Fishery Interim Summary Report Series No. 16-4

Determining Lake Trout Spawning Area at Tunk Lake

By: Joseph R. Overlock
Grand Lake Region

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Maine Department of
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Fisheries and Hatcheries Division

Job F-011
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SUMMARY

Tunk Lake, located in eastern Hancock County, is a well-known producer of quality landlocked salmon and trophy lake trout. Recently, a protective slot limit was put in place to reduce harvest of larger lake trout. Effectively capturing adult lake trout using non-lethal methods is critical to properly evaluate this regulation. In this study, fisheries staff sought to determine the location of lake trout spawning at Tunk Lake. This information would then be used to locate sites for non-lethal fall trap net sampling in future lake trout monitoring efforts.

Ten lake trout were captured by gill netting and were surgically implanted with radio tags. The movements of those fish were monitored during 8 tracking events throughout the fall of 2015. Peak spawning activity began between October 15th-18th and lasted until at least October 26th. Congregations of fish on and adjacent to several shallow shoals located in the southern end of the lake suggest this area to be the primary location of lake trout spawning. In the fall of 2016, additional tracking events, coupled with trap netting, should further enhance knowledge and understanding of lake trout spawning habits at Tunk Lake.

KEYWORDS: LKT,LLS,RADIO TELEMETRY,TAGGING,SPAWNING,SPECIAL REGULATIONS,TEMPERATURE,LAKE,GILLNET, TRAPNET

INTRODUCTION AND STUDY AREA

Tunk Lake is a 2010 acre oligotrophic lake located in T10 SD in Hancock County (Figure 1). With a mean depth of 71 feet and a maximum depth of 222 feet, Tunk Lake ranks as the third deepest lake in the state.

Tunk Lake supports principal fisheries for landlocked salmon and lake trout with management strategies for both species focused on maintaining above average size quality. Lake Trout were stocked in 14 of 40 years between 1938 and 1977 and once again in 1989. At present, the lake trout fishery is maintained solely by natural reproduction.

Beginning January 1st, 2014 a protective slot limit went into effect at Tunk Lake with the goals of increasing lake trout size quality and increasing biological control of small individuals (less than 16") that make up a large portion of the catch, approximately 61% in a 2014 winter census.

The current lake trout regulation at Tunk Lake is:

> *No bag limit on togue under 23 inches and no minimum length on togue. Daily bag limit on togue greater than 33 inches: 1 fish. All togue between 23 and 33 inches must be released alive at once.*

Regional fisheries staff plan to monitor changes to the lake trout population via creel census, periodic gill netting, and non-lethal sampling of spawning fish. Non-lethal methods to evaluate spawning adult lake trout include SCUBA, electrofishing, and (preferably) trapnetting. All of these methods require knowledge of lake trout spawning locations to be effective. Spawning locations have yet to be confirmed by any previous work at Tunk Lake. Radio telemetry has proven effective elsewhere as a means of locating spawning areas for follow-up sampling and Tunk Lake is a prime candidate for a radio telemetry project.

METHODS

During the fall of 2015, ten lake trout were captured from Tunk Lake via gillnetting and were implanted with radio tags (Advanced Telemetry Systems (ATS) model 1840B). Between October 5th-7th, fish were captured with small mesh gill nets and tags were implanted using surgical techniques. Only lake trout greater than 20 inches in total length were chosen for tagging in order to reduce effects of tag size (stress/delayed mortality) and to increase the likelihood of fish being sexually mature.

Fish to be tagged were transported to a surgery station set up at Rainbow Beach. A live cage for fish recovery was set up in Rainbow Brook, which was four to five degrees Fahrenheit cooler than the lake surface temperature of 61 degrees Fahrenheit. Fish were transported in coolers containing lake water that was iced and oxygenated. Radio tags were surgically implanted into ten fish. After surgery, fish were held in the live cage for 20-60 minutes and all appeared to have fully recovered at the time of release. All lake trout were released at Rainbow Beach. By the conclusion of the study it was determined that one fish died shortly following surgery and was therefore removed from analyses.

The nine remaining tagged lake trout averaged 26.5 inches and 6.6 pounds. The largest lake trout weighed 11.1 pounds. Of the tagged fish, five were male, three were female, and the sex of one individual could not be determined. Each fish was given a name for reference during tracking (Table 1).

Fish were tracked 8 times between October 8th and November 10th (3 day/late afternoon and 5 night tracking events) using an Advanced Telemetry Systems Model R2000 receiver. Wind direction/strength and water temperature were recorded for each tracking event. Tracking was conducted by roughly following a route along the shoreline that kept the boat over approximately 30-40 feet of water. Once a tag was heard, the route was abandoned and the tag was tracked until the location was found. That tag was then removed from the receiver's scan and the route was picked up once again. The shoreline route was tracked first, followed by deeper sections of the lake. Areas exceeding 150 feet of water were not thoroughly tracked due to difficulty in locating tags at deep depths (unless the boat passed almost directly over the top) and any fish not located were assumed to be in that area of the lake. Most of the fish were located after the initial shoreline route was completed for each tracking event. GPS coordinates, depth of water, and time were recorded once the location of a tag was determined.

SUMMARY OF FINDINGS

The locations of lake trout at Tunk Lake during eight tracking events indicated a clear pattern of movement to a few distinct areas during the spawning season. Lake trout spawning activity likely began in mid-October, coinciding with a drop in surface temperature. Early in the tracking period all lake trout were found in deep water at various locations throughout the lake. During the next few tracking events, lake trout were located in shallow water shoal areas at the southern end of the lake. At the end of the study period, when spawning had likely ceased, lake trout were again found in deeper water throughout the lake. Refer to Appendix A (Table 2, Table 3, Figure 3, Figure 4a-6, and Figure 5a-c) for details from each tracking event as well as movements of individual fish.

