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VIRGINIA SALTWATER RECREATIONAL FISHING DEVELOPMENT FUND
SUMMARY PROJECT APPLICATION*

NAME AND ADDRESS OF APPLICANT:	PROJECT LEADER (name, phone, e-mail):
Virginia Institute of Marine Science **P.O. Box 1346** **Gloucester Point, VA 23062**	**Dr. John E. Graves (graves@vims.edu)** **(804) 684-7352** **Andrij Z. Horodysky (andrij@vims.edu)** **Jon A. Lucy (lucy@vims.edu)**
PRIORITY AREA OF CONCERN:	**PROJECT LOCATION:**
Research – new project	**Virginia Institute of Marine Science**

DESCRIPTIVE TITLE OF PROJECT:

Use of pop-up satellite archival tags (PSATs) to determine the fate, movements, and habitat utilization of red drum released from Virginia's recreational fishery

PROJECT SUMMARY: Fifteen small pop-up satellite archival tags (PSATs) will be deployed to follow the fate, movements, and habitat utilization of adult red drum caught in the spring recreational fishery at the mouth of Chesapeake Bay. PSATs, with release times of 1 month, 3 months, and 6 months (five tags per treatment), will be deployed on red drum caught in May and June 2009. Data will be analyzed to determine survival, net horizontal movement, daily vertical movements, and seasonal habitat utilization of adult red drum.

EXPECTED BENEFITS: The fate or red drum released from the Virginia recreational fishery is not well understood. Conventional tag returns are quite low, a result that is consistent with high post-release mortality and/or high rates of tag shedding. Using a new generation of smaller PSATs with a range of release times, we will be able to gain a new perspective on the relative importance of post-release mortality and tag shedding for adult red drum. Furthermore, the net movements of fish after one, three, and six months will provide critical information on the connectivity of the Virginia recreational fishery with those along the U.S. Atlantic coast. Finally, the PSATs will provide important data on red drum habitat utilization; specifically, how they spend their time in the water column during six months of the year.

COSTS:

VMRC Funding:	$93,569
Recipient Funding:	$33,802
Total Costs:	$127,371

Modified to $ 90,369 on 11/10/08

New total costs: $ 124,171

Detailed budget must be included with proposal.

Updated 6/1/05

***This form alone does not constitute a complete application, see application instructions or contact Sonya Davis at 757-247-8155 or sonya.davis@mrc.virginia.gov : Due dates are June 15 (Jul. – Nov. Cycle) and December 15 (Jan. – May Cycle)**

Progress of this study will be available to those interested over the VIMS website (Fisheries/Tagging). Results will be communicated to local fishing clubs and submitted for publication in an international peer-reviewed fisheries journal.

V. Location

Red drum will be tagged at the mouth of Chesapeake Bay during the spring of 2009. Data transmitted from the satellite tags will be sent electronically to the Virginia Institute of Marine Science where all analyses will take place.

VI. Estimated cost

This proposal covers the cost of this one year pilot project. We expect the cost of this study to be $127,371, of which we are requesting $93,569 from RFAB/VMRC.

Proposed Budget:

	RFAB	**VIMS**	**TOTAL**
Personnel			
Graves, 1.0 mo/1.0 mo match	10,950	10,950	21,900
Lucy, 0.5 mo match		3,318	3,318
Horodysky, 3.0 mo (post-grad)	9,000		9,000
Fringe, 30% salaries	5,985	4,280	10,265
Supplies	3,000		3,000
Travel	500		500
Equipment			
12 satellite tags @ $4,000 ea	48,000		48,000
3 satellite tags refurbished @ $800 ea	2,400		2,400
Argos (satellite data transmission) @ $300/tag	4,500		4,500
Rewards (return of tags)	600		600
Total	84,935	18,548	103,483
Facilities and Administrative Costs	8,634	15,254	23,888
TOTAL	**93,569**	**33,802**	**127,371**

Requested funds would cover:

(1) One month of salary for the principal investigator with VIMS providing one month of the principal investigator's salary. Note that co-principal investigator Lucy requires not support from RFAB/VMRC on this project.

