SURVEY OF TURTLES IN CAPTIVITY ON SAVAII, SAMOA
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BACKGROUND

This survey was prompted mostly from concerns expressed via email messages from certain tourists who visited the "swim with turtle" operation at Satoalepai, Savaii. This attraction is listed by the Pacific Travel Guide as one of the Top 10 things to do in Samoa. The nature of the complaints involved the well being of the turtles in terms of the quality/quantity of feed, the unhealthy condition of the pool in which they were kept as well as the high density at which the turtles are stocked. Remarks made by one tourist included the following:

- The operator did not seem to bother about the 'conservation' or the welfare of the turtles;
- The turtles seemed agitated and unhappy (and we were quite distressed seeing them like that, as were the other tourists who were there at the same time);
- The turtles were quite obviously hungry - a local guy who was with us threw them a sliced mango, and they were clamouring to get to it;
- The water they were in was dirty and smelly, and you could tell they'd been there for some time, which made us wonder how (or if) they'd get out to breed, and lay eggs.

In an effort to minimize/eliminate this problem, a working group consisting of representatives from relevant Government agencies [Division of Environment (MNRE), Fisheries Division (MAF), Samoa Tourism Authority (STA), Division of Internal Affairs (MWCSD)] and SPREP (Marine Species Programme), was established. The survey to assess the situation concerning turtles being kept in captivity for tourism-related activities as well as for other purposes was one of the priority activities of the working group. Other priority activities include the development of guidelines for keeping turtles in captivity as well as those for turtle watching in the wild.

The relevant local legislation includes:

- *Local Fisheries Regulations 1996:* The Fisheries Division is responsible for these regulations and they include the prohibition of fishing for, possessing and selling of the turtle species *Eretmochelys imbricata* (hawksbill) and *Chelonia mydas* (green) with a carapace length less than 700 mm (27.6 inches).
- *Marine Wildlife Regulations 2008:* The Ministry of Natural Resources and Environment is responsible for these regulations and were recently passed by Cabinet. Any turtle watching and eco-tourism activity requires a license from the Division of Environment and undertaken in accordance with any condition Guidelines approved from time to time by the Minister.

1. SATOALEPAI, SWIM WITH TURTLES. OWNER MR MATAIA I SU'E

Operator/owner: Mr Mataia I Su'e

Persons interviewed: Mr Mataia I Su'e, Mrs Mataua Mataia

1.1 General

The undertaking has been in operation for about 4 years now (to 2008) starting in late 2004 with the sole objective of establishing an income generating avenue targeting tourists. [However, a similar survey conducted in 2002 by SPREP and the Samoa Visitors Bureau confirms the existence of this operation then. Thus it started before 2004]. This operation is popular and is listed by the Pacific Travel Guide as one of the Top 10 things to do in Samoa.

The operation include both watching turtles and swimming with turtles in the pool. However, tourists are not allowed to hold any turtle while swimming. It originally included both species of turtles commonly found in Samoa, hawksbill and green turtles. However, due to problems with food and aggressive (biting) nature of hawksbill, the operation now concentrates on green turtles. During the survey, only green turtles were present in the pool.

As many as 24 individual turtles were being kept in captivity at one time. However, the tally of turtles kept in captivity for the operation is not known (no records).

The closest marine area to the operation that has turtles is the Le Lava, Saleaula. However, there is no nearby turtle nesting site.

1.2 Pond/pen characteristics

The pool/pen where the turtle are kept is an area enclosing a small portion of the large brackish-water wetland adjacent to the village. Tilapia had been introduced into this wetland and forms an important part of the village subsistence/artisanal fisheries. The pool was built by creating rock walls connecting to the rocky shore. As reported in 2002, the pool/pen "is made up of mainly boulders and rocks build up to form a wall. The top of the wall forms a walkway along and around the turtle pen. There are gaps in the wall that allows for continuous exchange of water into and out of the pen, hence maintaining the freshness of water in the pen at all times". However, an improvement from the 2002 structure is the 4-ft wide sluice gate on the northern end of the pool/pen. This allows for faster water exchange.

