

S.M.J. VII, 1956, 2.

LIBRARY OF  
P. & A. MEYLAN

**The Edible Turtle (*Chelonia mydas*) in Borneo**

(5) Tagging Turtles (and Why)\*

by TOM HARRISSON

The purpose of this, the fifth note in the series, is to give a fairly general account of the first successful experiments yet to be made in the long-term tagging of marine turtles—and, from tag returns, establishing a basis for a census of turtles. Odd notes on this project in various publications have aroused interest in other countries, and requests for fuller information. The work was undertaken on behalf of and with the support of the Turtle Board of Sarawak, over the past ten years.\*\*

On taking up curatorial duties in Sarawak in 1947, I was faced inevitably with many disruptive effects left over from the Japanese occupation and then defeat. Sarawak was of little use to the Japs; and indeed in some ways a perfect nuisance by virtue of its aggressive and resolutely anti-Jap Dayak majority. Anyway they neglected rather than definitely destroyed.

This did not apply, though, to the turtle industry, which centres on the three small islands of Talang<sup>2</sup> Besar and Kechil and Satang, between Santubong and Tanjong Po in the extreme south-west. Here, for nearly a century—since the Rajah Brookes

---

\*=for previous notes in this series see:

1. Breeding Season—*S.M.J.*, V, 3
2. Copulation—*S.M.J.*, VI, 4
3. Young Turtles—*S.M.J.*, VI, 6
4. Growing Turtles and Growing Problems, *S.M.J.*, VII, 7.

see also *Nature*, 1952, 169; and *Journal Malayan Branch, Royal Asiatic Society*, 1950, XXII, 3.

---

\*\*=My experience of animal marking and census goes back twenty-five years, when I was one of the most active bird-ringers in Britain, and also organised several large scale censuses of birds and mammals, including the Great-crested Grebe National Census (1930) with Philip Hollom; birds of Lundy Island with Prof. V.C. Wyne-Edwards (1929); birds of St. Kilda with David Lack FRS. and Lord Tweedsmuir (1931); mammals of St. Kilda with the late Dr. J. A. Moy-Thomas; etc.

made the seas safe from "pirates" (vide Robert Nicholl in *S.M.J.* VII, 1, 1956, 247)—Malays of certain families collected the eggs of *Chelonia mydas*, the Green or Edible Turtle. For reasons which need not detain us here, just before the Japanese war, the (third) Rajah, H.H. Sir Charles Vyner Brooke, decided to buy out these Malay interests, terminating the considerable complexities arising from the gradual devolution of rights into many hands (in accordance with Mohammedan laws of inheritance). In 1941 he set up a Trust (Chap. 40 of the Laws of Sarawak, Vol. I, Revised Edition) which would handle all the profit for Malay charitable and religious purposes. The Curator of Sarawak Museum (then Mr. E. Banks) was to run the actual collecting of eggs.

This is still the basic arrangement, amplified by the strengthening of the original ordinance and with the appointment of a Board of three to supervise day-to-day running—the present Chairman is the Development Secretary (Mr. A. St. J. Hepburn), while the Hon'ble the Datu Bandar C.B.E. represents in particular the interests of the Turtle Trust. I am the third member, representing I suppose the interests particularly of the turtles!

Only eggs are collected—up to 2,000,000 or so a year. Adults never now are normally killed for meat in these waters.

This new—and purposefully controlled—system was only just beginning when the war intervened. During their occupation (1941-1945) the Japs treated the islands as sources of direct *meat* flesh; and part of the time as a bombing target area, later on as an area not to be about in to get bombed at by the Allies! When I took over in 1947 there was mild disorder. Also, it looked as if we were threatened with a possible serious *decline* in numbers of the laying turtles\*

---

\*For an indication of the position to 1950 see note (1) in this series, *S.M.J.*, V, 3, p.593.

Few postwar years have been so "good" as some prewar as regards gross eggs *sold* to the public. On the other hand, no postwar year has yet been so "bad" as 1935, with only just over half a million eggs, although currently 1956 is shaping rather badly. 1953 was a very "good" year — 2,065,898 eggs (just over half on Talang2 Besar); 1954 gave 1,121,890 and 1955 gave 1,581,014 eggs. But complex factors are involved. I will examine this aspect in a later note in the present series.