(2) The partial (25%) salary of a VIMS marine scientist (Horodysky) to assist with tag deployment and data analyses.

(3) A supply budget of $3,000 to cover the cost of fuel for participating recreational vessels that will serve as platforms for tag deployment , as well as miscellaneous field supplies including supplies to rig and deploy tags.

(4) A travel budget of $500 to cover transportation to marinas for field operations and to Virginia fishing club meetings for outreach presentations.

(5) The purchase of 12 new PSATs ($4,000 each).

(6) The cost to refurbish the three tags recovered from our RFAB/VMRC funded study of striped bass ($800 each).

(7) The charges for transmission of the tag data through the Argos satellite system (approximately $300 per tag, assuming a 30 day transmission period for each tag).

(8) Funding is requested to encourage the return of tags that was ashore. The tags are printed with "return for reward" and in our previous study we provided those returning tags with a shirt and a check for $100. Note that 100% of the data can be obtained from a returned tag and the tag can be rebuilt for $800, as opposed to $4,000 for a new tag. The amount of reward funding ($600) was calculated based on the percentage of tags beached/returned in our current striped bass study (40%) multiplied by the number of tags (15) and a reward per returned tag of $100.

(9) VIMS Facilities & Administrative Costs at the VMRC reduced rate of 25% (the standard institutional rate is 45%). VIMS will provide the difference of the reduced rate versus the institutional rate as match funds.

Proposal Submission to

Recreational Fishing Advisory Board
Virginia Marine Resources Commission

by

The Virginia Institute of Marine Science
College of William and Mary

Use of pop-up satellite archival tags (PSATs) to determine the fate, movements, and habitat utilization of red drum released from Virginia's recreational fishery

Proposed starting date: 1 January 2009
Proposed duration: 12 months

Dr. John E. Graves
Principal Investigator
Department of Fisheries Science

Mr. Andrij Z. Horodysky
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Mr. Jon A. Lucy
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Dr. Roger L. Mann
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Ms. Jane A. Lopez
Director, Sponsored Programs

I. Need

The Virginia portion of Chesapeake Bay supports a large recreational fishery for red drum (*Scianops ocellatus*) that has an important economic impact for the state (Kirkley and Kerstetter 1998). Many of the red drum captured by recreational gear are released because they either fall short of the regulatory slot limit minimum size (18") or exceed the slot maximum size (26"). Estimated annual catches (including releases) within Virginia waters ranged from 33,592 to 851,034 individuals between 2000 and 2007 (NMFS Marine Fisheries Statistics).

Despite the importance of red drum to marine recreational anglers in Virginia and other states along the U.S. Atlantic and Gulf of Mexico coasts, surprisingly little is known regarding the fate, movements, and habitat utilization of this species. Much of what we know about the fate and movements of red drum has come from studies employing conventional tags In Virginia, from 1995 through 2007, the number of adult red drum tagged has ranged from 37 to 1,091, with the largest numbers of tagged fish occurring over the past six years (Table 1). Surprisingly, tag returns have been very low, with a maximum of 3.3% for fish tagged in 2003.

Analysis of tag recapture data indicates the majority of recaptures of adult red drum tagged in Virginia waters occurs in Virginia waters, even after substantial times at liberty. Of the 37 recaptures noted since 1996, 31 (82%) have come from Virginia waters (Table 2). The remaining six tag recoveries occurred in North Carolina, four during the summer and two during the winter. The connectivity of the Virginia and North Carolina fishery is also supported by Virginia recaptures of adult red drum tagged in North Carolina. Of 4,544 adult red drum tagged in North Carolina waters and subsequently recaptured, 13 were reported from Chesapeake Bay (Burdick et al. 2007). Release and recapture information for adult fish tagged in North Carolina and recaptured in Virginia are note in Table 3.

