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Report on post-release mortality of scalloped hammerhead, *Sphyrna lewini*, and great hammerhead, *Sphyrna mokarran*

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Data Summary:

Great hammerheads, *Sphyrna mokarran*, and scalloped hammerheads, *Sphyrna lewini*, were fitted with acoustic transmitters and/or satellite tags after being captured during fishery-independent surveys or directed sampling efforts using gillnet, bottom longline, or drum line gear. One great hammerhead was incidentally captured using rod and reel gear, with light monofilament terminating in a 6/0 circle hook. Gillnets were deployed as part of the NOAA GULFSPAN survey (Carlson and Brusher, 1999). Briefly, a gillnet consisting of six different stretched-mesh size panels (3.0in to 5.5in, in 0.5in steps) strung together as a single gear, was fished perpendicularly to shore or with the wind. The gillnet was anchored at either end and continuously tended. Haul backs began approximately 30 mins after the gear first enters the water. Longline gear consisted of a 500 or 700m braided nylon mainline with demersal gangions, spaced at approximately 10m intervals, with alternating 12/0, 14/0 and 16/0 circle hooks. Haul backs began within approximately one hour of the gear first entering the water. Drum lines consisted of a cement block anchor, attached to 20-40m of line (variable based on water depth), running to the surface, terminating with a surface float. A 30m heavy monofilament line, terminating with a baited 18/0 circle hook, was attached to the anchor using a swivel, permitting a hooked animal to swim in circles around the anchor. Drum lines were checked every 2-3 hours. For each gear set, mid-water temperature (°C), salinity (ppt), and dissolved oxygen (mg/L) were recorded using a hand-held environmental meter (YSI, Inc.). Average depth (m) was calculated using the depth at the gear start and end points, as measured by the vessel's depth finder. Water clarity (depth of the photic zone, cm) was measured using a Secchi disc and the predominant bottom type (sand, mud, seagrass, oyster bed, etc.) was recorded. All work was conducted under Special Activities Licenses from the Florida Fish and Wildlife Conservation Commission (SAL-1666-SRP and SAL-1918-SRP), in accordance with University of South Florida Institutional Animal Care and Use Committee protocols IS00004541 and IS00008435.

Only individuals that appeared healthy and in robust condition were selected for tagging. Small sharks (< 1m total length) were brought on board the vessel and flexible vinyl tubing, connected to a small pump, was inserted into the mouth to pump oxygenated seawater over the gills during the tagging procedure. One adult male scalloped hammerhead (2.03 m total length) that was dual-tagged with an acoustic transmitter and a fin-mounted Smart Position and Temperature (SPOT) transmitting tag (Wildlife Computers) was brought on board the vessel for tagging, during which time the gills were continuously oxygenated using a seawater hose placed in the mouth. All other sharks > 1m total length remained in the water during the tagging procedure and were restrained by cleating the leader line to the boat and placing a tethered rope loop around the caudal peduncle, such that they were oriented head-first into the current to support natural gill ventilation. Animals were inverted to induce tonic immobility and a small incision was made along the ventral midline, anterior to the pelvic fins, using sterile instruments. A sterilized

acoustic transmitter (Innovasea) was inserted into the body cavity and the incision was closed with 2-3 sutures, made from sterile, resorptive materials, with each suture reinforced by redundant knots. For large (>2 m total length) great hammerheads, the suturing step was omitted as the thick musculature encourages the incision to close naturally, resulting in high tag retention (V. Heim, personal communication). All animals were measured, sexed, assigned a life stage, and externally tagged with an individually-numbered nylon-headed (sharks < 1.5m total length) or metal-headed (sharks > 1.5m total length) streamer tag prior to release. The release time, GPS location, and release condition, scored using the Hueter and Manire (1994) method, were recorded.