It therefore seemed to me urgent, once we had got things going again, to get to know—among other things—what sort of *size of population* we had to deal with. On this there was no information at all except what nearly everyone had “taken for granted”. It was normal—and natural enough—to work it out like this:

2,000,000 turtle eggs in a good year;  
..... c. 100 eggs per normal lay:  
So = c. 20,000 laying turtles.

But there were indications that the same turtle came up more than once in a year, from individuals with conspicuous malformations or queer coloration noted by the island staffs of watchers and egg-collectors from time to time.

In other parts of the world, where this great marine turtle breeds, also, there were goodish hearsay or “general” reports of females laying more than once in a year. From Bermuda, the American naturalist Samuel Garman had reported on this as long ago as 1884. He considered a single female might lay 2-4, even 5, times a season (“Contributions to the Natural History of the Bermudas: Reptiles,” in *Bulletin U.S. Nat. Mus.* 25; 1884). Earlier still, Mark Catesby’s “The Natural History of Carolina, Florida, and the Bahama Islands”, (published in 2 volumes, London 1733) reported 3 or 4 lays at 14 days intervals in the American mainland; his account of wholesale slaughter is only one of many which make ghastly reading today.

Clearly, if I had 20,000 (at least) turtles to worry about, this was much *less* of a worry than if I had a quarter of these. The bigger the potential laying population, the easier I could feel about those war-time Jap effects and the general decline of normal “law of the sea” procedures in the waters surrounding Sarawak, which continued into the post-war years. But there was no information for Sarawak that referred. How far were other distant places to be taken as parallels?

The Sarawak Museum Reference Library was largely removed by officers of the post-occupation Civil Affairs Administration while I was still up in the interior. When I had got together the main relevant literature by 1949-50, it added up to this. That all the general breeding reports and studies of *Chelonia mydas*

which could be taken at all seriously came from the Atlantic or other remote points, with one happy exception. This exception was also the only satisfactory scientific investigation yet made into this sort of problem among marine turtles. For the first time someone had studied average and general behaviour as well as the odd-looking and possibly abnormal individual. This was done by F. W. Moorhouse, between November 1929 and February 1930 at Heron Island on the Great Barrier Reef of Australia.\*

Dr. Moorhouse attached numbered copper sheets 1" square, into the carapaces of his turtles. His results showed most of the turtles layed more than once, many up to seven, even twelve times! Now it was clearly unsafe automatically to apply Australian findings to Borneo. For instance, these Australian turtles only layed from October to February, whereas in Sarawak our records already showed laying in every month, with a *minimum* in October-February (see especially note 1 of this series, in *S.M.J.*, V, 3). Again, Moorhouse reported eggs incubating for 72 days—much longer than anything in our first seasons of hatching.

But the Great Barrier Reef results determined me to go at this strongly in Sarawak. For, if Moorhouse's tentative conclusions at all applied here, it might well be that female turtles laid *more* often in this equatorial sea than in the shorter "season" further south. My formula might as well read:

$$\begin{array}{l} 2,000,000 \text{ eggs in a good year} \\ \dots \text{ c. } 100 \text{ eggs per normal lay} \\ \dots \text{ x } 20 \text{ lays per year} \\ \text{So} = \text{c. } 1,000 \text{ turtles.} \end{array}$$

With only 1,000, *every* turtle even possibly scared off by a bright light or fishing boat became a subject for grave concern.

---

\*F. W. Moorhouse "Notes on the Green Turtle" in *Reports of the Great Barrier Reef Committee*, 4(1), 1953.

I am obliged to the Great Barrier Reef Committee for their help in obtaining this and other publications. The literature, on other marine species has been summarised by the Director of Museums in Ceylon, Dr. P. E. P. Deraniyagala in his *Colombo Museum Publication* "Tetrapod Reptiles of Ceylon", 1939, with whom I correspond. An admirably succinct recent summary of available information is "Sea Turtles" by Robert M. Ingle and F. G. Walton Smith, a *Special Publication of the Marine Laboratory, University of Miami*, August, 1949; but it is concerned primarily with the Atlantic coast of America.

