

RESEARCH ACTIVITIES REPORT

EXPERIMENTAL CARAPACE MARKING OF GREEN TURTLES AT SEA LIFE PARK
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This report presents the preliminary results of an ongoing study initiated in November 1988 to find a practical and durable marking method to use on green turtles, Chelonia mydas, nesting at French Frigate Shoals. After first encountering and applying a flipper tag to a nesting turtle, the same animal will usually be seen again on a number of occasions reneesting or basking ashore later in the breeding season. The use of a carapace mark that is readable from a distance (>3 m), as opposed to rereading a small metal flipper tag, can significantly reduce the level of human disturbance to the turtle. Carapace marks used during past years at French Frigate Shoals have been made with Dupont Lucite and Zynolyte brands of spray paint. Numbers applied with Lucite usually remained readable for about 2 weeks. However, this product was discontinued by the manufacturer in 1985. Zynolyte has been used since that time, but has proven to be even less durable. There is now an increased need for a longer-lasting mark, ideally one that stays on for 2-3 months or more. This need arises from the fact that a greater timespan is currently being spent monitoring nesting turtles during the breeding season at French Frigate Shoals.

Testing to find an improved and practical marking substance has been carried out mainly using adult green turtles in captivity at Sea Life Park on Oahu. Turtles in the Park's large display lagoon were marked and

examined weekly during routine draining and cleaning. However, several weeks after the study started it became apparent that constant physical contact among the 25 turtles, including nipping at the marks, made this setting inappropriate for comparison with turtles in the wild. To rectify the problem, Sea Life Park agreed to move one of the turtles to a separate tank where the study could continue. The turtle used was an adult female (tag 2051, 2495) measuring 81.9 cm in straight carapace length. Having a single turtle in a tank by itself worked out well in that draining and inspection could take place at any desired time. The only problem encountered was the growth of fleshy algae (i.e., Enteromorpha sp. and others) on the carapace. It became necessary to remove this growth on a weekly basis by gentle scrubbing with a plastic mesh pad. Algae on the turtles' backs in the display lagoon occur far less often, due apparently to constant rubbing and also basking that takes place on a cement ramp and adjacent artificial sand beach.

All experimental items were applied to the clean carapace after the turtle had been allowed to air dry for 10-15 minutes subsequent to draining the tank. The tank was refilled after only 15-25 minutes of allowing the mark to *dry*. This interval approximated the average minimum time a nesting turtle might stay ashore, taking into account false nestings and other short-term terrestrial emergencies that occur at French Frigate Shoals.

The preliminary results of the study are for the most part straightward (Table 1). To date 60 items have been tested which include the use of paints, adhesive products, and other agents where durable bonding to the shell was considered a possibility. Two-part products were not included in the study due to the difficulties of working with them

under field conditions at French Frigate Shoals. Surprisingly, many of the items tested lasted only a short time, frequently 1 week or less. Poor retention was shown by all of the peel-off back adhesive materials, except for the 3M Scotch Lite (item 25, Table 1) which lasted 5-6 weeks. To date, the longest remaining agent has been Ace quick drying enamel paint (item 56) applied with a brush. This mark became unreadable after 8-9 weeks. However, Deco-Rez Coating (item 59) which is still being tested, has shown almost no wearing, chipping or peeling after 4-5 weeks. At present, this brush-on paint product appears very promising for use as a long-lasting mark. An important element in the application of both Ace and Deco-Rez is adequate "working" of the paint onto the carapace using multiple brush strokes. A 3/4" wide inexpensive "throw-away" brush was used to apply the various paints and liquid products tested throughout the experiment.

Another agent worthy of mention is item 1, a polyurethane foam dispensed from an aerosol can. As of this writing, the foam has remained firmly on the shell for 6-7 weeks. The problem with this substance, as with several others tested in the study, is the difficulty of being able to easily write recognizable numbers or other individual identification marks. The foam product comes out of the can with the consistency of whipped-cream. It therefore needs to be rubbed onto the shell with a stick or other hard object to obtain adhesion. However, a possible practical use might involve imbedding a plastic, metal or wood plate with prestamped numbers into the foam when it is applied to the shell.

A final item (60) worthy of favorable comment at this point is the use of the Dremel brand 20,000 rpm battery powered "moto-tool." Numbers 1-2 mm deep were engraved into (but not through) the keratin scute of the

carapace. This process proved to be relatively easy to accomplish with only minimal practice. The numbers were then filled in with paint to increase their readability from a distance. Unlike all of the other methods tested, except for item 21, this one involves the mild, but apparently harmless, scoring of the shell. No adverse response could be detected in the turtle's behavior while the engraving took place. This may be due to the very high rpm's involved. Numbers formed on adult turtles by this technique will likely be retained for many months, or possibly even years. Its use on nesting turtles may significantly surpass the original objective of this study, and result in other valuable applications for sea turtle research.