Congregations of fish in shallow water (less than ten feet deep) on and around "The Graveyard" shoal as well as immediately adjacent unnamed shoals during five of eight tracking events suggest this area to be the primary location of lake trout spawning at Tunk Lake (Figure 3). Based on these results a sample of lake trout can likely be obtained via trap netting at two to three locations suitable for net placement that were identified by this study. Trap nets will be set in the fall of 2016 to obtain a representative sample of the spawning lake trout population.

It appears that spawning activity was initiated between October 15th and October 18th when the surface water temperature dropped from 58 degrees Fahrenheit to 55 degrees Fahrenheit. Fish appeared to remain in shallow water and in the vicinity of "The Graveyard" and adjacent shoals until at least October 26th when water temperature was recorded at 52 degrees Fahrenheit (Figure 2). Based on work at Thompson Lake in southwestern Maine, DeRoche (1969) stated that "the onset of spawning appeared to be stimulated by heavy winds when water temperature neared 50°F". He also noted that the spawning period was extended in years where warm, calm weather continued into October, resulting in fish milling around the spawning habitat for many days with little actual spawning occurring. The fall of 2015 in Downeast Maine was very similar to this, with warmer than average temperatures extending into October. Additionally, the heaviest winds observed during any of the tracking events occurred during the 4th tracking event and were recorded as 10-12 mph out of the northwest (hardly considered "heavy"). Therefore, the tracking events may not have captured a night where a *major spawning event* took place. Although timing and duration of spawning may vary from year to year, these observations will help to narrow down the lake trout spawning window and will prove beneficial for future sampling at Tunk Lake.

Since each tracking event is merely a snapshot in time during the spawning period, it is difficult to draw firm conclusions about whether individual fish spawned or not in 2015. The sampling events did not account for other times during the same day/night or the days when tracking did not occur. Additionally, it is unknown if the surgical procedure influenced the drive or ability to participate in spawning activities. Although a few individuals were never found to be in shallow water, *the presence* of individuals on the spawning area is far more informative than their absence. Keeping these points in mind, observations about individual fish activity are mentioned in Appendix A below (Table 3).

The results of this study indicate that the majority of lake trout in Tunk Lake spawned in a distinct shoal area at the southern end of the lake during mid-October. Though further study over a longer time period may be necessary to validate these results, information from 2015 will prove useful in lake trout monitoring efforts moving forward. Further information will be gathered during the fall of 2016, when trap netting will be conducted in conjunction with additional radio tracking events.

AKNOWLEDGEMENTS

Thank you to the following Fishery Biologists for providing valuable insight during all phases of this project: Gregory Burr, Elizabeth Thorndike, Jeremiah Wood, Dwayne J. Seiders, and Stephen Seeback. All surgeries were performed skillfully by Jeremiah Wood. Additional thanks to Jeremiah Wood, Elizabeth Thorndike, and Gregory Burr for reviewing numerous drafts of this report and providing many helpful suggestions.

Lastly, thank you to Fishery Biologist, Supervisor, Mentor, and Friend, David P. Boucher for supporting this project and all the work we do. He strongly supported the writing of reports such as this as a means of sharing our work with colleagues and members of the public. Dave possessed the unique ability to inspire staff and, without effort, kindled a flame in many of us to endeavor to “be as good as Dave” someday. His untimely passing has left a void in the Fisheries Division, however his positive impacts on staff and the division will continue on, even in his absence.

Prepared by:
Joseph R. Overlock
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REFERENCES

Deroche, S.E. 1969. Observations on the Spawning Habits and Early Life of Lake Trout. The Progressive Fish-Culturist, 31:2, 109-113.