Unfortunately, Dr. Moorhouse never continued his researches. And no one else carried on where he left off, despite the economic importance of the Edible Turtle and the declining numbers almost throughout its range. Copper plates could hardly have lasted long anyway. I had to think not in single seasons but in years and decades. One or two other methods of marking had been vaguely tried elsewhere or were initially attempted here—such as branding the shell, wiring, drilling identification holes on the edge of the carapace in set patterns, decorating various sections of the body with special paints, etc.\* This type of approach in every case soon appeared very unlikely to be any use in the long-term study of turtles under tropical conditions—and conditions which were not primarily those of pure research, but rather of fitting this into the general pattern of mass-collecting turtles' eggs for profit within the framework of a conservative set-up where turtles are objects of respect.

Four simple essentials in Sarawak early emerged as follows:

1. First and foremost—that the turtles themselves should not be hurt or driven away. Not only on grounds of humanity and efficiency; also because there is strong sentimental and semi-religious feeling about these animals in these parts.
2. The markings must survive years of sea and storm.
3. The markings must survive the acute frictional contacts of copulation offshore (cf. note 2 of this series in *S.M.J.* VI, 4)
4. The mark-bearing identification must be easily applied if any appreciable proportion of laying turtles could be marked in a night, without increasing the staff (which was undesirable for accommodation, morale, and other reasons).

---

\*Apart from Moorhouse, the only other significant marine experimenter has been John Schmidt in the Danish West Indies, as reported in "*Meddelelser Kommissionen Hovundersogelser series*". *Fiskeri* 5 (1). This work was unfortunately not pursued to an effective conclusion. His best—but strictly temporary—results came from branding.

Dr. Parker of the British Museum (Natural History) kindly helped me obtain a copy of this rather inaccessible paper, and in other ways with advice and literature.

Of non-metallic methods, branding seemed the most likely. But to do this on any scale might violate Malay feeling, although not hurtful to the turtle. It also soon appeared unlikely brands could last many years, while branding-on apparatus involved awkward features.

Notching, filing, toe-clipping and other scarification methods were similarly examined, attempted and found unsuitable. A particular factor here is the difficulty of at once *detecting* the identification in the dark, and sand, as well as lack of long-term durability and the change of shape by wear; plus confusion with the numerous natural scars and cuts on old *Chelonia*.\* I will not in a note of this character, detain the student with a full account of the difficulties encountered in 1950-53. Not least was the allaying of legitimate fears held by the Malays, entitled to every consideration since they comprise the staffs on the three islands, the major part of the egg-buying public and the public to whose benefit the profits of the industry must be devoted through the Turtle Trust.

#### *A Satisfactory Tag Method?*

After abortive efforts with various other shapes and sorts of metal marker, attached at various points, a clip-in, long, over-folded tag was devised, with the well-helped help of Dr. John Hendrickson, Dpt. of Zoology, University of Malaya, who made several visits to the islands at my invitation as the guest of the Turtle Board. After some initial difficulties, this and the powerful spring "tweezers" to pinch it into place were perfected. Series of these tags, suitably coded, were specially made for us from hardened monel steel in the U.S.A. These tags were attached with the pincers to the rear edge of the forward flipper of female turtles while in the act of laying. Once she has started laying, you can do practically anything to a lady turtle and she won't stop. For all I know, you (not I) could chop her head off and she'd still go on. We worked, after some further trial, well in towards the junction of rear edge with main body, but avoiding friction inward. In general, 2" out proved best. But turtles vary

---

\*For advice on these methods, I am especially beholden to Dr. Fred Cagle. See also his note in *Copeia* 3, 1939, p.170.

very much in anatomical details. Right or left flipper was used, varied according to island and period (to assist *quick* visual checks).

Each tag bore on one side a number, on the other legend in capitals:

### SARAWAK MUSEUM

#### REWARD

These monel tags\* were first put into effective operation in 1953. Previous series had proved harmless but unreliable. No results have been considered reliable, therefore, on tags prior to 1953.

The major tagging was done on the main island, Talang<sup>2</sup> Besar, where the Board's Research Bungalow is established and full supervision is easiest. Smaller schemes were operated on the other two islands, Talang<sup>2</sup> Kechil and Satang. In the case of the last, as it is nearer the mainland, visits could be made more frequently and tagging there was carried on during a longer period, though on a smaller scale.