The pool/pen is almost square, about 20m in length x 20m in width. The deepest part is 1.6 m (at low tide) but most of the pool is about 1 m in depth.

During the visit, the water was a bit turbid with a visibility of about 5 m. It was explained by the operator that the turbidity during the visit was from land filling up near the road. This was confirmed when the site was visited on a later date (Jan 2009). The water within the pool/pen was very clear then.

The salinity was 1.5ppt confirming the high influx of freshwater from springs in the larger wetland area. There is also a relatively strong freshwater spring situated within the pool/pen itself on the south end. High tide would likely increase the salinity higher.

The bottom of the pool/pen is covered mostly with gravel and rocks. Sides are also rocks mostly around 1 ft in diameter.

One tree (talie) on the south side of the pool provides some shade and four mangrove trees (*Bruguiera* sp.) are also growing within the pool/pen.

- Location: S 13.44801; W 172.34665

1.3 Feeding/food

The turtles are fed with chopped-up ripe pawpaw, taro leaves (talo palagi, talo Samoa and taamu), 'fuefuesina' and 'laupule'. "Laupule" usually constitutes the last feeding of the day. When hawksbill turtles were present, they were fed with chopped up 'tilapia" caught from the other parts of the village waterway. Feeding is done twice a day, morning and evening. It was not possible to obtain exact amounts fed each time.

The operator claimed that the turtles (green) love feeding on the items listed above.

1.4 Maintenance

The turtles are cleaned when "dirty", using sand to scrub off dirt/seaweed on their backs. The pool itself is cleaned whenever necessary. This is done by stirring the bottom during the low tide and letting the stirred dirt flow out naturally with the tide. (Note: seaweed is not known to grow in the pool).

The pool where turtles are kept is not used for any other activity such as bathing and washing. These activities are done in other pools nearby which are separated from the turtle pool by rock walls.

1.5 Stocking turtles to the pool

Turtles are stocked/replenished whenever needed, i.e. when 1 or more are released back to the wild when they are large (i.e. "to allow it to go and nest"). To replenish, the operator asks fishermen to catch turtles. The turtles are bought from fishermen from either Satoalepai or Safa'i and bought at SAT30-50 each depending on size.

The turtles are kept in the pool/pen until they are big (about 1 m) and then released. Sometimes they are kept in the pool/pen for up to a year. Sometimes turtles are released when they look sick (particularly hawksbill) i.e. they hardly move around and not feeding.

The number of turtles usually kept at any one time is between 10-20 individuals with the maximum ever as about 24 and minimum of 10. There are no written records to confirm stocking and release information.

When buying turtles for restocking, size is always a consideration, i.e. no juvenile turtle (1 ft or less) and ever stocked. Carapace lengths of turtles used for stocking are always around 2 ft.

It was relayed that during Ofa and Val, the pool over-flooded and turtles got out (note: this contradicts what was said earlier that he started 4 years ago, unless he is mistaking it for Heta!! Ofa and Val cyclones were in 1990 and 1991). A wooden fence has been constructed over/around the pool to avoid turtle escaping during bad weather.

1.6 Skills of Operator

The operator is aware of the external feature differentiating a male from a female turtle (longer tail in males) but was not aware that this is only apparent when the turtles are big (reach maturity).

In addition, the operator is familiar with both green (laumei mumu-reddish turtle) and hawksbill turtle (laumei faiuga). However, the operator is not aware of the turtle life cycle (which was explained), and has no knowledge in keeping/farming aquatic animals.

1.7 Status (health) of turtle

The operator explained that ever since the start of the project, only about 3 turtles were observed to "look" sick. Symptoms were that they looked 'unhappy'/'lethargic'. The operator believed this was due to these turtles not feeding well and were thus hungry. This involved only hawksbill turtles and they were stocked into the pool for some sometime before they were observed as "unhappy". These "sick" turtles were released back to the sea. At least one of them was re-caught by a fisherman and brought back.

No turtle ever died while in captivity and that no turtle was ever observed suffering from fibropapillomatosis (fibropapilloma disease, external tumors), but one (green) had a white spot developing after stocking and was accordingly returned to the sea.

