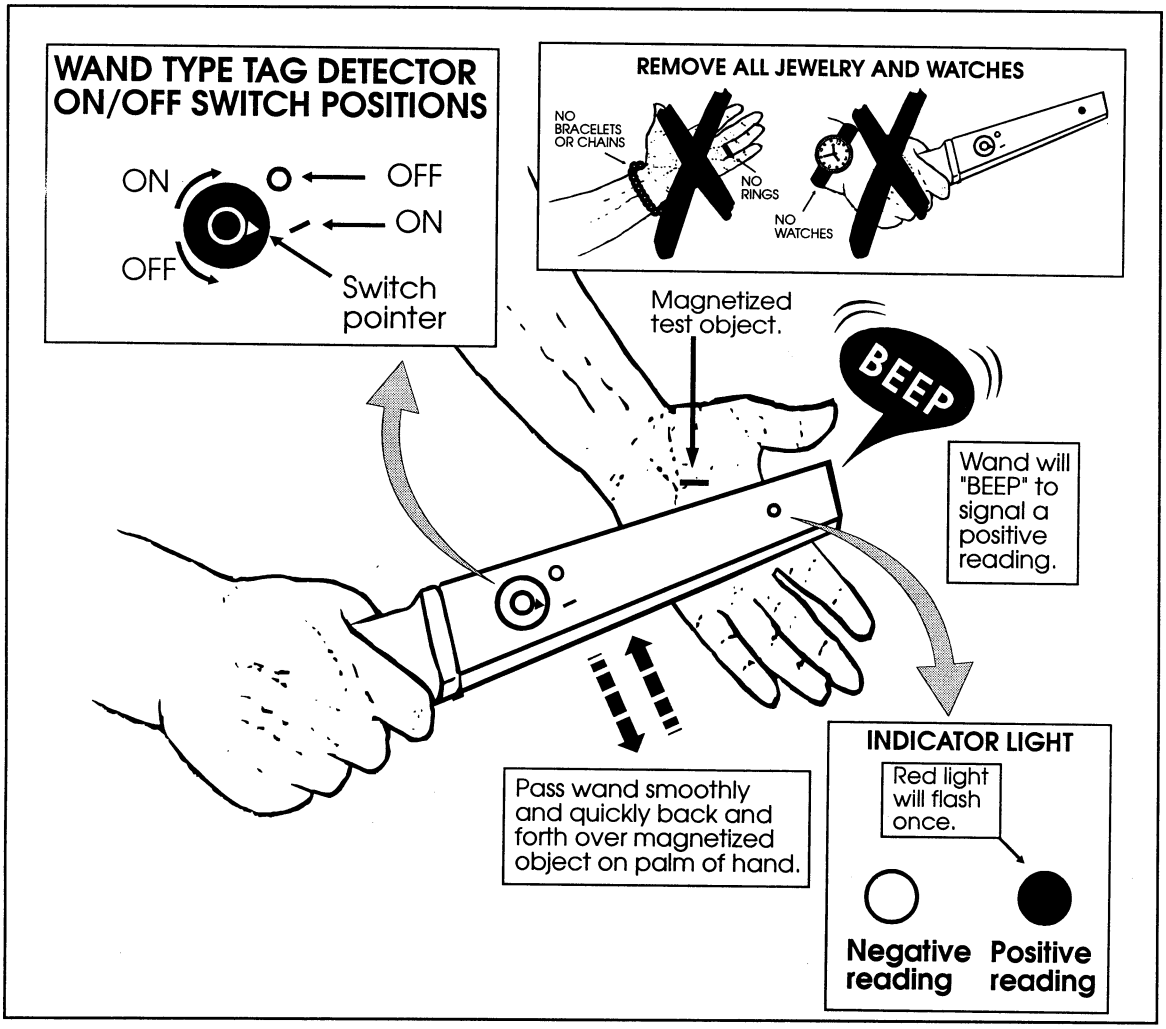
FIGURE 36 Warning that metal objects can interfere with magnetic tag detection.



5.1.2 **WAND TYPE TAG DETECTOR[1] TEST PROCEDURE**

Turn the power on (see FIGURE 37) and test the unit by passing it over metal with a known mangnetic content. A loud audible "beep" should be heard. Some wand type tag detectors also have a red LED light which illuminates when metal is detected. If no "beep" is heard when passed over a magnetized metal source, the wand type tag detector is either not turned on or is malfunctioning. Proceed only when the wand type tag detector passes the test procedure.

FIGURE 37 Testing wand type tag detector prior to initiating tag detection.



NOTE 1 If the wand type tag detector fails to "beep" during the test procedure check to make sure the batteries are fully charged before diagnosing the unit as malfunctioning.

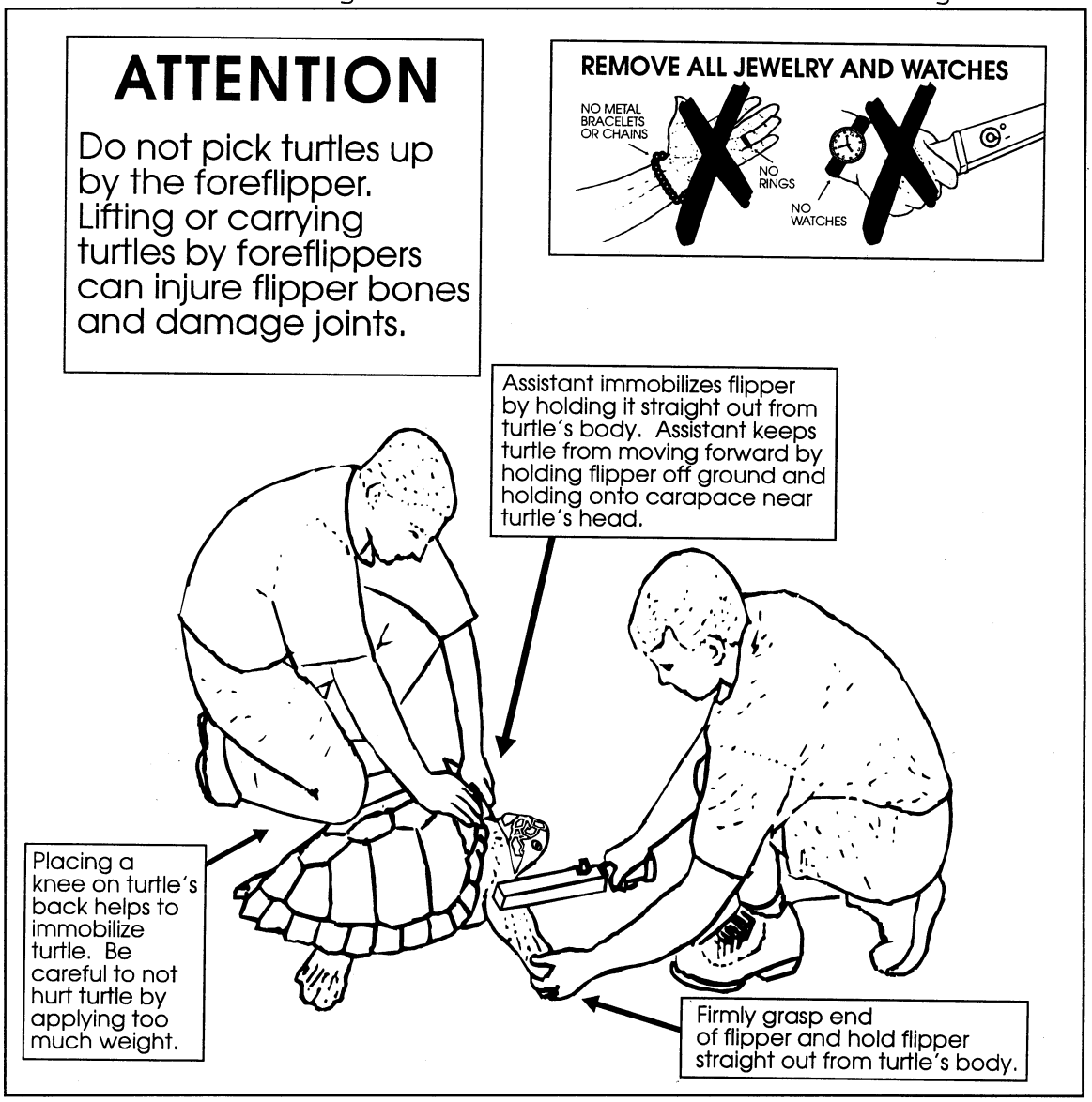
[1] See Appendix C - Equipment Suppliers for manufacturer.