For present preliminary purposes, however, and to keep a rather complicated subject—inter-island movement—out of it, *only Talang<sup>2</sup> Besar* tagging is hereafter considered in this note.

Active satisfactory tagging commenced in June and really got under way in July (1953). The system I had already devised (1948-9) for logging every turtle laying meant that each individual layer is located topographically on the beach, clocked, and its clutch registered for every night in the year as a permanent record. We know, therefore, exactly what proportion of turtles were tagged throughout and how these stand as samples of the whole in all main respects. With adequate returns over the years, this should enable precise computations on the population.

---

\*The manufacturers, who took a lively interest in making this project a success, were the National Band and Tag Company of 721 York Street, Newport, Kentucky, U.S.A. Tags cost, delivered, about 0.15 cents (Straits) each, on bulk order.

*Set-Backs.*

In 1953 I got Scrub Typhus while on my own up in the far interior, crashed in the aeroplane "rescuing" me, had to walk out over the mountains the hard way while still invalid. This presently pushed me home good and sick. When I got back in 1954, the atmosphere of local goodwill towards this experiment had markedly receded. Partly because no tagged turtles had returned after the end of the run of "repeats" in the same "short season" (see below) of 1953. Partly because in my absence the research had got rather above itself and threatened to turn Talang2 Besar into a laboratory first and business-like centre for egg collecting second. As well as tagging, other studies (e.g. hanging up turtles to weigh them by day) had been made, unsuited to local prejudice. Additional staff were employed and the normal functioning of the "industry" affected. Expenses mounted much in excess of long-term policy agreed by the Board. I had been away too long. . . . It was essential, though, not to panic. I therefore asked the Board to proceed through 1954 with caution, spreading a smaller sample over a longer "season" (9 months instead of 6). *But by 1955 there was still not a single record of a tagged turtle back from 1953.* Nor any recovery reported from outside Sarawak, despite wide publicity. In 1955 I therefore bowed to some Malay anxieties and suspended operations early in the year.

The total number of turtles marked under what I consider satisfactory conditions and safeguards on Talang2 Besar in the three years with the final monel tags was:

1953 —	1,514
1954 —	715
1955 —	82.

During the same period 1,255 were tagged on adjacent, smaller Talang2 Kechil (series K) and a smaller number on more distant Satang(S), making a total of about 4,000 altogether.

*Short-term "Research".*

Short-term "repeats" have already been mentioned. This was one immediate and initially satisfactory result of the tagging. Within a few nights of first application, tagged turtles were again



recorded. Although both their regularity and frequency of return proved to be much less than on the Great Barrier Reef, many repeated 2-4 times, and more. It almost at once became clear that the 1953 lay of over two million eggs had to be divided by several times one hundred to get the number of females doing the job.

This was fully confirmed by repeats of tagged turtles in 1954.

But the repeats of 1954 were turtles *unmarked in 1953*. And as it was beyond statistical conception that by chance none of 1953 had come up in 1954, I was left with this—that for 1953 turtles to lay on Talang2 Besar in 1954

- (1) the tagged turtles had quit us (or perished);
- or (2) the tags had quit the turtles;
- or (3) no 1953 turtles had layed in 1954 on the same beach (none were reported on the other islands, either).

It was reassuring to get those short-term repeats inside 1953. But in such a short time (within 1953) a tag could hardly have worn or rubbed off, seriously hurt or poisoned a turtle. And we already knew that the layers came in loaded with hundreds of eggs and probably *had* to discharge them in some sort of rhythm—so that the impulse to stay inshore and lay in the short-term sequence must be very powerful indeed, overbearing every other impulse, including perhaps pain and fear.

*1955: Watch was kept all through the year.* Not a single 1953 turtle or 1954 turtle tag was encountered. Every one of the one and a half million eggs in 1955 was laid by a turtle without a previous tag, human oversight apart.

#### *Long-term Returns.*

But on May 16th, 1956, the staff on Talang2 Kechil reported at last a tagged turtle up. This was at least a start. The numbers on the tag were unfortunately illegible\*. It reinforced my belief that the major explanation of what had *not* gone on could be that the individual Edible Turtle does *not* lay (in Sarawak waters)

---

\*It is now quite clear that this was tagged *prior* to the final fully satisfactory series and method *early* in 1953.

annually. The turtles were very late in 1956, like the *musim tedoh* (fine weather of summer). I arranged to spend the first fortnight of July 1956 in Talang2 Besar and see what could be won then; it was then we had begun in earnest in 1953.