1.8 Income/expenses

The highest number of visitors is around 100 per day in good days especially in the months of June-August (during Teuila). On the average good days can expect 40-100 visitors daily. However there are days when there are no visitors at all. Visitors are mostly overseas tourists but also include Samoans and local school field trips.

The fee charges are ST5 per adult and ST2 for children.

The expenses are mainly for general maintenance/improvement but not much as feed for the green turtles are from their own farm.

In addition to the swim with turtles operation, the family also operates 3 units over the water near the turtle pool, for accommodation. Two of these have 2 bedrooms while one has 1 bed-room.

1.9 Plans for the Future

The operator plans to expand the operation including building more houses/unit over the water for visitors accommodation.

1.10 Problems

The operator claimed that there have been no major problems facing him with his undertaking.

1.11 Information on turtles currently in captivity in pool

The operator had 18 green turtles of various sizes, but mostly around 50 cm CCL. None of the 18 turtles seem to have reached maturity size. There was no hawksbill turtle as the operator does not want to keep hawksbill turtles anymore because they bite and the difficulty in maintaining them especially the need to feed them with fish.

It was only possible to take measurement on 1 turtle during the survey. It had a CCL (max) of 56.5cm and CCW of 53.5cm. Tissue samples were also collected from hind flippers (given to Environment). External examination showed minimum algae growth. This turtle was also tagged (Right flipper-R39406; Left flipper-R39426).

The following constitutes observations on the turtles present in the pool during the visit:

- Almost all turtles appear pale (loss of colour from impact of freshwater?);
- Minimal algal growth on them;
- 1 turtle (green) had ½ of one of its front flipper gone (it had this when brought in by fisherman);
- 1 turtle (green) had its right hind flipper missing (also had it when brought in);
- 1 turtle (green) had its carapace end portion above its tail "bitten" off (also had it when brought in);
- Stomach flat, and those that came to feed when fed to catch one for sampling, looked healthy (only about 6 turtles came to feed when fed).

2. FAALA

Operator/Owner: Family of Sefo Leituala

Person interviewed: Sefo Leituala

2.1 General

This operation started about 10 years involving finfish and then including turtles for about 5 years now. It started as a hobby but tourists have visited it. The father (who has passed away) had approached certain Government Departments for assistance to develop it into a "commercial" operation. [Note: the family does not eat turtles and the village also don't seem to like eating turtles].

Even since it started, it was always open to anyone without any fee charged. Both green and hawksbill turtles have been kept in the pond. [The interviewee referred to the green turtle currently in the pond as laumei faiuga/mumu, which is wrong].

The interviewee claimed that green turtles are plentiful in the sea adjacent to their village especially near Aganoa. He also claimed that turtles similar to that in the pond (which is a green) also nests at Aganoa (Note: green turtles have never been recorded as nesting in Samoa except American Samoa on Ross Atoll). The maximum number of turtles kept in the pond is 7 green turtles and it currently has only one very large one (green).

2.2 Pond characteristics

Similar to the operation in Satoalepai, this pond was created by building up rock walls into the sea and connecting to the rocky shore forming the other sides of the pond. The pond measures 15 m x 10 m with only a small portion on the west end having water depth of about 1.18m, with the rest of the pond having water depth of about 0.5 m or less deep (note: measurements were done during low tide thus would be deeper in high tides). There is a freshwater spring on the north-west end of the pond. Water exchange with the tide occurs through the rock walls that were erected on the sea side and the salinity measured was 0.9 ppt (low tide). Water visibility was high (i.e. very clear water).

There is no shade available and no algal growth was observed in the pond.

2.3 Feeding

The turtles were usually fed with mashed fish (surgeonfish) but now food for the turtles is switched to pawpaw as well as o'o (fruit of coconut). There is no consistent timing for feeding but anytime, with minimum of once a day. The turtle eats the food provided.

2.4 Maintenance

The turtles kept in the pond were never washed nor was there any cleaning required for the pond as there was no need as it was always clean. The pond is not used for other things such as washing/bathing.

2.5 Stocking turtles to the pool

Turtles are stocked into the pond only when the owner catches turtles from fishing at night.