5.2 TAG DETECTION

5.2.1 If possible, the turtle should be held a least 1 m away from the ground, sand, metal equipment, vehicles, electronic circuits, walls containing pipes or reinforcement steel, etc. It may be possible to shield a turtle on a nesting beach from magnetized particles in the sand by placing a piece of plywood under the turtle before passing the detector over its flippers (Fontaine *et. al.* 1993).

One or two people must immobilize the turtle and hold one of the foreflippers stationary, fully extended out from the turtle.

FIGURE 38 Immobilizing turtle for detection of wire tags.



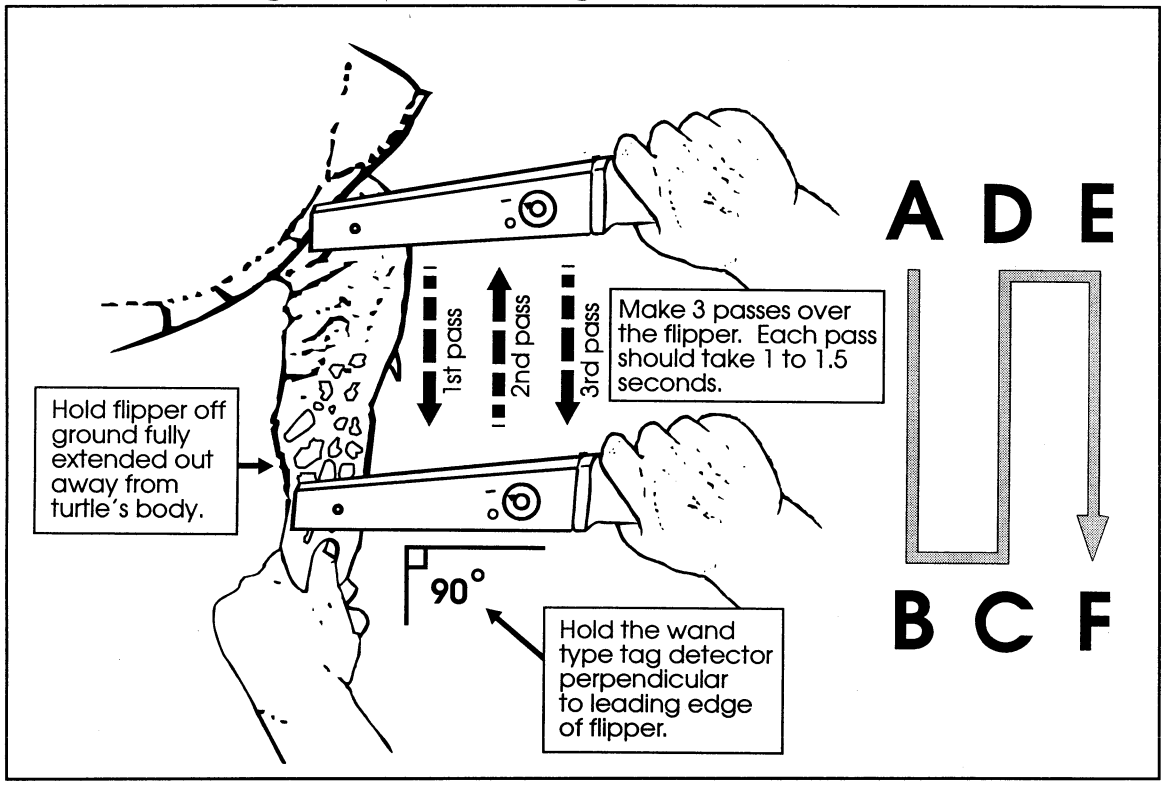
5.2.2 Hold the tag detector perpendicular to the leading edge of the flipper starting next to the body at the margin of the flipper and the carapace/plastron. Pass the wand over the surface of the flipper keeping it perpendicular to the leading edge of the flipper. Try to get the wand as close to the flipper surface as possible without touching it.

Move the wand quickly but smoothly from one end of the flipper to the other. Each pass should take about 1 second from one end of the flipper to the other. The wand requires movement to detect a tag. Holding the wand stationary over a position or very slow movement may not detect a tag.

Scan each surface of both flippers at least 3 times:

1. From the body to the flipper tip;
2. From the flipper tip to the body; and
3. From the body to the flipper tip.

FIGURE 39 Proper positioning of wand over the turtle's flipper for magnetized wire tag detection.



NOTE 2 Most wire tags should be located in the area of the claw. If no tags are detected after 3 passes along the entire flipper try several short passes back and forth in the area of the claw.

NOTE 1 **Stop** after 3 passes or when an internal magnetized wire tag is detected which ever occurs first.

5.2.3 IF A SUSPECTED TAG IS DETECTED

If the wand "beeps" during an examination of a flipper attempt to locate the exact location of the metal source. Carefully re-pass the wand over the suspected tag site and ensure that consistent multiple readings can be made.

NOTE 1 Make sure the wand is not bouncing off the flipper surface causing false positive readings.

If consistent multiple readings are made, carefully re-check the area under and around the flipper with the wand to make sure there are no metal sources that might be giving a positive reading. Also, carefully examine the flipper surface to make sure there is no sign of visible imbedded metal.

NOTE 2 Surface embedded metal may be a fish hook, steel buckshot, wire fishing leader, etc.

NOTE 3 Check both sides of the flipper.

NOTE 4 **IF AN INTERNAL WIRE TAG IS DETECTED:**

1. Note which flipper contained the tag (left, right, or both);
2. Photograph the turtle (from as many different angles as possible);
3. Scan for a PIT tag (Passive Integrated Transponder);
4. Thoroughly scrub clean the carapace. Examine the carapace very closely for any signs of a living tag. Take close up photos of living tag if found.
5. Examine closely all trailing edges of the flippers for flipper tags and flipper tag scars. Photograph all tags and tag scars.
6. Carefully record all observations and examinations made.

(See Fontaine *et. al.* 1993, and Caillouet *et. al.* 1997 for descriptions and location of tags).

5.2.4 **IF NO INTERNAL WIRE TAG IS DETECTED**

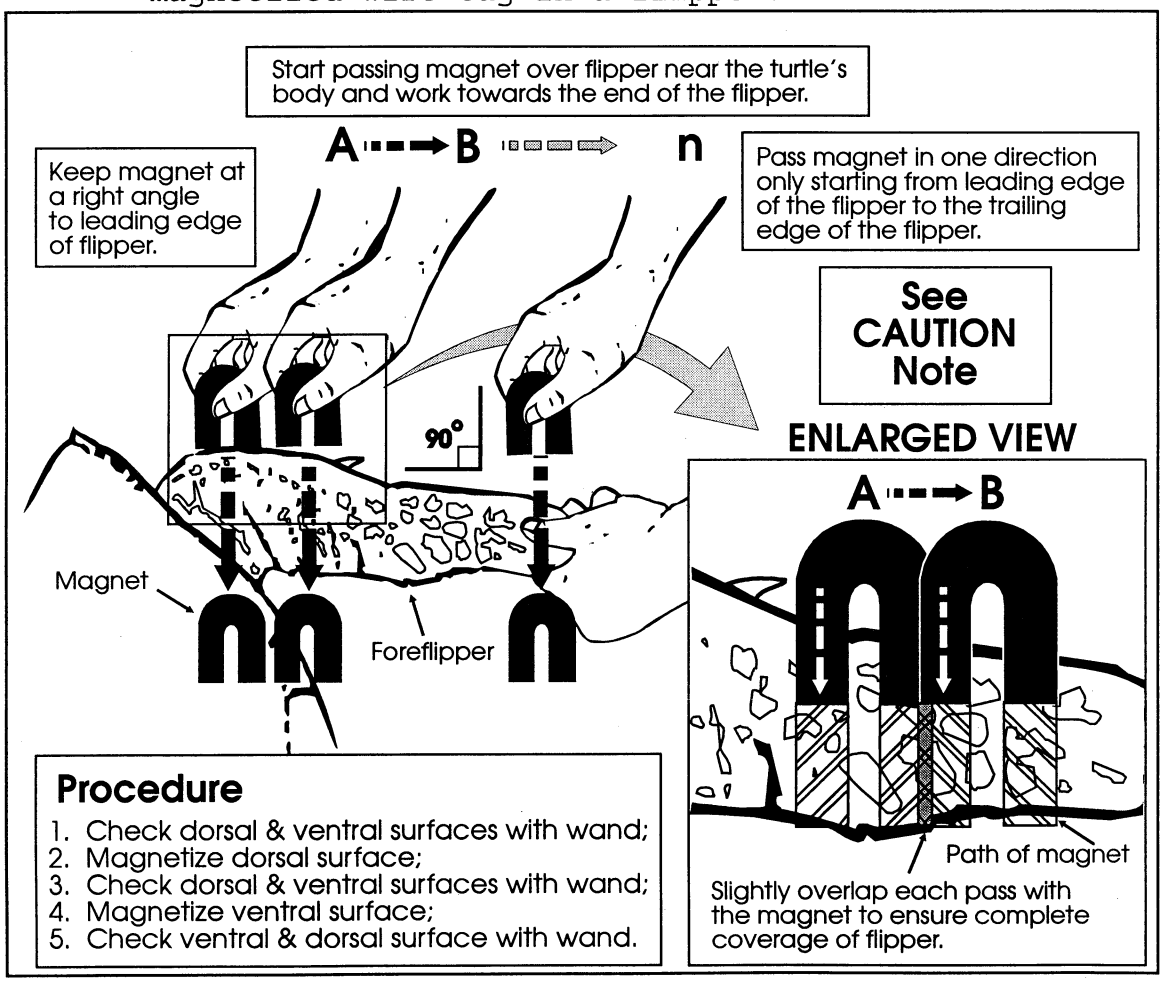
Proceed to tag magnetization.