APPENDIX A

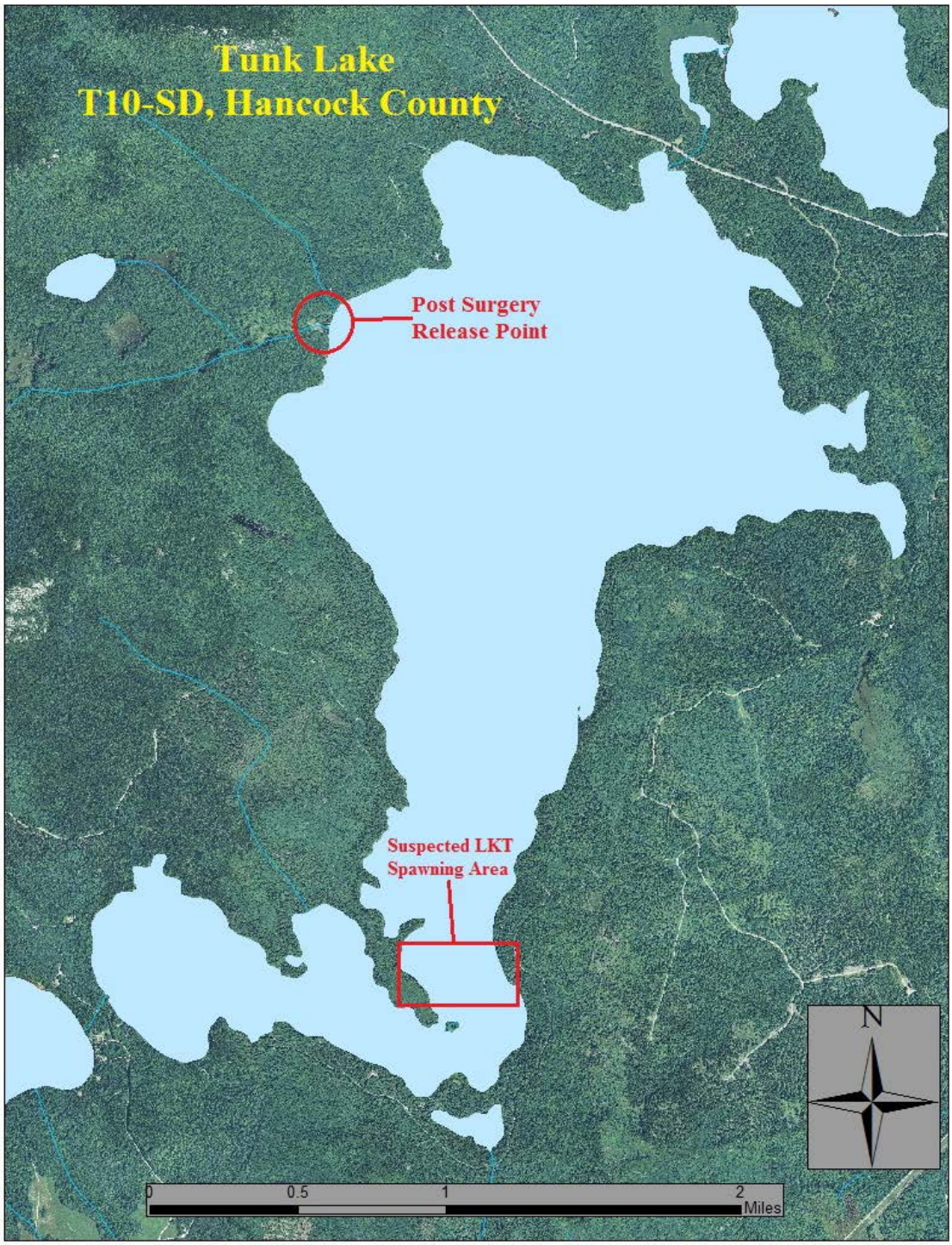

Figure 1: Tunk Lake area map

Tagged Lake Trout						
Tag Number	**Name**	**Lt. (in)**	**Wt. (lbs)**	**K-Factor**	**Sex**	**Maturity**
148.624	Lords	23.4	3.8	0.82	F	MAT
148.654	Johnson	30.1	8.4	0.86	M	MAT
148.683	Havey	29.9	8.6	0.89	M	MAT
148.712	Melissa	31.1	9.9	0.91	F	MAT
148.742	Stu	26.7	6.5	0.95	M	MAT
148.772	Flounder	29.5	11.1	1.20	?	?
148.803	The Boz	23.7	4.1	0.85	M	MAT
148.861	Buck	19.8	2.5	0.90	M	?
148.893	Joan	24.4	4.8	0.92	F	MAT

Table 1: Tagged lake trout information

Summary of Tracking Events								
Sampling #	**Date**	**Timing**	**# LKT Located (of 9*)**	**Depth Range (ft)**	**Water Temp (F)**	**Wind Direction/Speed**	**# LKT in <10' of water**	**# LKT in 10-20' of water**
1	10/8/2015	Day	7	60-102	60	WNW/5-10mph	0	0
2	10/11/2015	Night	8	54-117	59	S/8-10mph	0	0
3	10/15/2015	Night	8	3-84	58	SW/8-10mph	1	0
4	10/18/2015	Night	9	2-105	55	NW/10-12mph	3	0
5	10/20/2015	Night	8	2-100	55	SSW/8-12mph	2	0
6	10/22/2015	Night	9	2-79	54	SSW/5-10mph	5	1
7	10/26/2015	Day	8	4-64	52	NW/5-10mph	1	3
8	11/10/2015	Day	8	19-101	50	S/5-10mph	0	2

*Note: It was determined that one fish died shortly following surgery and was therefore removed from analyses.