Turtles kept in the pond are released when they are big (except the current one). Some turtles were tagged and released by a Peace Corps volunteer (attempts to identify the volunteer concerned for the information was not successful). It was estimated that more than 10 turtles have been released since the start of the operation, mainly due to limited space and limited food. The current turtle (green) has been kept in the pond for over 5 years since caught. The maximum number of turtles kept in the pond at any one time was seven but one is the usual number.

2.6 Skills of Operator

The operator has no knowledge of turtles including the external feature distinguishing the difference between male and female turtles, their ecology, and even the differences between turtle species. No one in the family also has any skill in keeping/farming aquatic animals.

2.7 Status (health) of turtles in captivity

Only one turtle died while in captivity, which is believed to have been a hawksbill. There were no signs of sickness and was in the pond for more than 7 months when it died (malnutrition?). The dead turtle was thrown to the sea. It was also claimed that one turtle (hawksbill) had fibropapilloma disease (external tumors). These were on the turtle when caught and it was released again.

2.8 Income/expenses

Visitors have not been charged yet.

2.9 Plans for the future

The family has been trying to develop this into a tourism-related activity for income generation.

2.10 Problems

The only problem experienced concerns the one turtle that died while in captivity. This was very likely to be due to malnutrition.

2.11 Information on turtles currently in captivity in pool

There was only one large (possibly mature) green turtle in captivity. Its carapace was covered with a thin layer of algae growth. On examination, its stomach was flat but the turtle looks a bit thin. Its CCL (max) measured at 100.5 cm and CCW 93.9cm, indicating maturity. Tissue samples were collected from hind flippers and the turtle tagged (right-R39411; left-R39412).

Given the size of the turtle (reaching maturity), it was recommended that it be released.

3. AUALA

Operator/Owner: Women's Committee

Person interviewed: Liu (Women's Committee Representative)

Interviewer: Joyce Samuela-Ah Leong/Mikey/Iona

3.1 General

The operation started in 2003 but was damaged in 2006 by strong wave action and turtles were then taken out of the fence. The purpose is for tourist watching. Swimming with turtles has never been allowed.

The Interviewee does not recognize the different types of turtles.

It was also relayed that turtle nesting was common at the Faga at Papaloa in the past. It is suspected that nesting there may still be happening but people do not check them now.

3.2 Pond characteristics

The pond for keeping turtles was created within the village natural pool with has fresh-water springs in a few places. The north side of the pool though is bordered by the main road. The water exchange is through the rock wall and large concrete pipes (under the road) connecting the pond and the sea. The village used sticks to form a barrier across the pipe outlets to block turtles and other big fish from escaping from the pond into the sea. A few mangrove plants are growing at one side and the pool. The pond where turtles are kept is about 10m x 10 m with the deepest part having water depth of about 1.5 m. During the survey, water visibility was about 5-7 m with the pond bottom constituting mostly of rocks and mud. The pond has a small "cave" used as a hiding place by the turtles.

3.3 Feeding

The turtles are fed pele leaves as well as left-over food, three times a day. The interviewee confirmed that the turtles eat these.

3.4 Maintenance

The women's committee clean the sea weeds and remove any rubbish from with the pond. This is usually done every 4 months. Sometimes the men also help out with this when necessary.

3.5 Stocking turtles to the pool

Turtles for stocking the pool are those caught by village fishermen who bring them to the women committee. The turtles are never bought from the fishermen. So stocking is dependent on those brought in by fishermen.

Duration on how long each individual turtle is kept in the pond depends on the advice from the Fisheries Division, but one time in 2006 all turtles were removed when the fence was damaged by strong wave action.

The interviewee was not sure on the number of turtles usually kept but there were about 20 at one time.

3.6 Skills of Operator

The interviewee had no knowledge on turtles, the different species, life cycle and the difference between a male and female turtle. This also seems to be the case with the women committee members. In addition, none has the skill in keeping animals in water.

3.7 Status (health) of turtle

There has never been a case of a turtle becoming sick or dying while in captivity. The fibropapilloma disease has never been observed on any turtle involved.