5.3 TAG MAGNETIZING/RE-MAGNETIZING

5.3.1 If no tag is detected after examining both surfaces of the front flippers, then a magnet needs to be passed over the flippers in an attempt to magnetize an un-magnetized wire tag.

Pass a magnet over both surfaces of the front flippers to magnetize any wire tag that might be present. The magnet should be passed in **only one direction** in **parallel** sweeps from the **leading edge** of the flipper **towards the trailing edge**. Each sweep of the magnet should slightly overlap the previous sweep to ensure complete coverage of the entire flipper surface. Follow procedure (**Steps 1-5**) in FIGURE 40.

FIGURE 40 Proper technique for magnetizing a previously non-magnetized wire tag in a flipper.



CAUTION **Sweeping the magnet in any direction other (i.e. parallel) than from the leading edge to the trailing edge (i.e. perpendicular) of the flipper may result in a failure of the tag to take a magnetic charge and even un-magnetization of a previously magnetized tag. The magnetized wire tag holds it's magnetic charge in a polar orientation. Running a magnet parallel to this polar orientation can lift a magnetic charge off the tag and/or change the polar orientation resulting in a negative reading.**

5.3.2 After passing the magnet over each flipper surface, attempt to detect a magnetized tag following the procedure outlined in **5.2 TAG DETECTION**. Continue the detection and magnetizing procedure.

NOTE 1 Stop after 3 passes or when an internal wire tag is detected whichever occurs first.

If an internal wire tag is detected follow the procedure outlined in **5.2.3 IF A SUSPECTED TAG IS DETECTED** above.

6.0 MAGNETIZING AND DE-MAGNETIZING WIRE TAGS PRIOR TO INSERTION

6.1 TESTING A CUT WIRE TAG FOR MAGNETIC CHARGE

Tags may come both magnetized and non-magnetized from the manufacturer. Most tagging applications using internal wire tags use a magnetized wire tag. Usually the tags will arrive from the manufacturer as specified by the tagger (i.e. magnetized or non-magnetized). There is the possibility that tags ordered as non-magnetized may become magnetized by inadvertant contact with a magnetic source. Testing the entire role of tags with the wand will not always positivley distinguish between magnetized and non-magnetized wire tags. An individaul tag cut from the roll must be tested to determine if the tags are magnetized or non-magnetized.

Complete the test procedure as outlined in section **3.2.4 TEST PROCEDURE**. Turn on the wand type tag detector and proceed with the test procedure as outlined in section **5.1.2 WAND TYPE TAG DETECTOR TEST PROCEDURE**.

With a cut wire tag resting flat on the palm of the left hand, scan the tag with the wand. Move the wand parallel along the length of the wire tag using a smooth sweeping motion. Scan the tag at least 3 times.

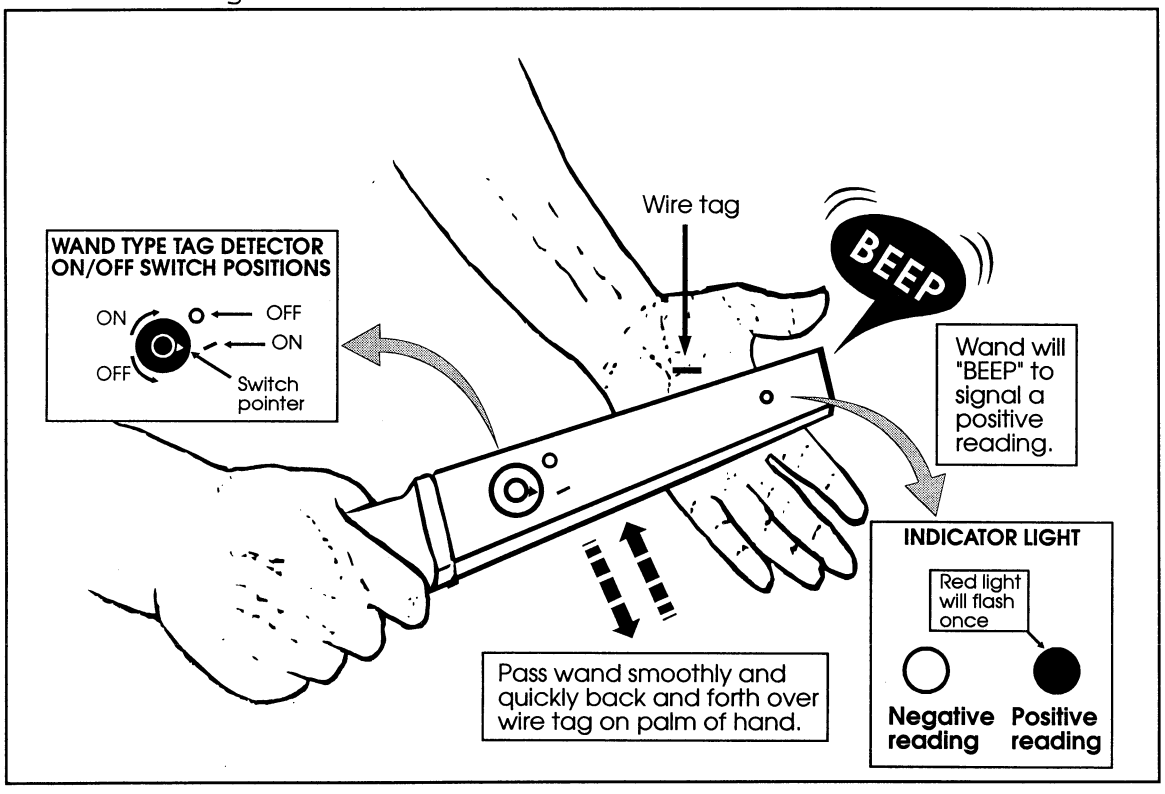
NOTE 1 Remove all jewelry and watches before scanning cut wire tag on hand.

If the wand "beeps" during an examination of a tag carefully re-pass the wand type tag detector over the tag several times and ensure that consistent multiple readings can be made.

If consistent multiple "positive" readings (wand "beeps") are made then the tag is magnetized. If tagging is to be done with un-magnetized tags then the tags will have to be de-magnetized. See section **6.3 DE-MAGNETIZING WIRE TAGS PRIOR TO INSERTION.**

If consistent multiple "negative" readings (no "beep" from wand) are made then the tag is non-magnetized. If tagging is to be done with magnetized tags then the tags will have to be magnetized. See section **6.2 MAGNETIZING WIRE TAGS PRIOR TO INSERTION.**

FIGURE 41 Scanning a cut wire tag for the presence of a magnetic charge.