Table 2: Summary of tracking events

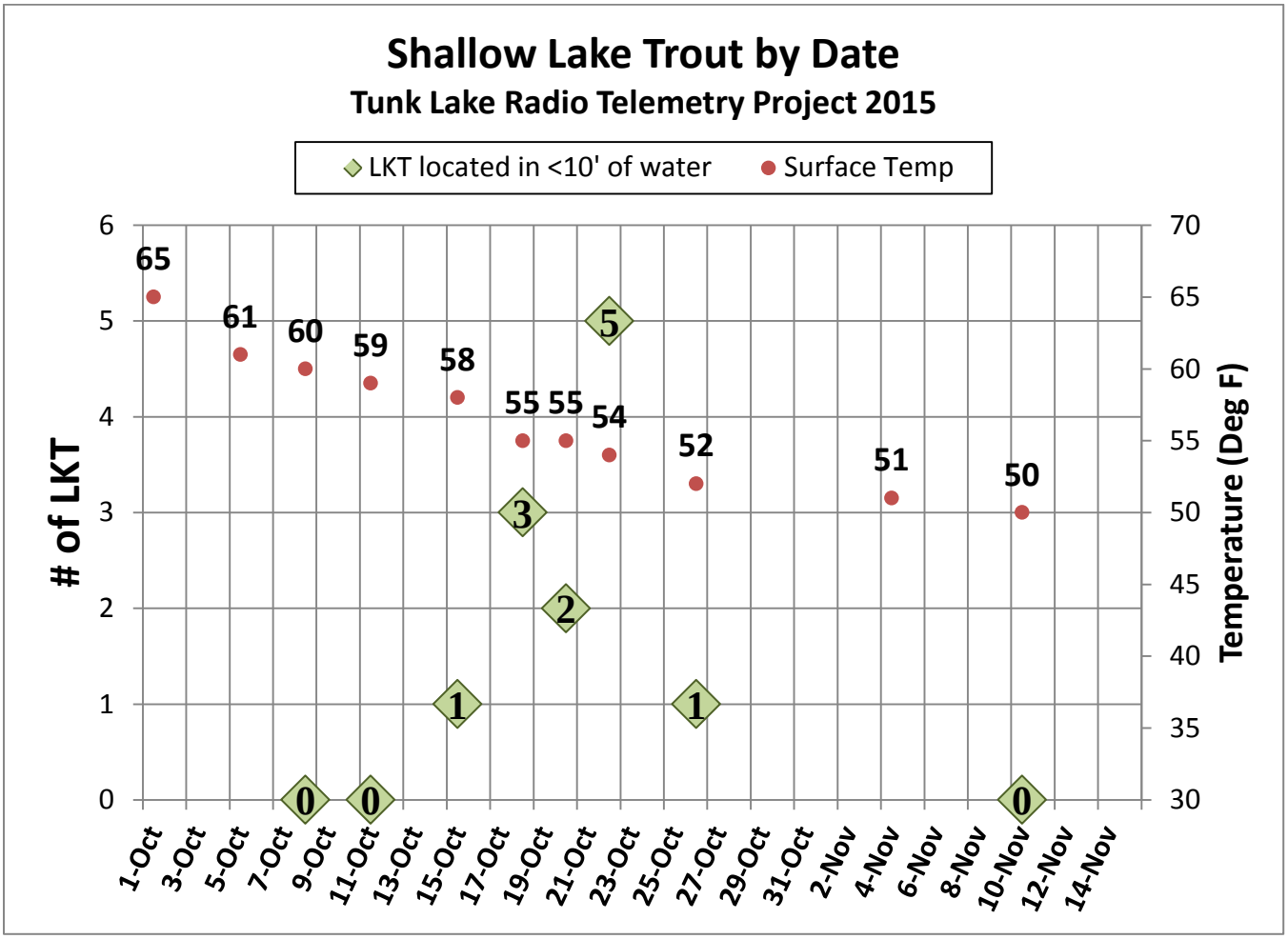

Figure 2: Shallow lake trout by date

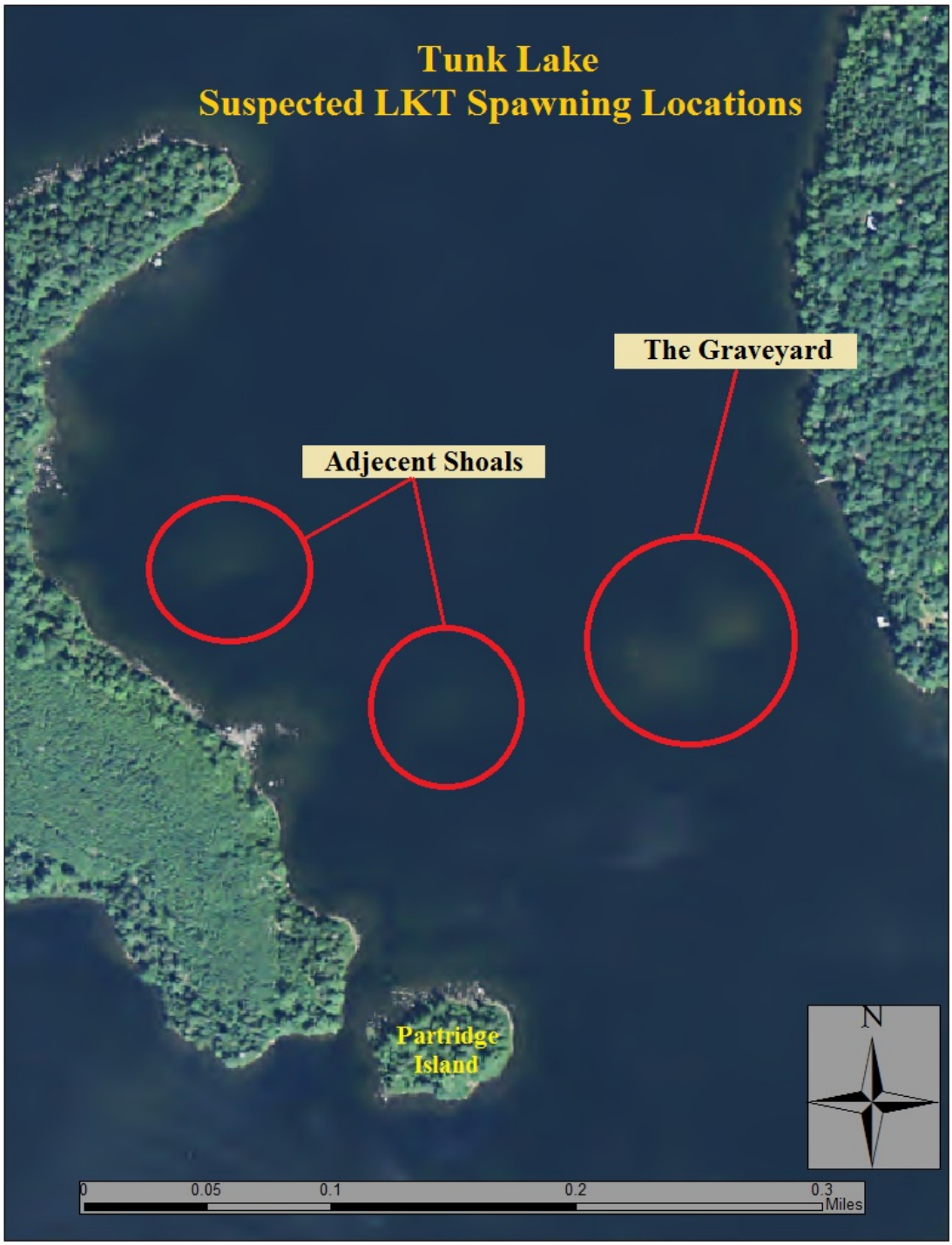

Figure 3: Suspected LKT spawning locations

Tag# 148.624: "Lords"	
	"Lords" was located during all 8 tracking events in locations ranging from 17-104 feet of water and was never found directly on "The Graveyard", but was in close proximity 3 times.
Tag# 148.654: "Johnson"	
	"Johnson" was located during all 8 tracking events in locations ranging from 2-80 feet of water and was found directly on "The Graveyard" once and on 2 adjacent shoals 3 times.
Tag# 148.683: "Havey"	
	"Havey" was located during 7 of 8 tracking events in locations ranging from 15-86 feet of water and was never found on "The Graveyard," but was found just off an adjacent shoal.
Tag# 148.712: "Melissa"	
	"Melissa" was located during 4 tracking events in locations ranging from 45-117 feet of water and was never found to be near "The Graveyard" or the shoals adjacent to it. It is not known if "Melissa" failed to spawn or if any time spent on the spawning grounds were simply missed by the tracking events conducted.
Tag# 148.742: "Stu"	
	"Stu" was located during all 8 tracking events in locations ranging from 64-101 feet of water and was never found to be near "The Graveyard" or the adjacent shoals. It is not known if "Stu" failed to spawn or if any time spent on the spawning grounds were simply missed by the tracking events conducted.
Tag# 148.772: "Flounder"	
	"Flounder" was located during all 8 tracking events in locations ranging from 2-90 feet of water and was found directly on "The Graveyard" twice and on an adjacent shoal once. The sex and maturity of this fish could not be determined at the time of tagging.
Tag# 148.803: "The Boz"	
	"The Boz" was located during all 8 tracking events in locations ranging from 3-102 feet of water and found directly on "The Graveyard" 4 times and on an adjacent shoal once. This was the first fish to appear in shallow water and was found in shallow water more times than any other fish.
Tag# 148.861: "Buck"	
	"Buck" was located during 6 of 8 tracking events in locations ranging from 3-95 feet of water and was found to be directly on "The Graveyard" once and in close proximity to it 1 other time. It was questionable if this fish would actually spawn this year as sexual maturity could not be determined at the time of tagging.
Tag# 148.893: "Joan"	
	"Joan" was located during all 8 tracking events in locations ranging from 2-84 feet of water and was found directly on "The Graveyard" once and in close proximity to it 1 other time.
Tag # 148.835:	
	It was determined that this fish number 148.835 died shortly after surgery and was therefore removed from analyses.