3.8 Income/expenses

The women committee charges SAT2 per person for those who visit. Visitors include tourists as well as people from other villages as well as local schools. There are no records of monies collected. (Note: the village council received some funding from the Ministry of Natural Resources and Environment under a small grant project to improve their pool).

3.9 Plans

The women's committee will continue the operation and would like more turtles to be brought in. This is dependent on turtles brought by their village fishermen.

3.10 Problems

No major problem.

3.11 Information on turtles currently in captivity in pool

During the survey, only 1 green turtle was in captivity, with carapace measurements of 15cm CCL and CCW of 13 cm. Green algae growth was observed on the turtle back and its stomach flat though it looked healthy and very mobile. The turtle was tagged (Left-R39409; Right-R39410).

4. REMARKS

Operation level: The three turtle-keeping operations surveyed on Savaii all target income generation especially from tourists although the one at Faala has not yet started charging any fees. While two are family operated, one involves the village women's committee. The undertaking in Satoalepai is a full operation involving one family and is listed by the Pacific Travel Guide as one of the Top 10 things to do in Samoa. This can be considered as the only truly commercial operation in that turtles are bought from fishermen and visitors are charged a relatively high fee and that units for accommodation are also available. The operation in Auala is dependent on fishermen providing them with turtles free with a small fee, while that at Faala is dependent of the owner himself in catching turtles with no fees charged yet.

Structure type: All utilize part of the natural surrounding/environment with two involving the building up of walls with available resources (rocks) and using part of the natural rocky coastline as sides of the structures for keeping turtles in.

Water in ponds/salinity: While all are connected to the sea, fresh-water influxes from springs nearby and within the ponds themselves very much influence the salinity in which the turtles are kept. The salinity readings taken at Satoalepai and Faala, 1.5 and 0.9 ppt respectively, are very low compared to the oceanic seawater which has a salinity of 35 ppt. It should be noted though that the measurements were taken at low tide thus the fresh-water from springs would have a higher influence. Salinity readings should be taken throughout a tidal cycle to monitor actual salinity fluctuations within these ponds as well as depths. The pale appearance of turtles at Satoalepai, especially between scales, but particularly on the limbs and on the necks, seems to be an impact of fresh-water.

Water exchange: Water exchanges with the sea are through the rock walls that were built specifically for this purpose or for the road in the case of Auala. However the operation at Satoalepai has a 4-foot wide gate of wire mesh that facilitates better/faster water exchanges. The pond at Auala has pipes that connect it to the sea. Faala has a wide wall on the sea side allowing water exchange with the sea.

Water depths: The operation at Satoalepai has sufficient water depths. However, that at Faala has only a small part of the pond with sufficient depth.

Water quality: Water turbidity inside the pool at Satoalepai during the visit is a concern. Even though a visit later confirmed that the water can become very clear, it is obvious that the water quality can be affected. It is necessary to monitor water quality at this site especially when it is a favourite site for tourists. Monitoring should form a major part of the guidelines to be developed by the working group. Water clarity at Faala was good. The presence of mud in part of the pond at Auala is also a concern.

Turtle sizes: The operation at Satoalepai seems to have undergone a natural selection process in terms of turtle species used. The emphasis is now on green turtles due to ease in maintenance especially where food is concerned and its non-aggressive nature, i.e. not like the hawksbill turtle that has a tendency to bite. The size range of turtles currently being kept at this operation indicates that they are from sub-adults stocks foraging in the shallow waters of Samoa. The large green kept at Faala is very likely to have reached sexual maturity and it was recommended for it to be released back to the sea.

Food/feeding: Feeding is always major concern for any animals kept in captivity. While indications are that the turtles do feed on the food provided and that there were no signs of malnutrition, there is no way to determine whether they provide sufficient nutritional elements for them to grow properly and become good reproductive animals when reaching maturity.

5. RECOMMENDATIONS

The 2002 SPREP report by Job Opu (Marine Species Officer then) carries very important and valid recommendations most of which have not been followed up. However, some of his recommendations seem to have been adopted by certain operators, e.g. the use of only non-breeding turtles and not allowing handling of turtles by visitors. Some of his recommendations are repeated here because of their relevancy and importance. Where new recommendations are made, they are kept in general terms as they will be dealt with in details in the guidelines to be developed by the working group now established to deal with the issue and in view of the new regulations recently passed that includes provisions that deal with turtles in captivity.