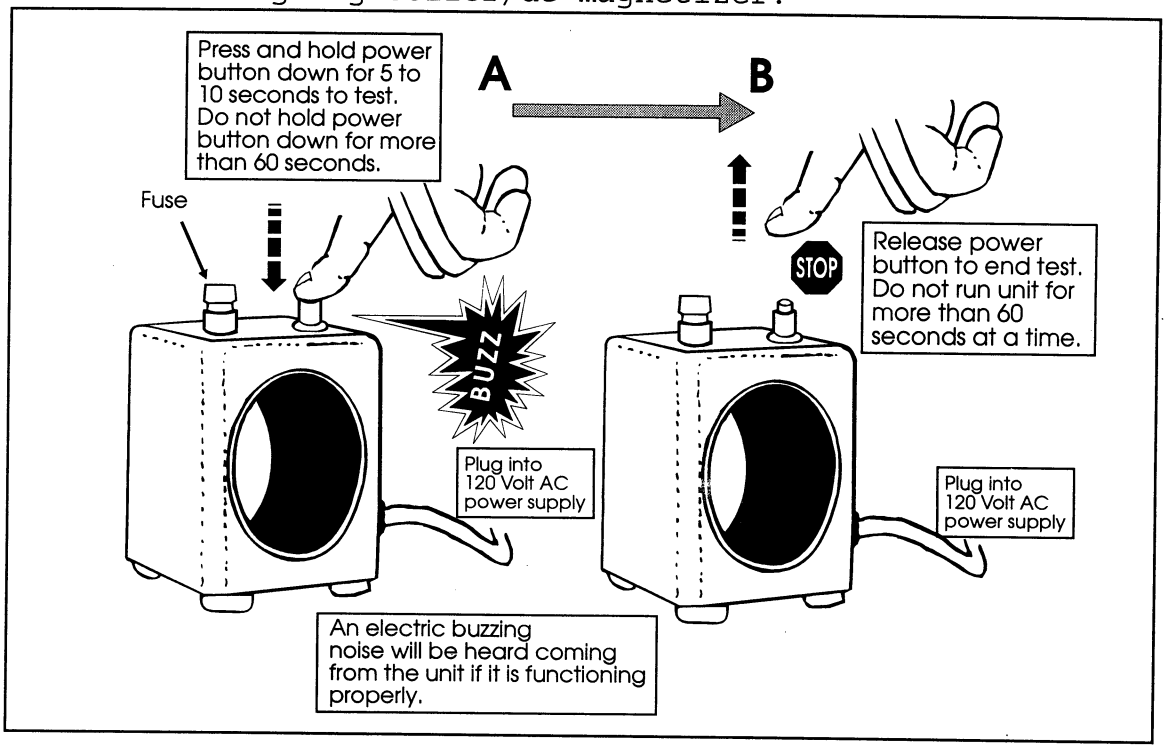


6.2 MAGNETIZING WIRE TAGS PRIOR TO INSERTION

6.2.1 Test procedure for magnetizer/de-magnetizer

Plug in the magnetizer/de-magnetizer. Press down and hold the on switch. If the unit is functioning properly it will "buzz" and start to heat up. Hold the switch down for 5 - 10 seconds and release. If the unit didn't "buzz" or warm up then the fuse is blown or the unit is malfunctioning. Proceed when the magnetizer/de-magnetizer is functional.

FIGURE 42 Testing magnetizer/de-magnetizer.



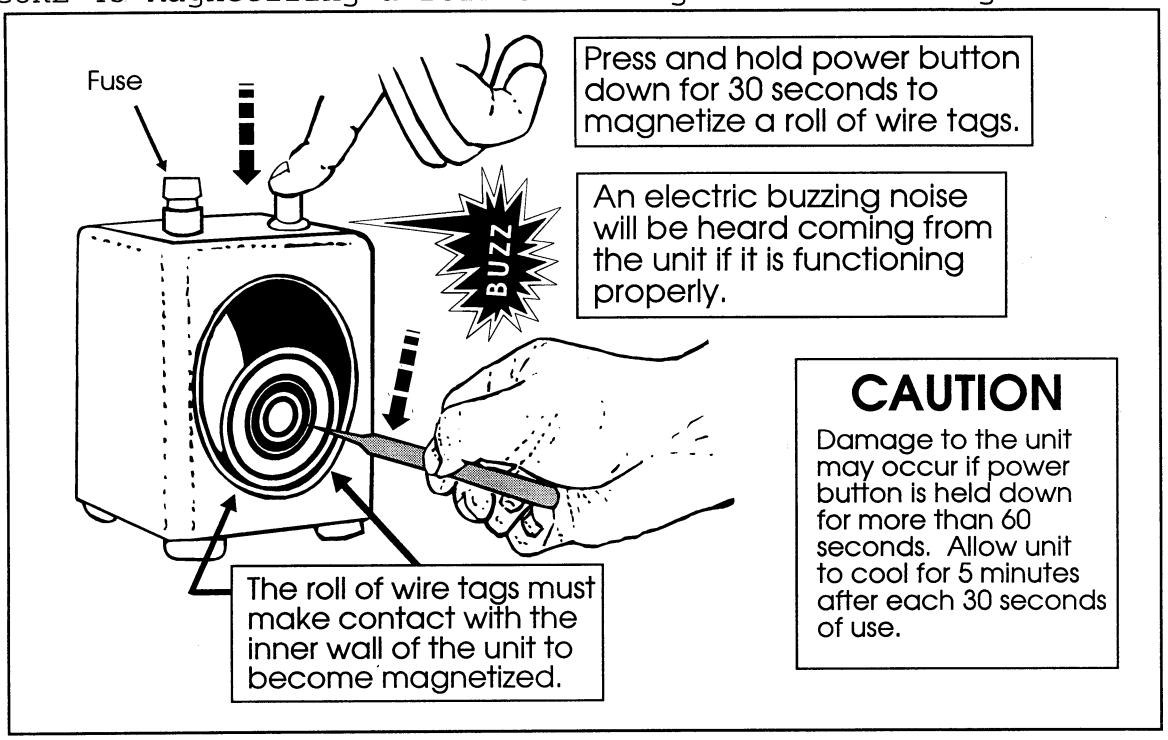
6.2.2 Magnetizing wire tags

Hold the roll of un-cut wire tags or strip of pre-cut wire tags with a pair of non-magnetized tweezers inside the magnetizer/de-magnetizer. While **TOUCHING** the inside wall of the magnetizer/de-magnetizer press the on switch down and hold for 30 seconds. Release the switch and withdraw the tags from the magnetizer/de-magnetizer.

***CAUTION* DO NOT run the magnetizer/de-magnetizer continuously for more than 60 seconds. Continuous use for more than 60 seconds can lead to over-heating and damage to the magnetizer/de-magnetizer.**

***CAUTION* Allow the magnetizer/de-magnetizer to cool down for 5 minutes after each 30 seconds of use. Damage to the unit and blown fuses may result if the unit is not allowed to cool between each use.**

FIGURE 43 Magnetizing a roll of un-magnetized wire tags.



NOTE 1 The tags must come in physical contact with the inside wall of the magnetizer/de-magnetizer in order to become magnetized. Failure to make good contact with the inside wall of the magnetizer/ de-magnetizer may result in partial or no magnetic charge being transferred to the tags.

Re-test "magnetized" wire tags using the procedure outlined in **6.1 TESTING A CUT WIRE TAG FOR MAGNETIC CHARGE.**

NOTE 2 AUTOMATIC TAG INJECTOR
Wire tags can also be magnetized by passing un-cut wire tags through a magnetic head on the automatic tag injector. The magnetic head is an optional part available from the manufacturer (See Appendix C).