Upon release, animal movements were tracked by arrays of passive acoustic receivers. Movements of four of these animals are reported in SEDAR 77-SID05 (Gardiner et al., 2021). Arrays in Terra Ceia Bay, the Manatee River, and Sarasota Bay include directional gates (lines of acoustic receivers with overlapping detection ranges, see Heupel et al. (2006)), providing complete coverage across all entry/exit points from these estuaries such that animals cannot emigrate from the estuary undetected. Using similar, but more conservative, criteria to Heupel and Simpfendorfer (2002) and Heupel and Simpfendorfer (2011), animals were classified as 1) survivals – individuals that maintained continuous movement for a period ≥ 14 days or 2) mortalities – individuals that ceased movement within 14 days and individuals that disappeared within a gated array, after 6 months had elapsed.

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Table 1. Post-release outcomes for scalloped hammerheads, *Sphyrna lewini*

Tag Type	Tag ID	Gear	Area	Date	Temp (C)	FL (cm)	Sex	Life Stage	Soak Time (hrs)	Release Condition	Days Tracked	Outcome
V13-1L	A69-9001-13212	GN	TCB	2018-08-06	30.8	36	M	YOY	0.93	2	7	Mortality
V13-1L	A69-9001-13213	GN	TCB	2018-10-29	23.5	53	F	Juvenile	1.00	1	0[1]	Mortality
V16 + SPOT	A69-1602-28016 171803	DL	GOM	2019-04-18	24.8	159	M	Mature	3.15	3	0[1,2] 15	Survival

[1] tag detected at single station; [2] animal was released within an open system where acoustic receiver coverage was sparse. Hook timers were not used in this study, soak times reflects time from the start of deployment of the gear until the capture of the animal. Days tracked is the number of days the tag was detected continuously moving. GN = gillnet, DL = drumline, GOM = Gulf of Mexico, TCB = Terra Ceia Bay.

Table 2. Post-release outcomes for great hammerheads, *Sphyrna mokarran*

Tag Type	Tag ID	Gear	Area	Date	Temp (C)	FL (cm)	Sex	Life Stage	Soak/ Fight Time (hrs)	Release Condition	Days Tracked	Outcome
V16-4L	A69-9001-18216	RR	SB	2018-07-03	30.5	123	F	Juvenile	0.95	2	0	Mortality
V16-4L	A69-9001-8529	BLL	TCB	2019-04-15	25.7	178	M	Juvenile	2.27	3	574	Survival
V16-4L	A69-9001-18214	BLL	MR	2019-05-14	28.0	154	F	Juvenile	1.82		696	Survival
V9-2L	A69-1602-12138	BLL	TB	2020-06-30	33.3	166	F	Juvenile	1.18	2	314	Survival
V16-4L	A69-9001-2917	BLL	TCB	2020-08-18	31.3	98	M	Juvenile	0.95	2	309	Survival
V16-4L	A69-9001-63104	BLL	MR	2021-06-23	29.8	84	F	YOY	0.93	2	0	Mortality
V16-4L	A69-9001-63102	BLL	TCB	2021-06-23	29.6	123	F	Juvenile	1.67	2	16	Survival
V16-4L	A69-9001-63103	BLL	TCB	2021-06-23	29.6	107	M	Juvenile	1.83	3	2*	Undetermined
V16-4L	A69-9001-63105	BLL	MR	2021-06-29	28.3	88	F	YOY	0.80	2	121	Survival
V16-4L	A69-9001-61092	BLL	TCB	2021-10-20	25.2	104	F	YOY	1.70	3	3*	Undetermined

[1] tag detected at single station; * animal departed the estuary, status unknown due to timing of download of adjacent array. Hook timers were not used, soak times reflects time from the start of deployment of the gear until the capture of the animal. Days tracked is the number of days the tag was detected continuously moving. BLL = bottom longline, RR = rod and reel, MR = Manatee River, SB = Sarasota Bay, TB = Tampa Bay, TCB = Terra Ceia Bay.