Burdick et al. (2007) noted a decrease in the reporting rate of tagged red drum with increasing body size; juveniles had a tag reporting rate of 18%, subadults had a 13% return rate, and adults had a reporting rate of only 2% The reporting rate of 2% for adult red drum tagged in North Carolina is similar to the values reported for adults tagged in Virginia (ranging from 0 – 3.3% between 1995 and 2007; Table 1). The low rate of return for adults could reflect a high post-release mortality, or a high rate of tag shedding. Tag shedding may be influenced by the type of tag anchor. For example, increasing use of stainless steel dart anchors (as opposed to plastic or T-bar anchors) over the past few years in the Virginia Tagging Program is correlated with increasing tag recapture rates (J. Lucy, Virginia Institute of Marine Science, personal communication).

There is a clear need to differentiate between tag shedding and post-release mortality of red drum released from the recreational fishery. Pop-up satellite archival tags present an excellent means to do so. Developments in satellite archival tags have greatly improved scientific understanding of the behavior, movements and post-release survival of marine vertebrates – animals from which it is not practical to physically recover tags to obtain data (Arnold and Dewar, 2001; Graves et. al. 2002; Holland, 2003). PSATs take physical and positional measurements while attached to study animals, independently detach at predetermined times, float to the surface, and transmit data to orbiting satellites of the Argos system (Graves et al., 2002). Data are then transmitted from satellites to a ground station and to the individual researcher. Using high resolution PSATs, it is easy to determine the fate of tagged animals and the data reveal exciting insights into short term depth and temperature utilization as well as horizontal movements. Until recently, most PSAT deployments have been on large pelagic marine vertebrates such as billfishes, tunas, sharks, and sea turtles, owing to the size and mass of the tags (~ 65g). However, recent miniaturization of tag subcomponents has led to the development of a new generation of PSATs that are 33% smaller, extending the potential use of these tags to smaller species.

This year, with funding from the RFAB/VMRC, we applied ten of the smaller PSATs (Microwave Telemetry X-Tags), to large striped bass caught on live eels in the winter recreational fishery near the mouth of Chesapeake Bay. While the new X-Tags have been used successfully to

study the movements and habitat utilization of large pelagic species, they have not been applied to large coastal species. These species present special challenges for PSAT studies. First, many large coastal species associate with structure, providing an opportunity to entangle the tags, possibly resulting in premature release. Secondly, many large coastal species school, providing an opportunity for a conspecific to attack the tag as it would a lure, possibly causing premature release or damaging the antenna and thereby preventing data transmission once the tag is released. Finally, coastal species often occur close to land. If a tag were to pop off close to shore it could wash up early in the 30 day data transmission period, thereby reducing the quantity and quality of subsequent data transmissions.

The results of our pilot study of striped bass demonstrate that the smaller PSATs are very well-suited for studying the fate and habitat utilization of large coastal species. Nine of the ten tags that we deployed transmitted data after releasing from the striped bass after 30 days. There were no premature releases, indicating that fouling with substructure or attacks on the tags by conspecifics were not a major problem. After releasing from striped bass, the tags had sufficient battery power to transmit the archived data for approximately 30 days. One of the nine reporting tags had very limited and poor data transmission, possibly indicative of a damaged antenna. Data recoveries from the other eight reporting tags were very good (typically 80 – 90% of the archived data for tags that remained at sea for the 30 day transmission period). Three of these tags washed ashore during the 30 day transmission period, and as expected, data transmission rates were reduced for two of these tags. However, because the position of these tags was known when they washed ashore, two have been recovered and the location of the third tag is known within +/- 100 meters and it is expected to be recovered in the near future. In addition, one reporting tag washed ashore after the 30 day transmission period and was recovered by a beachcomber. When tags are recovered, it is possible to download 100% of the archived data, and recovered tags can be rebuilt for $800, a substantial savings off the $4,000 cost of a new tag). It is also possible that the other tags will yet wash ashore and be recovered by beachcombers.