6.3 DE-MAGNETIZING WIRE TAGS PRIOR TO INSERTION

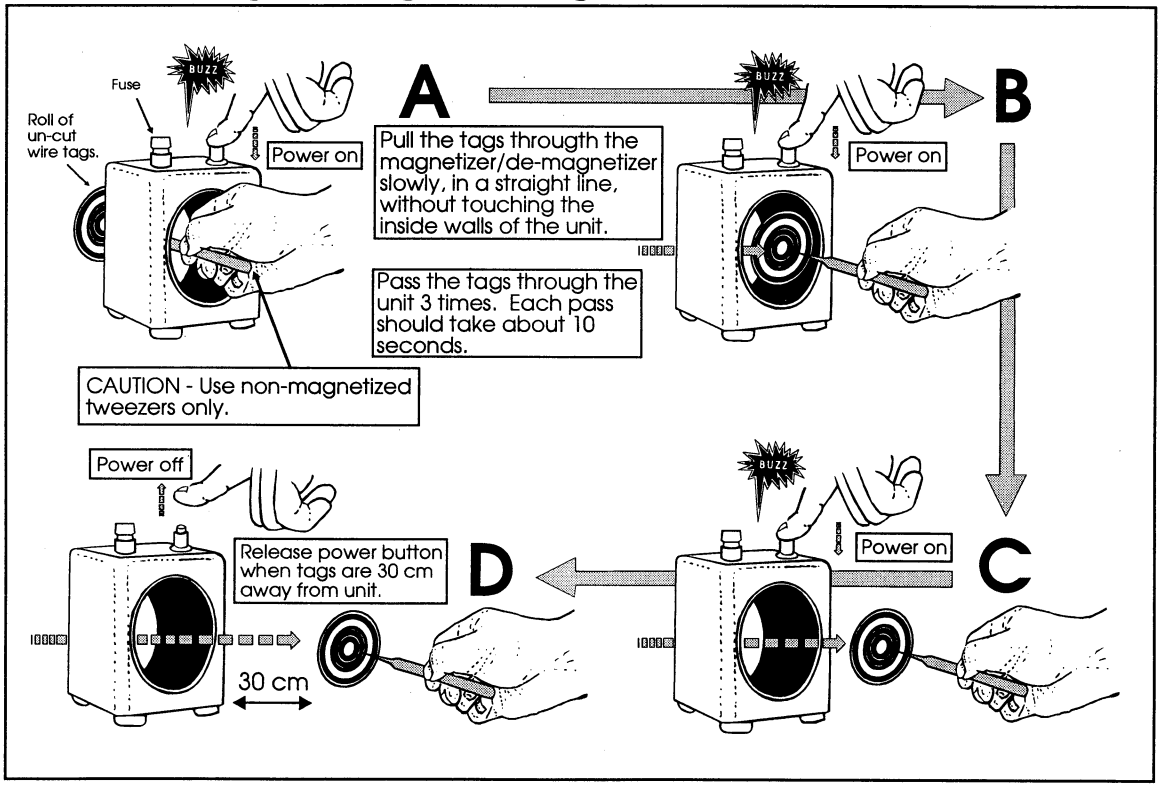
6.3.1 Test procedure for magnetizer/de-magnetizer

Plug in the magnetizer/de-magnetizer. Press down and hold the on switch. If the unit is functioning properly it will "buzz" and start to heat up. Hold the switch down for 5 - 10 seconds and release. If the unit didn't "buzz" or warm up then the fuse is blown or the unit is malfunctioning. Proceed when the magnetizer/de-magnetizer is functional (see FIGURE 42).

6.3.2 De-magnetizing wire tags

Place the roll of un-cut wire tags or strip of pre-cut wire tags with a pair of non-magnetized tweezers through the inside of the magnetizer/ de-magnetizer. While pressing the on switch down, slowly draw the tags through the magnetizer/de-magnetizer **WITHOUT TOUCHING** the inside of the unit. Continue to pull the tags in a straight line until they are 30 cm (12 inches) away from the magnetizer/ de-magnetizer and then release the switch. Repeat passing the tags through the magnetizer/ de-magnetizer 3 times. Each pass should take about 10 seconds.

FIGURE 44 De-magnetizing wire tags.



Re-test "de-magnetized" wire tags using the procedure outlined in **6.1 TESTING A CUT WIRE TAG FOR MAGNETIC CHARGE.**

***CAUTION* DO NOT let the tags TOUCH the inside wall of the magnetizer/de-magnetizer. If the wire tags touch the inside wall of the magnetizer/de-magnetizer they will pick up a magnetic charge.**

NOTE 1 USING AUTOMATIC TAG INJECTOR
If after several attempts to de-magnetize a roll of wire tags with the magnetizer/de-magnetizer the tags are still magnetized then the tag injector may be equipped with a magnetized head. Remove the head from the tag injector and check it with the wand type tag detector. If the head is magnetized then replace it with a non-magnetized head available from the manufacturer (See Appendix C).

Store all non-magnetized tags in a location away from magnets and large masses of ferric metal. Un-magnetized tags placed near large sources of ferric metal and magnets may pick up a magnetic charge.

***CAUTION* Stereo speakers and electric motors contain powerful magnets. Steel workbenches and large hand tools (hammers, screwdrivers, and socket sets) contain ferric metal and may hold a magnetic charge. Keep un-magnetized tags away from these sources.**

7.0 CLEANING AND MAINTENANCE OF TAG INJECTORS

Cleaning and maintenance is critical to successful tagging. The tag injectors contain many high precision components which can become stuck or otherwise inoperable if not cleaned regularly during use and at the end of each day's tagging and before being stored. Careful cleaning will enhance performance and greatly extend the life of the unit. Both the automatic and manual tag injectors are water resistant and can be fully immersed in clean **FRESH water** for cleaning purposes. Care should be taken, however, with the automatic tag injector to ensure that all internal moving parts are allowed to completely air dry before the injector is packed away in it's storage box.

7.1 BASIC CLEANING OF THE AUTOMATIC (MULTI-SHOT) TAG INJECTOR

7.1.1 Cleaning the tag injector head/pushrod assembly during a tagging session. (Refer to Figure 1).

A. Several times during a tagging session the front half of the tag injector (including: needle, head, cutter & cutter lever, and pushrod lever) should be immersed in a bucket of clean **FRESH water**. Any visible dirt or salt water residue on the unit should be washed off at this time;

B. While holding the front half of the tag injector below the surface of the water, depress the cutter lever and hold the cutter lever in the "down" position. While the tag injector is still below the surface of the water, slide the pushrod lever back and forth over it's entire length of travel at least 10 times;

C. Shake water off the tag injector and blot dry with a paper towel. Sterilize the tag injector needle before resuming tagging.

7.1.2 Cleaning the tag injector at the completion of a tagging session.

A. At the completion of a tagging session the front half of the tag injector (including: needle, head, cutter & cutter lever, pushrod lever) should be immersed in a bucket of clean **FRESH water**. Any visible dirt or salt water residue on the unit should be washed off at this time;

B. While holding the front half of the tag injector below the surface of the water, depress the cutter lever and hold the cutter lever in the "down" position. While the tag injector is still below the surface of the water, slide the pushrod lever back and forth over it's entire length of travel at least 10 times;

C. Allow the tag injector to air dry before storing in the plastic storage box.

7.2 ADVANCED CLEANING AND MAINTENANCE OF THE AUTOMATIC TAG INJECTOR

7.2.1 General information

A. Disassemble the tag injector on a clean dry surface;

B. There are many small pieces that will be removed to clean the internal parts of the tag injector, work over a surface that will catch and hold any pieces that are dropped. The top lid of the tag injector storage case works well. Open the lid and remove the foam insert from inside the lid. Place the foam underneath the open lid to support the lid in a level position;

C. Use the correct tool(s) for disassembly and reassembly;

D. Pay close attention to the orientation of parts when disassembling the injector, this information will be valuable during re-assembly;

E. Do not force parts apart or together. All parts should come apart and re-assemble smoothly without the use of force. Forcing parts together will cause expensive damage to precision parts;

F. When re-assembling, tighten all parts to finger tight. Over-tightening may break or damage parts;

G. If you are in doubt as to your mechanical capabilities, leave the disassembly and re-assembly to a more qualified person.

7.2.2 To remove needle. (Refer to Figure 1).

A. Slide the needle into the socket end of the 1/8" needle removal tool until the hex nut on the needle clamping unit engages in the hex socket of the wrench. Un-screw needle counter-clockwise to remove needle. Pull the needle and the threaded needle clamping nut out the front of the tag injector head.

7.2.3 To remove tag injector head

A. Remove needle (7.2.2);

B. Fully depress cutter lever;

C. Remove the two hex head bolts on the bottom of the tag

injector just to the rear of the head with the 3/32" Allen socket wrench from the tool kit. Slide the head out the front of the tag injector body.