The satisfaction that ensued (for me) is, I hope, the justification for this somewhat involved account. My wife and I arrived on the island, with some of the first real summer weather, on July 1st. On July 2nd we got the first *long-term* repeater tag which was legible, and on the following days a whole run of them. This had nothing to do with my being there. *Every* layer has to be clocked and flagged, for the record and to enable egg collection after the turtle has camouflaged the nest. It is easy to see the shiny tags without special examination, on the fore flipper. Some can of course be missed. But not over weeks and months. The coincidence in this month was simply reasonable expectation—in this late and poor turtle year, if any 1953 tags were to appear in the third year after, July should be the start of it. So it turned out. The early July Talang2 Besar results included:

Tag Number:	1956—	1953—	1953—		
	First recovery on:	Initially tagged on:	"Repeat" recovered in:		
			July	Aug.	Sept.
B 1375	July 4	July 30	—	2	—
B 1685	July 6	July 18	1	3	—
B 661	July 7	July 1	1	3	2
B 2005	July 7	August 12	—	1	1
B 963	July 9	July 6	1	—	—
B 2102	July 9	August 15	—	—	—
B 1692	July 10	July 18	2	2	—
B 887	July 11	July 4	—	—	—
B 2024	July 13	August 12	—	—	—
B 1375	July 13	July 30	(cf. July 4, 1956)		
B 1685	July 16	July 18	(cf. July 6, 1956)		
B 661	July 17	July 1	(cf. July 7, 1956)		
B 1544	July 18	July 16	—	3	1
B 1421	July 18	August 1	—	—	—

All these tags were in perfect condition, and the reptilian bearers showed no signs even of minor injury or decline on the tagged flipper after three years at sea. It will be seen that within ten days respectively, all the first three returns had repeated. It should also be noted that some of these which *did not repeat in 1953* may have been tagged after the start of their laying series, as not every laying turtle was tagged on each night of 1953, of course.

I had to tear myself away to the mainland on July 18. The staff continue the record and the main "season" was not until August. The present note is complete to this stage only.

*Tagging so Far: Summary.*

While it is clearly too early to generalise anything, the results so far are, I venture to believe, of such interest that I make no apology for giving a preliminary report at this stage. It is hardly too much to say that the results obtained in Sarawak may open a new era in the study of marine turtles, of which *Chelonia mydas* is only one of several with economic importance. From the data that may now be obtained with tagging, it should be possible to plan the conservation of valuable and remarkable animals nearly everywhere in the world in danger of extinction. Moreover, the Green Turtle, and to a lesser extent the Loggerhead and Hawksbill, have exceptionally wide range round the world. They offer practical opportunities for fundamental research into climate and breeding, water conditions and migration, and other great problems which *no* other marine animal—and perhaps no other animal on earth—can equal.

From these wide vistas, I must return to our little island and our shoe-string studies so far.

What the work to date does usefully demonstrate may be summarised simply thus:

- (i) Hardened steel tags can be applied to adult marine turtles so that they are easily legible and the animal unharmed three years later.

(ii) Edible Turtles in Sarawak waters do not (normally) breed *more than once in three years*.

(iii) Of the turtles laying up to mid-July, 1956, a much larger proportion bore no tags than the proportion not tagged in 1953. It may well be that *most turtles do not lay again at the place of tagging until at least the fourth year after?*

Many other speculations suggest themselves. And there are conspicuous complications. These must await further returns, fuller analysis and more thorough discussion later. In particular, returns of Sarawak Museum tags from other areas would provide invaluable information. Any assistance in publicising this scheme will therefore be welcome.

Queries and correspondence suggesting aspects we may have overlooked or improvements which might be incorporated in this study will also be welcomed.

\* \* \*

*Postscript:*

Since the above went to press turtles have continued to come up with regularity. All but one have been animals tagged in July—September, 1953. Most have repeated two or more times this year—as to October 1, 1956.

Further results will be given in the next of these notes, we hope.

The picture should also become a lot clearer in 1957, as more tagged turtles are logged back (or not).