TURTLES:

1. ***Turtle sizes:*** Only non-breeding size turtles should be used. In addition, no juvenile turtles should be kept in captivity for any purpose. This is practised at Satoalepai.
2. ***Species:*** Hawksbill turtle requires a high protein feed. Given the ease with which green turtles food can be obtained, it might be worth considering allowing only green turtles for this type of activity.

OPERATION:

3. ***Handling turtles in captivity:*** For the "swim-with-turtle" operation, a certain distance between swimmers and turtles should be established. Under no circumstance should the turtles be touched,

held, lifted, ridden or doing any form of harassment to the turtles in the water. [This does not include the handling of turtles for scientific or health purposes by authorised personnel].

4. ***Feeding/food:*** Even though no sign of malnutrition was observed amongst the turtles during the survey, it is recommended that where possible effort should be made to provide some of the natural food (e.g. sea-grass for green turtles) and that adequate amounts are provided daily, administered at least twice a day.
5. ***Density:*** Space is another very important factor for consideration. Overcrowding easily leads to disease blooms and aggressiveness in individuals. Thus sufficient space should be carefully calculated for each operation considering dimensions (pond area and depth) of each pond.
6. ***Record keeping:*** Record keeping is also another important aspect. Each individual turtle should be measured and have proper records done upon receipt and eventual fate. Each individual turtle should have a history record with the operators up until its fate. This will require a means of marking each turtle to identify it from others.
7. ***Monitoring:*** An important component of record keeping includes monitoring of the health of the individual animals, water quality, etc). Any "sick" turtle should be reported immediately to relevant authorities and must be separated from the rest of the animals.
8. ***Release/replenishing cycle:*** This refers to the release of turtles kept in captivity after a certain period of time. This is particularly important where the salinity in the pond water used for keeping turtles is low. It was noted that fresh-water is the likely cause of "pale" turtles at the Satoalepai operation. A release/replenish system should be in place so as to avoid these problems including the ability of the turtle to find food naturally when released as well as other parameters such as its ability to be a normal reproductive animal.
9. ***Tagging:*** Each turtle to be released should be tagged and information (turtle measurements, species and tag numbers) recorded properly and submitted to the Division of Environment and Conservation or Fisheries Division.

FACILITY:

10. ***Water quality:*** In addition to density, water quality is vitally important in maintaining the health of the animals. Two very important factors are water exchange and salinity. Water exchange through rock walls may not be sufficient in maintaining good water quality. Thus a wide gate allowing a freer exchange of water with the changing tides should be put in place for each pond used for keeping turtles. Ponds with limited water exchange are characterized with algal blooms making the water column murky green/red in colour. Marine turtles' normal environment is the ocean where the salinity is around 35ppt. Thus low salinity would be detrimental to the health of animal. See recommendation 8 above for minimizing the impact where water salinity is low.
11. ***Depth:*** Ample water depth (1m and deeper) is also important to the health of the turtles. This should also be an important consideration.
12. ***Shade:*** Sufficient shade to protect the turtles from the heat of the sun is necessary. This is particularly important for sites where the water is shallow with hindered water exchange at any time.

TRAINING/AWARENESS/INFORMATION:

13. ***Tagging/tissue sampling:*** The operators should be trained to tag turtles and collect tissue samples from each turtle to be released. Thus each should be provided with tags and applicator as well as tissue sampling equipment with instructions.
14. ***Workshop:*** It was very apparent that the operators have limited knowledge on marine turtles. A workshop should be conducted where all aspects concerning turtles are discussed. This includes the status of marine turtle species in the world, biology, ecology and other important aspects. This can be done in conjunction with 13 above.
15. ***Information sheets:*** It is also important that information sheets be produced and made available at the operation on turtle species in captivity for information of the public as well as visitors who might want these.

Reference

Opu, Job. 2002. Preliminary Investigation of 2 turtle holding pens on the Island of Savaii, Samoa. SPREP Report, 26 November 2002.