7.2.4 To remove cutter assembly

A. Remove needle and tag injector head (7.2.2 & 7.2.3);

B. Retract pushrod lever into the tag injector body to release cutter lever. Cutter lever will pop "up". Hold the cutter lever in the "up" position. Press down on the oval button on the top of the cutter lever and turn 90° to release spring tension. Lift the button and spring up and out of the cutter lever;

C. Remove the dowel pin holding the cutter lever to the tag injector frame. Two 5/64" Allen wrenches will be required. One to unscrew (counter-clockwise) the bolt on the right side of the pin and the other wrench to keep the dowel pin from turning during disassembly. Push the dowel pin out of the tag injector frame using the tip of the Allen wrench;

D. Lift the cutter lever up and out of the tag injector frame. Hold the pushrod lever fully retracted back into the tag injector body and lift the cutter assembly upwards about 1/8" and slide the whole assembly forward and out the front of the tag injector frame. Slide the cutter off the "U" shaped support;

E. Hold the round base of the cutter assembly in one hand and lift the inner "T" shaped cutter up about 1/16". Turn the inner "T" cutter and continue to pull the "T" away from the base. The base will separate from the "T" shaped cutter to aid in cleaning. See Figure 45;

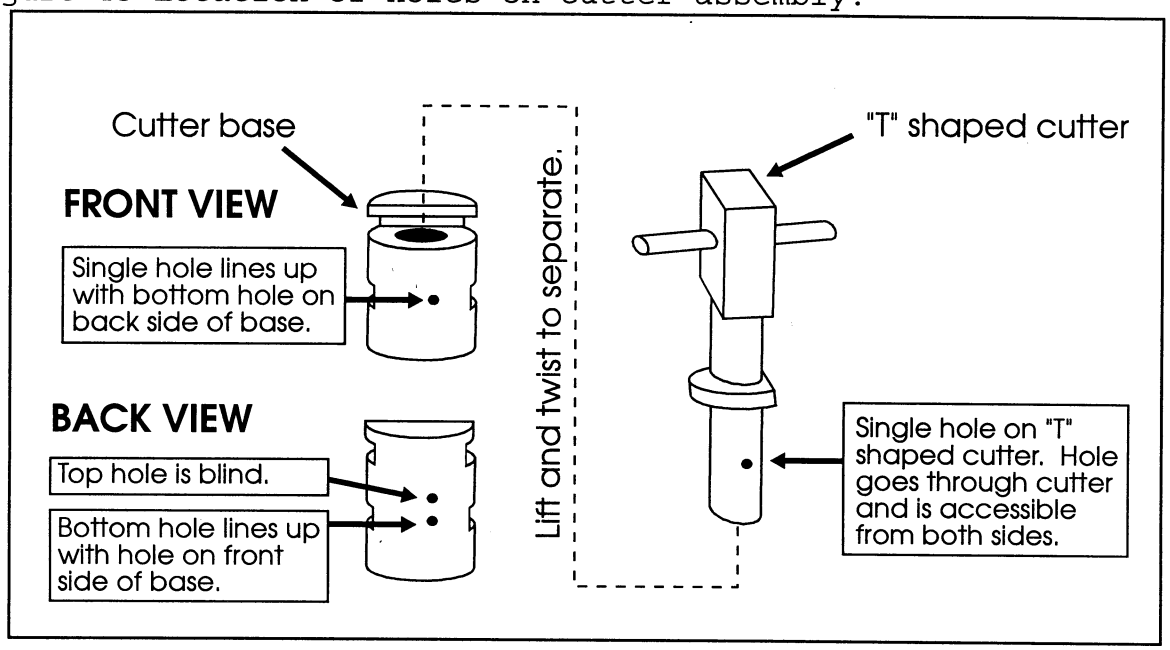
F. Slide the pushrod lever forward to inspect the pushrod. If the tip of the pushrod is bent or damaged it will have to be replaced. The procedure for replacing a pushrod is beyond both basic and advanced general maintenance and the manufacturer's manual should be consulted. Pushrod replacement should be done only after reading and fully understanding the manufacturer's manual and schematics for the tag injector.

7.2.5 Cleaning disassembled parts

A. Clean all signs of visible dirt or residues off the head, cutter assembly (2 parts), needle and needle clamping nut using an alcohol soaked cotton swab and/or paper towel. Cut a 1 1/2" piece off the roll of wire tags and straighten to make a cleaning tool for the cutter. DO NOT discard the 1 1/2" piece of wire after cleaning. Keep it in the vial with the spare needles for future cleaning. Carefully

probe the 3 holes of the cutter base and the 2 holes on the "T" shaped cutter to remove any deposits that might cause the pushrod to stick. The cutter base has 2 holes on the back and 1 on the front. Note that the bottom hole (back of base) on the cutter base lines up with hole on front and the wire cleaning tool should slide easily through cutter in these 2 holes. The top hole on the cutter base is a blind hole. The wire cleaning tool should slide smoothly through the front and back holes on the "T" shaped cutter assembly. See Figure 45. Use compressed air (10 -20 psi max, if available) to blow alcohol off clean parts or allow them to air dry on a clean paper towel.

Figure 45 Location of holes on cutter assembly.



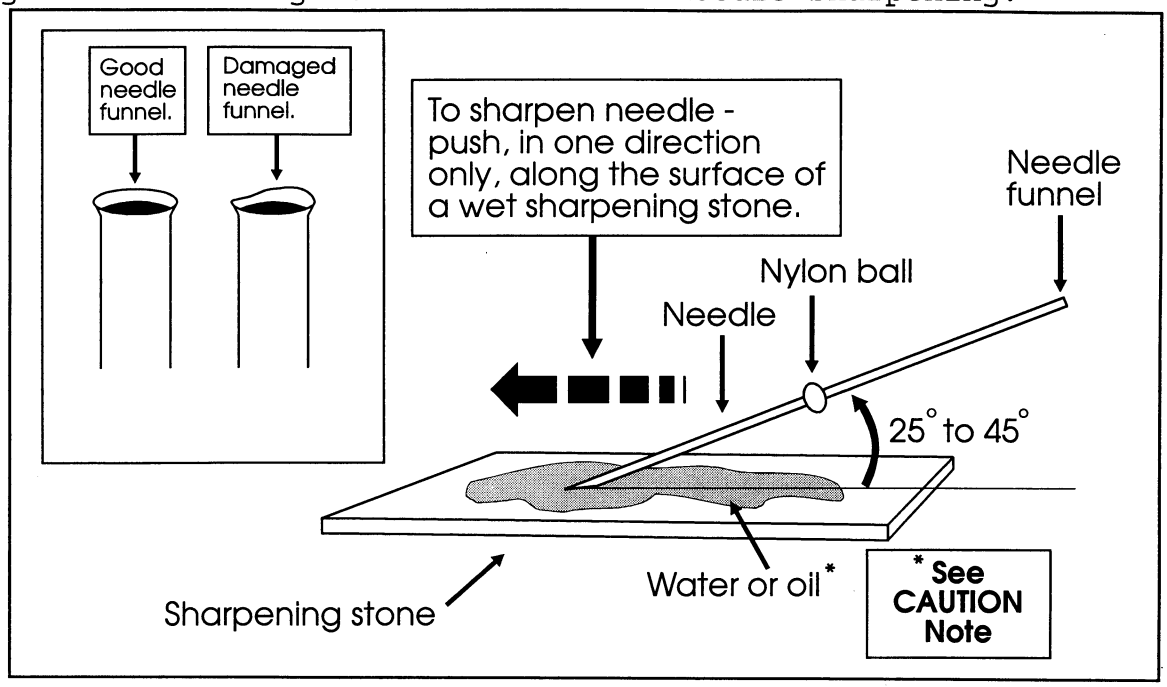
7.2.6 Checking needle/reconditioning needle

A. Remove needle (7.2.2);

B. Use the magnifying loupe in the tool kit to examine the back (dull end) of the needle. The end of the needle should flare slightly outward. The flared end of the needle is called the "funnel". See Figure 46;

***CAUTION* If oil is used to lubricate the sharpening stone the needle must be thoroughly cleaned with a 50% chlorine bleach solution and rinsed with alcohol.**

Figure 46 Checking needle funnel and needle sharpening.