The data from both transmitting and recovered PSATs gives us a unique perspective on the fate, movements, and habitat utilization of eight striped bass. All eight fish lived, including two that were hooked deeply with J hooks. Net movements (from point of release to the first transmission location of the popped up tag) were under 100 miles for all fish, and three of the fish tagged outside of Chesapeake Bay entered the Bay, presumably on their annual spawning migration. Fish occupied the water column from the surface down to depths of 25 m, and there was no apparent day/night difference in habitat utilization (Figure 1). During the time the fish were tagged the water column was well mixed, and the tagged fish occupied a fairly limited thermal range, although some movement into warmer surface waters was noted at times (Figure 1).

The success of the new, smaller PSATs with striped bass suggests that they will be well suited to follow the fate of adult red drum released from the Virginia recreational fishery. In addition, the tags can provide valuable information on movements and habitat utilization of this important recreational species.

II. Objectives

The objective of this study is to utilize the new generation of small pop-up satellite archival tags to follow the fate, movements, and habitat utilization of adult red drum released from the Virginia recreational fishery. A total of fifteen tags will be released: five programmed to release (pop up) after 30 days, five programmed to release after 60 days, and five programmed to release after 180 days.

III. Expected Results or Benefits

This study will directly address the question of "what is the fate and behavior of adult red drum after release from the recreational fishery?" The very low recovery rates of conventional tags

from adult red drum tagged in Virginia and North Carolina waters suggests either high post-release mortality or high rates of tag shedding. By following the fate of fifteen fish for 30 – 180 days we will be able to estimate post-release survival. Furthermore, the PSAT data will allow us to assess movements of red drum within the same season (30 and 90 day tags) and between seasons (180 day tags), and get a better understanding of the connectivity of the Virginia fishery with those in neighboring states. Finally, the temperature and depth data will provide a critical insight into how red drum utilize the water column over daily and seasonal time scales.

IV. Approach

The Microwave Telemetry, Inc. (Columbia, MD) PTT-100 HR X-Tag will be used in our study. This tag is slightly buoyant, and weighs 40 grams in air. The body of the tag contains a lithium composite battery, a microprocessor, a pressure sensor, a temperature gauge, and a transmitter, all housed within a black resin-filled carbon fiber tube. Flotation is provided by a spherical resin bulb embedded with buoyant glass beads. This tag model is programmed to record and archive a continuous series of temperature, light, and pressure (depth) measurements, and can withstand pressure equivalent to a depth of 3000 m. Tags will be programmed to disengage after 30 days (5 tags), 90 days (5 tags) and 180 days (5 tags) and will record measurements approximately every two minutes.

PSATs will be attached to red drum by an assembly composed of 16 cm of 400-pound test Momoi® brand (Momoi Fishing Co., Ako City, Japan) monofilament fishing line attached to a large hydroscopic, surgical grade nylon intramuscular tag anchor according to the method of Graves et al. (2002). Anchors will implanted with 5-cm stainless steel applicators attached to 0.3-m, 1-m, or 2-m tagging poles (the length of the tagging pole varied depending on the distance from a boat's gunwhales to the water) and will inserted approximately 5 cm deep into an area about 6 cm posterior to the origin of the dorsal fin and 5 cm ventral to the base of the dorsal fin (see Figure 2 for attachment on a striped bass). In this region, the nylon anchor has an opportunity to pass through and potentially interlock with pterygiophores supporting the dorsal fin well above the coelomic cavity containing visceral organs (Graves et al., 2002). A conventional tag with a stainless steel anchor will also implanted posterior to the PSAT on the opposite side of the fish.

Tagging operations will be conducted in May and June 2009 in the area around the Chesapeake Bay Bridge where a significant recreational fishery for large red drum has been prosecuted for many years. We have secured the cooperation of skilled captains and anglers familiar with this fishery to assist with our operations. Red drum will be caught on 30 lb class sportfishing tackle with three to four foot leaders of 80lb test line, and fought in a manner consistent with typical recreational fishing practice. Consistent with the fishery, size 8/0 and 9/0 circle hooks and J hooks will be used. It is realized that previous studies have demonstrated a decreased incidence of deep hooking in red drum caught on circle hooks as opposed to standard J hooks (Aguilar 2003, Beckwith and Rand 2005, Vecchio and Wenner 2007), but as both types of hook are commonly used in the fishery, we plan to use approximately equal numbers of both. We are aware that the limited sample size of this study (15 tags) will not be sufficient to investigate differences in post-release survival relative to hook type. Bait will primarily consist of blue crab although live croakers may also be used.

