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1990-2011 Review of Live Marine Turtle Strandings with Abnormal Buoyancy^a

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This report reviews live marine turtle strandings with buoyancy problems in the Hawaiian Islands from 1990 to 2011. Positive buoyancy in marine turtles is usually the result of abnormal air or gas formed internally causing the turtle to float. This results in an inability to dive normally to feed and also to avoid predators and other dangers. These turtles are usually found stranded on the beach or are retrieved by boaters or swimmers. The causes for the air accumulation has various etiologies such as fishing line, tumors, infection, foreign bodies, trauma and neurological. Locations of the air or gas can include the lungs, peritoneal cavity and gastrointestinal tract. Diagnosis as to the location of the air/gas helps to govern the type of treatment rendered. Diagnostic imaging tools such as radiographs, endoscopy, ultrasound, MRI and CAT scan can be helpful if affordable and available. Many times cause and location of the problem cannot be determined. In most cases, positive buoyancy was only one of multiple causes for stranding. This report focuses only on the buoyancy aspect of these cases.

Since 1990, there have been 35 live stranded turtles that the Marine Turtle Research Program (MTRP) has treated for buoyancy concerns (Table 1). When broken down by species, 31 were green turtles (*Chelonia mydas*), two were olive ridleys (*Lepidochelys olivacea*), one was a hawksbill (*Eretmochelys imbricata*) and one was a loggerhead (*Caretta caretta*). Of these 35 live strandings, 19 were rehabilitated and released in collaboration with NOAA contract veterinarian, Dr. Robert Morris. The remaining 16 died. Euthanasia was carried out on 13 of the 16 due to a poor prognosis. Comprehensive necropsies were completed on all 16 turtles.

Kewalo Research Facility (KRF) at Kewalo Basin, Oahu was utilized from 0-189 days (average of 36 days) by MTRP for turtles with buoyancy issues. Days spent at KRF were determined on a case by case basis as advised by the veterinarian. Turtles that were eventually released resided in these tanks for 13-189 days with an average of 50 days for each case. Turtles that did not survive inhabited the tanks for 0-100 days, with an average

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of 19 days for each case. There was one case where a turtle was held in a natural enclosure on the island of Hawaii. This turtle was released after 445 days.

Treatments varied with each case and evolved throughout time due to advances in medical technology and successes in previous cases. Most cases used many different treatments and diagnostic methods. The summaries below include each case that specific treatment or diagnostic method was used, regardless of whether alternative methods were also utilized. Therefore, many cases are included multiple times.

X-rays were taken in 16 cases to get a better look at the internal anatomy and to assist in diagnosing the cause of abnormal buoyancy. Of those 16, 13 turtles were able to be rehabilitated and released.

Endoscopy was used to evaluate internal organs to note abnormalities and attempt to diagnose the cause of buoyancy in four cases. In two of those cases, endoscopy via the mouth proved to show no signs of intestinal necrosis from possibly ingested line. Both turtles were successfully rehabilitated and released. In the other two cases, endoscopy via an inguinal area incision did not lead to useful diagnoses for treatment or life expectancy. Both animals died due to causes discerned via gross necropsy and post-mortem histology.

Aspiration of the peritoneal cavity was used on two turtles that were thought to have air trapped within. This procedure only provided buoyancy correction leading to release in 1 case.

Antibiotics were used in many cases as one aspect of treatment. Of the 20 abnormally buoyant turtles that received antibiotics, 16 were rehabilitated and released.

Intraperitoneal (IP) fluids of various compositions were administered for treatment to 11 turtles. Nine of these were rehabilitated and released.

Mineral oil administered orally or per os (PO) was used to lubricate the digestive tract to aid movement of foreign bodies or natural impactions. Of the six treated, five were rehabilitated and released.

Simethicone was given PO in five turtles to help reduce bloating due to excess gas in the gastrointestinal tract. Four of the five were rehabilitated and released.

Fibropapilloma tumors were removed in three cases of positively buoyant turtles. Tumors were removed from the eyes, mouth and flipper areas. It is unlikely that external tumor removal alone would have been a factor in normalizing the buoyancy in a turtle. However, two of the three external tumor removal cases did recover and were released.

Cause of positive buoyancy in live turtles was determined by Dr. Robert Morris. However, the cause of abnormal buoyancy in turtles that did not survive was determined through a combination of the veterinarian's diagnosis while the turtle was alive and the results of a post-mortem comprehensive necropsy by USGS Dr. Thierry Work.

Fishing line ingestion occurred in eight buoyancy cases, with seven recovering cases. Lung related problems (disease, fibromas, edema, etc) occurred in 10 cases, with no survivors. Trauma to the carapace occurred in two cases, with one survivor. There were 15 cases that occurred that the cause of positive buoyancy was unknown. Of these cases, 11 survived.

Based on these data, it was concluded that marine turtles with known lung problems causing positive buoyancy have had a 0% survival rate (n=10). Nine of the 10 cases were directly related to fibromas or masses in the lungs that were detected post-mortem. In contrast, cases of known fishing line ingestion that lead to positive buoyancy have a high recovery rate with seven out of eight (88%) cases being released after rehabilitation. There were 15 cases with an unknown cause of positive buoyancy, and 11 of them were rehabilitated and released.

The data also showed that x-rays, antibiotic treatment, IP fluid admission, mineral oil administered PO and simethicone administered PO were used in multiple cases and were at least 80% effective within the individual cases that they were utilized. However, with varied approaches being used by the veterinarian to evaluate and treat positive buoyancy, more data collection in the future using similar rehabilitation and treatment methods may more clearly determine the benefits of some methods over others.

Table 1.

1990-2011 Summary of 35 Live Marine Turtle Strandings with Abnormal Buoyancy						
Abnormal Buoyancy since 1990			Treatments/Diagnostics	Total Treated	Lived	% Survival
Total	35		X-ray	16	13	81
Green Turtles	31		Antibiotics	20	16	80
Olive Ridleys	2		IP Fluids	11	9	82
Hawksbills	1		Aspirate	2	1	50
Loggerheads	1		Mineral Oil (PO)	6	5	83
			Simethicone (PO)	5	4	80
			Endoscopy	4	2	50
			Tumor Removal	3	2	67
Final Result						
Released	19					
Died/Euthanasia Death	16					
Number of Days in Rehabilitation		Cause of Buoyancy		Total	Lived	
Total	0-189 (445)		Unknown	15	11	
Live	13-189 (445)		Lung Related	10	0	
Fatal	0-100		Fishing Line Ingestion	8	7	
			Injury	2	1	

Inclusions: This report is accompanied by an Excel spreadsheet of the summary statistics in Table 1 – Abnormal Buoyancy Results_table.xlsx