C. If the funnel is damaged, re-ream to shape using the reaming tool supplied in the tool kit. Place the sharp end of the reaming tool into the funnel and apply light pressure while turning the tool like a drill. The rim of the funnel can be smoothed with the sharpening stone found in the tool kit;

D. Sharpen the needle on the sharpening stone supplied in the tool kit. Use fresh water to lubricate the sharpening stone. Firmly hold the needle at an angle between 25 and 45° to the sharpening stone. Use the old angle as a guide during sharpening. Push the needle, in one direction only, along the wet sharpening stone. See Figure 46.

7.2.7 Reassembly

Reassembly generally follows the reverse order of disassembly.

A. Insert the "T" shaped cutter into the cutter base and turn "T" shaped cutter 90° to lock the cutter into the base. Slide the cutter assembly back onto "U" shaped bracket. Make sure the 2 holes on the cutter base face back towards the open end of the "U";

B. Hold the pushrod lever in the fully retracted position and slide the "U" shaped bracket with the cutter assembly into the tag injector frame. The base of the cutter assembly should nest with the round hole, bottom center, of the tag injector frame;

C. Slide the cutter lever onto the "T" shaped cutter;

D. Re-install the dowel pin through the cutter lever and the tag injector frame. When installing the dowel pin, hold the pushrod lever in the fully retracted position and have the rear of the cutter lever slightly angled upwards (a 30° angle works well). Install the washer and bolt to secure the dowel pin;

E. Make sure the cutter assembly base is lined up and is resting in the hole on the underside of the tag injector. While holding the pushrod lever fully retracted into the tag injector, fully depress the cutter lever. This will level and seat the "U" shaped head backing plate;

F. Slide the head into the front of the frame and secure with 2 hex head bolts from the bottom of the tag injector frame. Make sure these 2 bolts are snug;

G. Retract the pushrod lever back into the tag injector body as far as it will go. This will slightly raise the cutter lever (about 1/8"). Reinstall the cutter lever button/spring assembly by pushing down into the recessed slot and turning 90° clock-wise. The cutter lever should pop "up";

H. Slide the nylon ball along the needle until it lies 1/3 of the way along the needle from the sharp tip. Insert the blunt end of the needle into the head as far as it will go. The nylon ball should sit just inside the head. Slide the needle clamping nut (threaded side towards head) over and down the needle shaft. Using the needle clamping nut, slide the nylon ball down the needle shaft until the threads on the clamping nut engage the head. Start threading the clamping nut by hand into the head before using the socket tool. Use the needle removal socket tool to screw the needle clamping nut into the head. Be careful not to damage the sharp needle tip when inserting the needle into the socket tool. The needle should be tightened until snug. The nylon ball will be lightly compressed when the needle is seated properly;

I. Carefully depress the cutter lever as if cutting a wire tag. Do not force the lever if there appears to any more resistance than is normally felt cutting a tag. The pushrod should now slide forward smoothly. If the cutter and or pushrod levers bind or will not move the tag injector has not been re-assembled correctly. Disassemble and re-assemble;

J. Slide the pushrod lever back and forth to confirm that the injector has been reassembled properly. The tip of the pushrod should just be visible in the beveled tip of the needle when the pushrod is fully extended forward.

7.3 BASIC CLEANING OF THE MANUAL (SINGLE-SHOT) TAG INJECTOR

7.3.1 Cleaning the tag injector head/pushrod assembly during and after a tagging session (Refer to Figure 20).

A. Several times during a tagging session the front half of the tag injector (including: needle, head, and pushrod screw) should be immersed in a bucket of clean **FRESH water**. Any visible dirt or salt water residue on the unit should be washed off at this time;

B. While holding the front half of the tag injector below the surface of the water, depress and release the pushrod plunger at least 10 times to clean the pushrod and needle bore.;

C. Shake water off tag injector and blot dry with a paper towel. Sterilize the tag injector needle before resuming tagging.

7.4 ADVANCED CLEANING AND MAINTENANCE OF THE MANUAL TAG INJECTOR

7.4.1 General information

A. Disassemble the tag injector on a clean dry surface;

B. There are many small pieces that will be removed to clean the internal parts of the tag injector, work over a surface that will catch and hold any pieces that are dropped.

C. Use the correct tool(s) for disassembly and reassembly;

D. Pay close attention to the orientation of parts when disassembling the injector, this information will be valuable during re-assembly;

E. Do not force parts apart or together. All parts should come apart and re-assemble smoothly without the use of force. Forcing parts together will cause expensive damage to precision parts;

F. When re-assembling, tighten all parts to finger tight. Over-tightening may break or damage parts;

G. If you are in doubt as to your mechanical capabilities, leave the disassembly and re-assembly to a more qualified person.

7.4.2 To remove needle (Refer to Figure 20).

A. Un-screw (counter clock-wise) the needle/head assembly from the tag injector body. Separate needle/head assembly from

the tag injector body. Inspect the pushrod. if the pushrod is bent or damaged it must be replaced.

7.4.3 To remove/replace pushrod

A. Remove needle (7.3.2);

B. Un-screw and remove pushrod/plunger disassembly screw. pull plunger out the back of the tag injector body. Be careful not to lose the spring as the pushrod and plunger are removed;

C. Un-screw the pushrod retaining collar (counter clock-wise) from the plastic plunger;

D. Remove the pushrod from the back of the pushrod retaining collar;

E. Use a piece of wire cut from a roll of wire tags to make a new pushrod. Make the new pushrod 1/8" to 1/4" longer than the old pushrod. Make a small bend matching the bend in the old pushrod on one end of the new pushrod. A pair of needle-nosed pliers or tweezers will be required to form the bend in the pushrod. The bend keeps the pushrod fastened behind the pushrod retaining collar. Gently bend the pushrod to make it as straight as possible without kinking the wire.

7.4.4 Cleaning

Clean all signs of visible dirt and residues off the needle/head assembly and pushrod using an alcohol soaked cotton swab and/or paper towel. Cut a 1 1/2" piece off a roll of wire tags and straighten to make a cleaning tool for the cutter. DO NOT discard the 1 1/2" piece of wire after cleaning. Keep it in the vial with the spare needles for future cleaning. Use the wire cleaning tool to remove any dirt of residue from the needle bore by passing the wire in and out of both the front and rear of the needle bore.

7.4.5 Reassembly

Reassembly generally follows the reverse order of disassembly.

A. Insert the pushrod through the pushrod retaining collar from the back. The retaining bend in the pushrod should lie flat on the back surface of the retaining collar;

B. Screw the retaining collar/pushrod into the plastic plunger (clockwise);

C. Holding the plunger with pushrod attached vertical, pushrod up, place the spring down over the pushrod until the spring rests in the indentation on the front (top) of the retaining collar;

D. While still holding the plunger vertical, slide the tag injector body down over the pushrod/plunger. Gently rotating the plunger/pushrod will help guide the pushrod through the narrow hole on the end. A small screwdriver may be used to help guide the pushrod through the end hole. Access to the pushrod is through the pushrod/plunger disassembly screw slot;

E. Make sure the spring is still sitting squarely in the recessed hole in the retaining collar. Turn the plunger until the pushrod/plunger disassembly screw hole is visible in the pushrod/plunger disassembly screw slot. The plunger may have to be depressed slightly to allow the hole to line up in the slot. Reinstall the pushrod/plunger disassembly screw (clockwise);

F. Carefully slip the back (dull) end of the needle over the end of the pushrod and guide the needle/head assembly over the pushrod until it contacts the tag injector body;

G. Screw the needle/head assembly onto the tag injector body (clockwise). Check that the plunger and pushrod move smoothly by depressing and releasing the plunger several times. Depress and hold the plunger as far as it travel. Carefully cut the pushrod with wire cutters or scissors flush at the needle tip. Be careful not to cut the tip off the needle when trimming the pushrod.

8.0 REFERENCES CITED

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Eckert, S.A., Crouse, D., Crowder, L.B., Maceina, M., and Shah A. 1994. Review of the Kemp's ridley sea turtle head-start program. NOAA Technical Memorandum NMFS-OPR-3, 11 p.