The optimum site to apply a mark to the carapace was determined in this study to be the third or fourth lateral scutes. These scutes of either the left or right side are much less prone to abrasion from the turtle rubbing its own front flippers over the carapace.

Table 1. Experimental carapace marking of green turtles,
Chelonia mydas, at Sea Life Park.

No.	Application	Number of weeks retained and readable
1.	Everlast sealant foam (aerosol)	
2.	Permatex form-a-gasket sealant (2A pliable)	<1
3.	Permatex aviation form-a-gasket sealant (3D liquid)	<1
4.	Permatex heavy-duty rubberized automotive undercoating (aerosol)	<1
5.	Westley's rubberized automotive undercoating (aerosol)	<1
6.	Plumber's Goop sealant	2-3
7.	Seal-All cement	<1
8.	Evercoat muffler and tailpipe sealer	1-2
9.	Devcon steel repair	1-2
10.	3M polyurethane marine sealant	<1
11.	Macco Liquid Nails adhesive (LN602)	1-2
12.	Duro Extend Rust treatment	<1
13.	Lexel Sealant (white)	1-2
14.	Lexel Sealant (clear)	
15.	Henry 208 plastic roof cement	<1
16.	Grener firm grip antislip paste	<1
17.	Lida topway fashion lipstick	<1
18.	Kiwi Elite white shoe polish	<1

19.	Turtle Wax (automotive)	<1
20.	MDR whip-end rope dip.	
21.	Pumie heavy-duty scouring stick	
22.	NAPA clear silicon sealant	1-2
23.	3M aluminium tape	1-2
24.	3M Controltac white adhesive reflective film (peel-off back)	
25.	3M Scotch Lite red adhesive reflective sheet (peel-off back)	5-6
26.	GSA 182-5041-X1-66 red adhesive reflective sheet (peel-off back)	1-2
27.	3M custom cut black, blue, and white adhesive vinyl numbers (peel-off front and back)	1-2
28.	Tuck Tape (green duct tape)	<1
29.	Ace Hardware white and black adhesive vinyl reflective house numbers (peel-off back)	<1
30.	Ace Hardware adhesive metal house numbers (peel-off back)	<1
31.	Jogalite adhesive orange reflective strip (peel-off back)	1-2
32.	Dyer adhesive vinyl boat numbers (peel-off back)	<1
33.	MDR Bootstripe boat tape	1-2
34.	Woolworth's silver adhesive reflective cloth tape (peel-off back)	<1
35.	Dymo Label (peel-off back)	<1
36.	C & P Hardware adhesive vinyl house numbers (peel-off back)	<1
37.	Thermacote Welco silver-streak marker	
38.	Non-skid grit impregnated adhesive strip (peel-off back)	2-3
39.	Crayola crayons no. 389 (blue, purple, red, orange, and green)	1-2

40.	Suction cups applied with silicon sealant	<1
41.	Liquid Paper (570-01 blue and 564-01 white)	
42.	Cutex finger nail polish (white and pink)	1-2
43.	Hard-As-Nails with Nylon pink finger nail polish	2-3
44.	Unipaint silver marker	1-2
45.	Unipaint gold marker	2-3
46.	Hi Impact black felt-tip marker	1-2
47.	Sanford's black felt-tip marker	1-2
48.	Polyurethane clear gloss spray	<1
49.	Dutch Boy fast drying spray paint (white)	1-2
50.	Fuller O'Brien epoxy spray paint (toast)	1-2
51.	Zynolyte spray paint (gray, olive, and flat white)	1-2
52.	Ameritone Mirrolac spray paint (white and gray)	2-3
53.	Super Stripe orange traffic paint (aerosol)	1-2
54.	Krylon spray paint (white)	1-2
55.	Fancy Finger instant finger nail glue used to affix pieces of scute cut from a dead turtle	1-2
56.	Ace Hardware flat white quick drying enamel (19A101)	8-9
57.	Ameritone interior/exterior acrylic enamel (olive)	<1
58.	Appliance touch-up paint epoxy fortified (harvest wheat)	3-4
59.	Deco-Rez Coating aluminium pigmented moisture cured urethane (ASP1 type 2 & 3)	
60.	Dremel 20,000 rpm cordless Freewheeler Moto-Tool used with #115 and #192 cutters to engrave scutes	

263-3611

.mt0
L:marking.ghb

→ "3 or 4 hrs in Past
work with
shaked brush
stir well
carapace

SL. 81.9 scl female
tag 2051, 2495
SEA LIFE PARK
HAWAII

Number of
weeks
(length of
time retained
readable
(weeks))