Table 3: Observations of individual fish activity

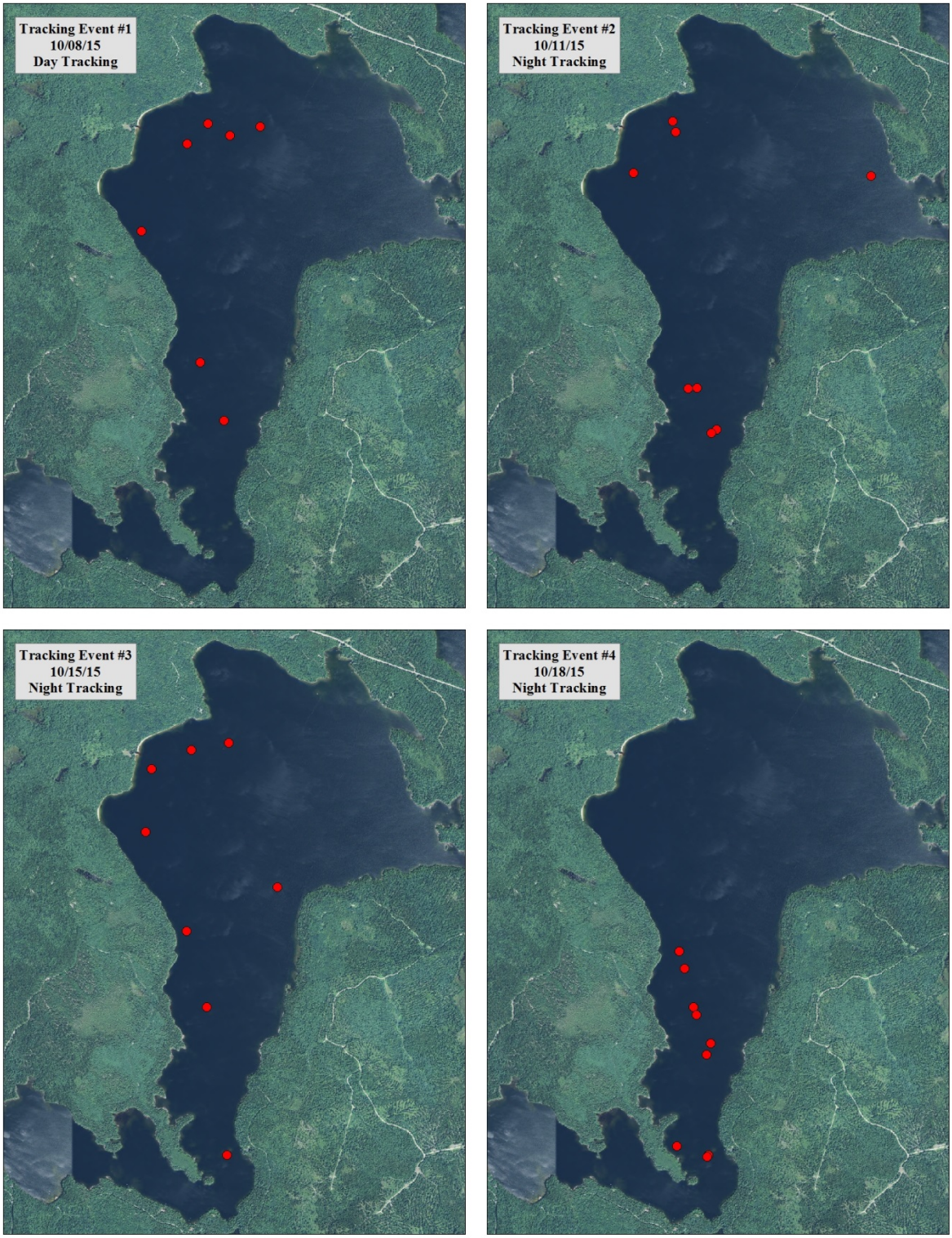

Figure 4a: Fish locations by date

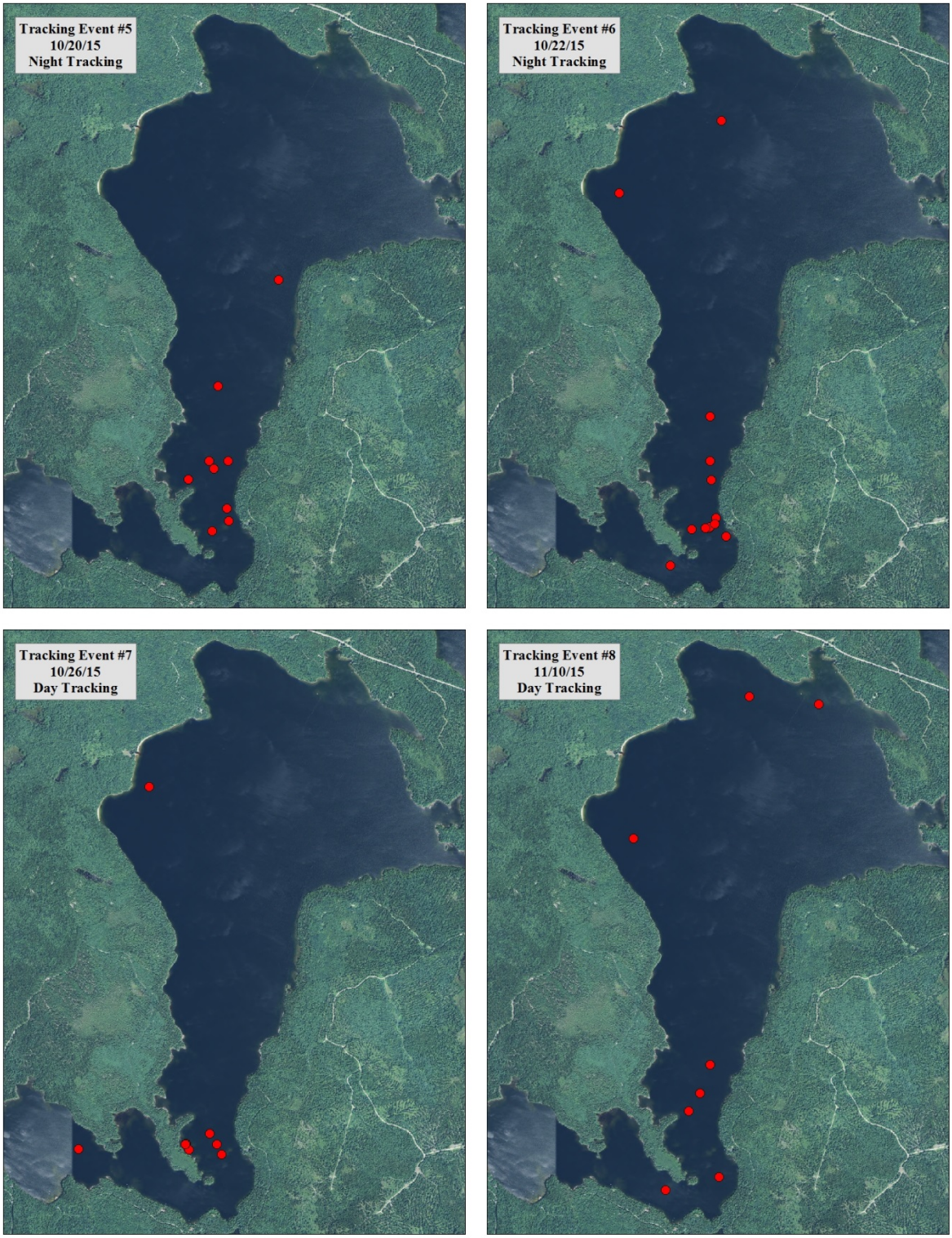

Figure 4b: Fish locations by date

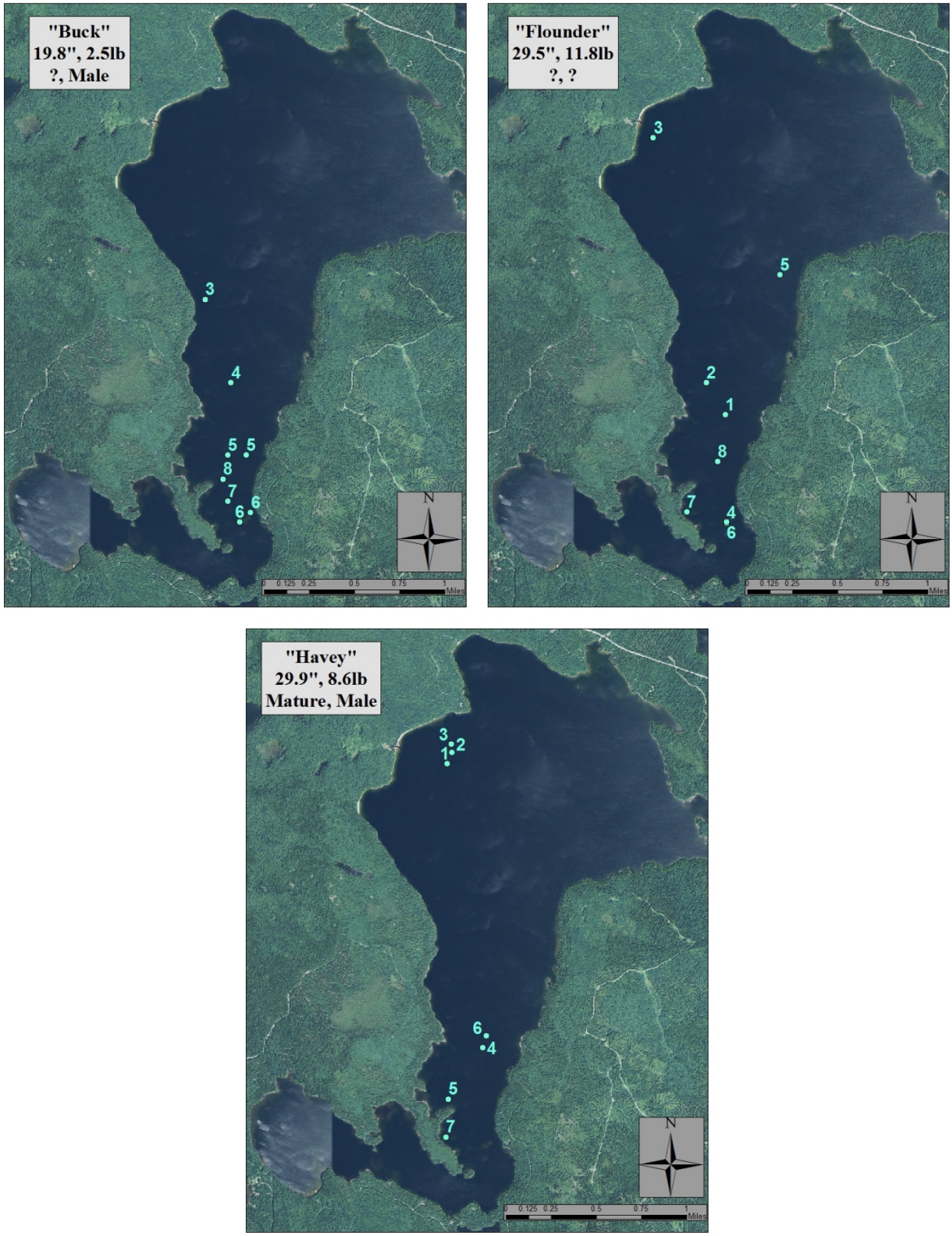

Figure 5a: Individual fish locations labeled by tracking event

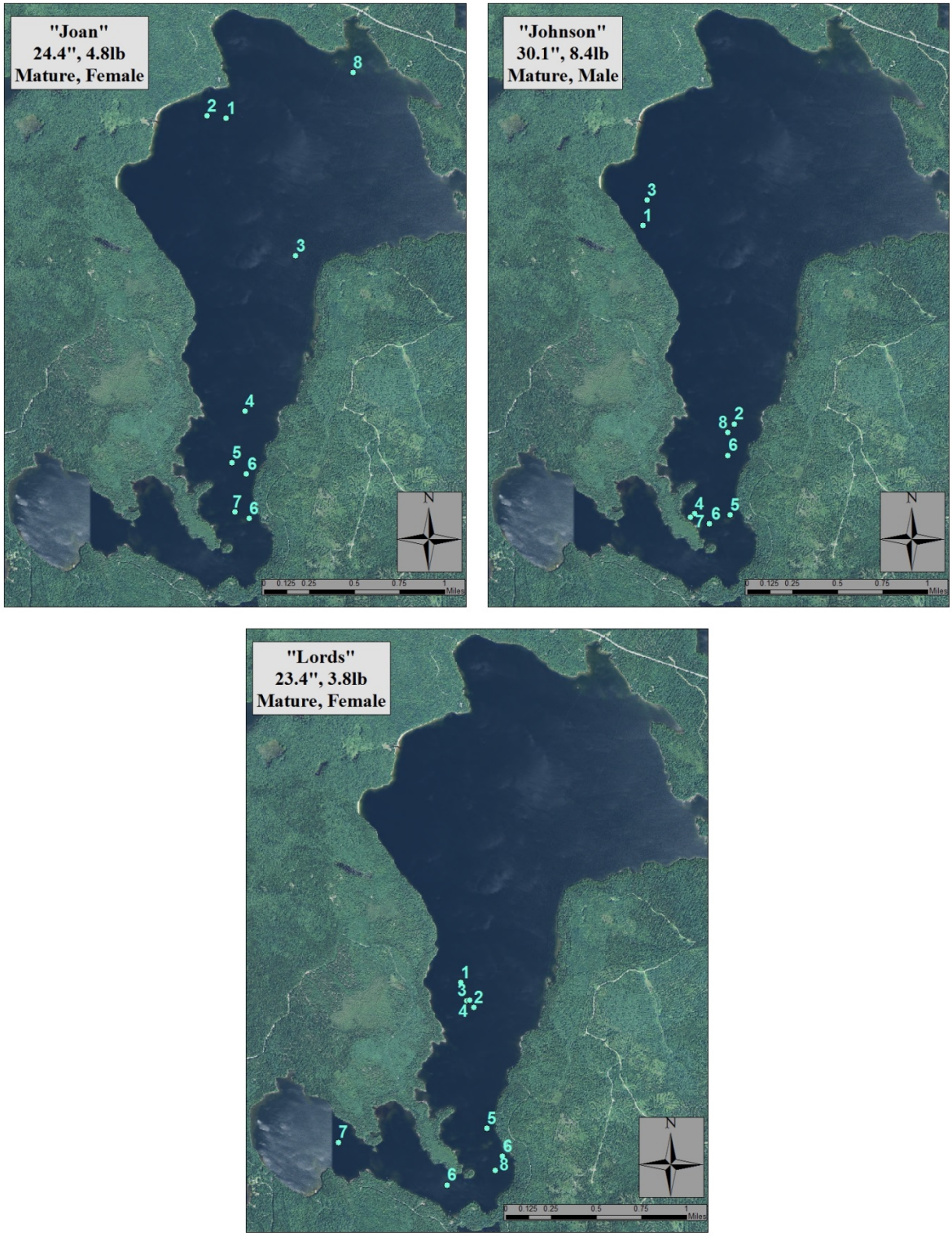

Figure 5b: Individual fish locations labeled by tracking event

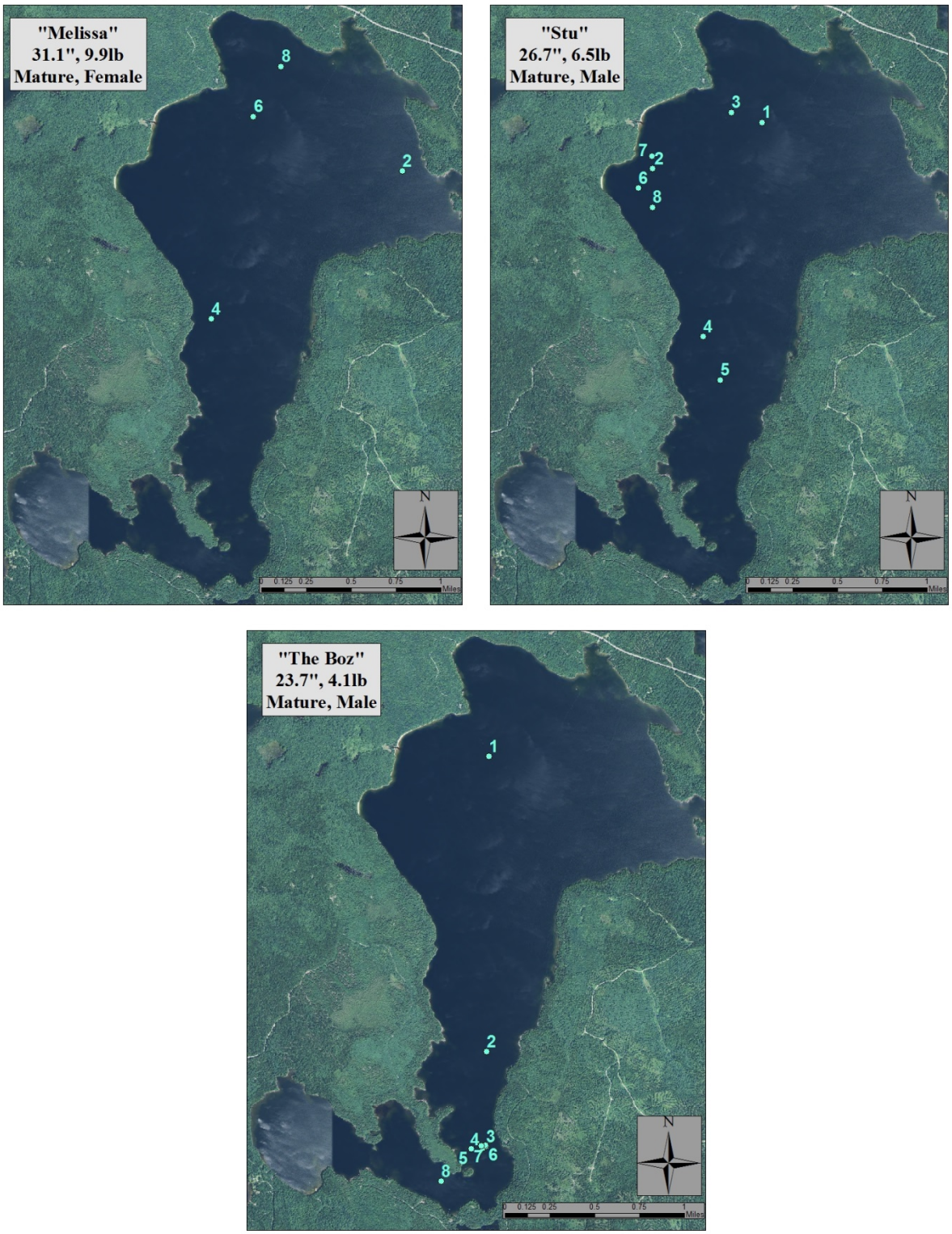

Figure 5c: Individual fish locations labeled by tracking event

COOPERATIVE

STATE FEDERAL

PROJECT

This report has been funded in part by the Federal Aid in Sport Fish Restoration Program. This is a cooperative effort involving federal and state government agencies. The program is designed to increase sport fishing and boating opportunities through the wise investment of angler's and boater's tax dollars in state sport fishery projects. This program which was founded in 1950 was named the Dingell-Johnson Act in recognition of the congressmen who spearheaded this effort. In 1984 this act was amended through the Wallop Breaux Amendment (also named for the congressional sponsors) and provided a threefold increase in Federal monies for sportfish restoration, aquatic education and motorboat access.

The program is an outstanding example of a "user pays-user benefits" or "user fee" program. In this case, anglers and boaters are the users. Briefly, anglers and boaters are responsible for payment of fishing tackle, excise taxes, motorboat fuel taxes, and import duties on tackle and boats. These monies are collected by the sport fishing industry, deposited in the Department of Treasury, and are allocated the year following collection to state fishery agencies for sport fisheries and boating access projects. Generally, each project must be evaluated and approved by the U.S. Fish and Wildlife Service (USFWS). The benefits provided by these projects to users complete the cycle between "user pays – user benefits."

Maine Department of Inland Fisheries and Wildlife
284 State Street, 41 SHS, Augusta, ME 04333-0041