Fontaine, C.T., D.B. Revera, T.D. Williams and C. W. Caillouet, Jr. 1993. Detection, verification and decoding of tags and marks in head started Kemp's ridley sea turtles, *Lepidochelys kempii*. NOAA Technical Memorandum NMFS-SEFC-334, iii plus 40 p.

APPENDIX A

TABLE 1 Number of Kemp's ridley sea turtles released with internal magnetized wire tags and location of tags by year-class.

Year-class	Number tagged	Location (flipper)
1978[1]	9	left front[a]
1982[1]	12	all[a,b]
1984[2]	1041	right front[a]
1985[2]	1533	left front[a]
1986[2]	1726	left front[a]
1987[2]	1280	left front[a]
1988[2]	910	left front[a]
1989[2]	1914	left front[a]
1990[2]	1979	left front[a]
1991[2]	1944	left front[a]
1992[2]	1963	left front[a]
1993[2]	188	left front[a]
1994[3]	170	right front[c]
1995[4]	168	right front[c]
1996[5]	3336[d]	right front[e]
1996[2]	174	left front[a,f]
Total	18347	

[1] Turtles were tagged either at Sea World of Texas, San Antonio, or Texas A & M University, College Station.

[2] All turtles were tagged at the NMFS Galveston Laboratory.

[3] 54 hatchlings were tagged at Rancho Nuevo, with magnetized wire tags. 116 hatchlings were tagged at the NMFS Galveston Laboratory.

[4] 120 hatchlings were tagged at Rancho Nuevo. 60 with magnetized wire tags and 60 with non-magnetized wire tags.

[5] All hatchlings were tagged and released immediately at Rancho Nuevo.

[a] Tags were applied to yearlings*. All tags were magnetized prior to release (* Some of the 1978 and 1982 year-classes received the tags as sub-adults/adults).

[b] Initial wire tagging experiment, wire tags were placed in all 4 flippers. Most of the turtles lost the tags in the rear flippers. All tags were magnetized prior to release.

[c] Tags were experimentally placed in the right front flipper of hatchlings to simulate mass tagging at Rancho Nuevo. All tags were magnetized prior to release. Turtles were yearlings at the time of release.

[d] Number of hatchlings tagged on nesting beach at Rancho Nuevo.

[e] All hatchlings were tagged and released with non-magnetized wire tags in the right front flipper.

[f] All turtles were tagged with non-magnetized wire tags in the left front flipper. Ten turtles received a tag in both the left and right front flippers.

APPENDIX A

TABLE 2 Experimental results of sea turtles tagged with the internal wire tag.

LOGGERHEAD SEA TURTLES - 1993 YEAR-CLASS

EXPERIMENTAL GROUP	NUMBER AT START OF STUDY	NUMBER AT END OF STUDY	% SURVIVAL	% TAG RETENTION	MEAN WEIGHT AT END OF STUDY (g)
MAGNETIZED	55	55	100	100	5711*
NON-MAGNETIZED	55	52	95	95	5767*
CONTROL	55	54	98		5850*

* STUDY ENDED AT 21 MONTHS OF AGE.

KEMP'S RIDLEY SEA TURTLES - 1994 YEAR-CLASS

EXPERIMENTAL GROUP	NUMBER AT START OF STUDY	NUMBER AT END OF STUDY	% SURVIVAL	% TAG RETENTION	MEAN WEIGHT AT END OF STUDY (g)
MAGNETIZED	58	54**	93	100	587
NON-MAGNETIZED	60	58	97	100	588
CONTROL	60	58	97		578

** 1 KEMP'S RIDLEY DROWNED.

APPENDIX A

TABLE 2 Experimental results of sea turtles tagged with the internal wire tag (continued).

KEMP'S RIDLEY SEA TURTLES - 1995 YEAR-CLASS

EXPERIMENTAL GROUPS (1,2,3)	NUMBER AT START OF STUDY	NUMBER AT END OF STUDY	% SURVIVAL	% TAG RETENTION	MEAN WEIGHT AT END OF STUDY (g)
1.MAGNETIZED	20	19	95	90	600
1.NON-MAGNETIZED	20	17	85	100	600
1.CONTROL	20	17	85		596
2.MAGNETIZED	20	20	100	95	565
2.NON-MAGNETIZED	20	19	95	100	553
2.CONTROL	20	19	95		555
3.MAGNETIZED	20	19	95	100	547
3.NON-MAGNETIZED	20	18	90	95	559
3.CONTROL	20	18	97		559

APPENDIX B TROUBLE SHOOTING EQUIPMENT PROBLEMS

TABLE 4 Trouble shooting equipment problems.

PROBLEM	POSSIBLE CAUSES	SOLUTION
Auto injector		
Wire will not advance when advance lever is depressed	Wire spool is not in the down and locked position. See Figure 1.	Make sure wire spool is in the down and locked position.
	Cutter lever is in the down position.	Fully retract pushrod to release cutter lever to up position.
	Drive rollers worn.	Replace worn drive rollers.
Pushrod will not advance or is sticking	Cutter lever is in the up position.	Fully depress cutter lever to cut tag.
	Needle is not seated or funnel is damaged.	Reseat needle and inspect funnel. Re-ream funnel if necessary.
	Pushrod and needle are dirty.	Clean pushrod and cutter head assembly.
	Cutter head mounting bolts are loose.	Tighten bolts.
Needle is not penetrating skin easily	Dull needle.	Re-sharpen or replace needle.
Needle pulls out of injector	Needle is not seated properly.	Reseat needle and tighten needle clamping nut.

Pushrod is jammed and will not move at all	Pushrod wire is bent and/or broken. Needle not seated or funnel is damaged.	Disassemble injector and inspect pushrod wire. Replace if necessary. Reseat needle and inspect funnel. Re-ream funnel.
Cutting short tags	Drive rollers are worn.	Replace worn drive rollers.
Cutter not cutting smoothly	Injector is dirty. Cutter is dull or damaged. Cutter lever springs or pins are loose, missing or damaged.	Clean injector. Replace cutter. Tighten pins and replace missing parts.
Counter not working	Dead battery.	Return tag injector to manufacturer for replacement.
Magnetizer/de-magnetizer Not working	No power. Unit overheated.	Plug unit into working 110 V power source. Wait for unit to cool down. Replace fuse if blown
Manual injector Pushrod sticks	Needle bore clogged or dirty. Needle bent. Pushrod bent.	Clean needle and pushrod. Straighten or replace needle. Straighten or replace pushrod.

APPENDIX C EQUIPMENT SUPPLIERS

INTERNAL WIRE TAGS AND TAG INJECTORS

Northwest Marine Technology, Inc.
Shaw Island, WA 98286
Telephone (360) 468-3375
Facsimile (360) 468-3844

MAGNETIC DETECTION WANDS

Northwest Marine Technology, Inc.
Shaw Island, WA 98286
Telephone (360) 468-3375
Facsimile (360) 468-3844

MAGNETIZER/DE-MAGNETIZER

Kendrick & Davis, Inc.
99 Lafayette Drive
Syosset, NY 11791

APPENDIX D RECOMMENDED EQUIPMENT REQUIRED FOR TAGGING HATCHLINGS

TABLE 5 List of recommended minimum required equipment for tagging 10,000 hatchlings in one nesting season.

Item#	Description	Quantity
1	Portable automatic (multi-shot) tag injector kit	1-3*
2	Coded wire tags (3 rolls - 5,000/roll)	15,000
3	Cut coded wire tags[a]	10,000
4	Manual (Single-shot) tag injector[a]	3
5	Replacement needles for multi-shot tag injector (package of 5)	2
6	Non-magnetized tweezers	3
7	Magnetizer/de-magnetizers	2
8	Two prong to three prong electrical plug adapter	2
9	Medium non-latex surgical gloves (box of 100)	4
10	Large non-latex surgical gloves (box of 100)	4
11	Isopropyl alcohol (pint)	16
12	Tincture of iodine (1 oz)	30
13	Cotton swabs (box of 500)	2
14	Paper towels (roll)	10
15	Plastic bucket (5 gallon)	3**
16	Plastic trays for holding hatchlings	4

* 3 tag injectors are recommended - 2 in continuous use + 1 backup.

** 2 buckets for sea water (cleaning hatchlings), 1 bucket for fresh water (cleaning tag injectors)

[a] Strictly for back-up use in the event all automatic tag injectors become inoperable and can not be fixed.