STUDY
NOTES BY George Balazs and

Experimental Marking of Green Turtles at Sea Life Park

1. Great Stuff[®] Insulating foam sealant (aerosol)
- 1WK 2. Permatex Form-a-Gasket Sealant (no. 2A pliable non-hardening)
3. Permatex heavy-duty rubberized automotive undercoating (aerosol)
- 3/31 4. Plumber's Goop[®] sealant (2-3 wks)
- 1-2 wks 2/26 5. 3M Aluminum tape
- 1WK 6. Permatex Aviation Form-a-gasket Sealant (no. 3D liquid)
- 2/8/89 7. Ace Quick Drying Enamel (197A101 Flat White) ← (brush apt. application - applied with a brush)
- 1WK 8. Westley's Rubberized automotive undercoating (aerosol)
- 1WK 3/31 9. Henry 208 Wet Surface Plastic Roof Cement
- 1WK 10. "Suregrip" athletic pine pitch **Crumens**
- 1-2WK 2/28 11. Fuller O'Brien Epoxy spray paint (Toast 616-77)
12. 3/31 Zynolyte spray paint (flat white and gray) **olive** 1-2 wks
13. Zynolyte spray paint (gray) Evercoat sealant foam (aerosol)
14. 3/31 Ameritone Mirrolac spray paint (white and gray)
15. Ameritone interior/exterior acrylic enamel (olive)
16. Seal-all cement
17. MDR Whip-end rope dip
18. Unipaint Marker (gold and silver) **silver - 1-2 Gold 2-3**
- 1-2 wks 2/25 19. Unipaint Marker (silver) NAPA clear silicon ~~sealant~~ sealant
- 1-2 wks 3/30 20. MDR Bootstripe boat tape **felt tip**
- 1-2 wks 21. HI Impact Intensive Color Marker (black)
- 1-2 wks 22. Sanford's Marker (black) **felt tip**

9
8/2/89

Crumens
Firm grip
anti
slip
paste

GHB

23. Thermacote Welco Silver-Streak marker

1-2 wks 3/31 24. Crayola No. 389 (blue, purple, red, orange and green)

25. 3M Polyurethane Marine Sealant (No. 5200)

26. 3M Controltac Adhesive Film (white reflective) (peel-off back) adhesive

27. Super Stripe Traffic Paint (aerosol orange)

1-2 wks 28. Evercoat Muffler and Tailpipe sealer

2/16 29. Heavy-duty Pumie Scouring stick

5-6 wks 2/18/89 30. 3M Scotch lite sheeting (red reflective) (peel-off back)

1-2 wks 31. Red Reflective Sheeting (GSA 182 5041 X1 66) (peel-off back)

32. Dymo Label (3/8" wide) with silicon cement adhesive

33. House numbers (peel-off self-adhesive) adhesive

1-2 wks 34. Devcon Steel Repair

1-2 wks 35. Macco "Liquid Nails" Construction Adhesive (LN602)

2-3 wks 2/25 36. Non-skid (Black, grit impregnated) (peel-off self-adhesive) back

37. Krylon spray paint (white)

38. Liquid Paper (570-01 blue and 564-01 white)

39. Cutex Finger Nail Polish (white and pink)

40. Silicon suction cups (with silicon cement) sealant

1-2 wks 2/25 41. Jogalite Reflexite strip (peel-off back) adhesive

<1 wk 42. Duro Extend Rust Treatment

2-3 wks 2/25 43. Hard-As-Nails with Nylon (Pink Finger Nail Polish) adhesive

1-2 wks 2/25 44. Lexel Sealant (white)

<1 wk 2/25 45. Dyer vinyl boat numbers (peel-off back)

3-4 wks 2/25 46. Appliance Touch-Up paint (epoxy fortified, harvest wheat)

GHB

adhesive

adhesive

- 2/25 47. Ace Hardware vinyl house numbers (white and black, peel-off back)
- 2/25 48. Ace Hardware metal house numbers (peel-off back)
- 2/25 49. Woolworths cloth refectant tape (silver) peel-off, back
- 50. Turtle (automotive) wax
- 3/15 51. Polyurethane clear gloss spray
- 52. Ameritone latex exterior house paint (brown)
- 3/16 53. 3M precut vinyl letters, 1/2" high, (front and back peel-off)
- 3/16 54. Dutch Boy fast drying spray paint (white)

adhesive

adhesive

Lida top way fashion lipstick 2/1wk

~~Shoe polish (white)~~

~~3M Duct tape~~ (green) 2/1wk
Tuck Tape brand (green) 2/1wk

3/16 Dremel engraving 3 - 2051's 2nd lat L & R #112
4th lat R #115 w/white

3/5 everlast foam (not feasible to form numbers)

~~Krytox~~

2/1wk Kiwi Elite White Shoe Polish

3/31 everlast foam (aerosol) w/plastic tag imbedded

3/24 Deco-Rez Coating ASP1 Type 2 & 3
Aluminum pigmented moisture cured urethane

1-2 wks

3/31 Fancy Finger Instant Nail Glue - glue 4 scales