If tags are deployed in a short widow in late May/early June and remain attached for the full programmed duration, we would expect five tags to start transmitting at the end of June (30 days), five at the end of August (90 days), and five at the end of November (180 days). Data transmitted by the tags via the Argos satellites will be used to determine net displacement, survival, and habitat utilization. Net displacement will be measured from the GPS coordinates of the release location to the first precise (Argos location code 1, 2, or 3) location of the popped off (transmitting) tag. Survival will be determined following Horodysky and Graves (2005), with an emphasis on daily vertical excursions in the water column. Individual depth and temperature records will be analyzed following the methods detailed in Horodysky et al. (2007) for daily and seasonal patterns, and when sufficient vertical movements are made in a 24 hour period, habitat preferences will be determined.

References

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Table 1. Adult red drum (30-53 in TL): Tagging effort, recaptures and recapture rates by year (1995-2007). Data courtesy of J. Lucy, Virginia Institute of Marine Science.

Tag Year*	No. Drum Tagged	Recaptures (with year fish tagged)					Total by 2007	Recap Rate
		Tag Year	Tag Year +1	Tag Year +2	Tag Year +3	Tag Year +4		
1995	37	0 (95)	0 (96)	0 (97)	0 (98)	0 (99)	0	0%
1996	54	1 (96)	0 (97)	0 (98)	0 (99)	0 (00)	1	1.9%
1997	93	0 (97)	0 (98)	0 (99)	1 (00)	0 (01)	1	1.1%
1998	79	0 (98)	0 (99)	1 (00)	0 (01)	0 (02)	1	1.3%
1999	99	1 (99)	0 (00)	0 (01)	0 (02)	0 (03)	1	1.0%
2000	49	0 (00)	0 (01)	0 (02)	0 (03)	0 (04)	0	0%
2001	131	1 (01)	0 (02)	0 (03)	0 (04)	0 (05)	1	0.8%
2002	276	5 (02)	1 (03)	1 (04)	0 (05)	0 (06)	7	2.5%
2003	210	2 (03)	4 (04)	1 (05)	0 (06)	0 (07)	7	3.3%
2004	259	0 (04)	2 (05)	0 (06)	0 (07)	--	2	0.8%
2005	269	3 (05)	1 (06)	4 (07)	--	--	8	3.0%
2006	305	1 (06)	2 (07)	--	--	--	3	1.0%
2007	1091	1 (07)	--	--	--	--	1	0.1%

Table 2. Summary data for recovered adult red drum tagged in Virginia waters, 1996 – 2007. Data courtesy of J. Lucy, Virginia Institute of Marine Science.

Tagger	Tag No.	Fish Lth (in.)	Tag Date	Tag Location	Rcap Date	Recapture Location	Days Out	Remarks
C. Paige	11345	44	6/13/96	Inner Middle Ground Shoal	6/16/96	Inner Middle Ground Shoal	3	Killed – C. Lloyd, 42 in TL
J. Miller	37203	32.5	9/26/97	Cape Point, NC	9/28/00	Sandbridge Little Island Pier	1098	Rel w/o tag – A. Villalpundo, 37.5 in TL
L. Savage	11256	47	6/5/98	Cobb Island, Surf	5/23/00	Cobb Island Surf	718	Rel w/o tag – B. Herlihy, 47 in. TL
S. Wray	35534	44.5	5/26/99	Inner Middle Ground Shoal	6/1/99	Inner Middle Ground Shoal	6	**Rel W/TAG – A. Thompson, 46.5 in TL**
M. Firestone	57092	27	8/15/99	Rudee Inlet	8/22/99	Rudee Inlet	7	**Rel W/TAG – M. Firestone, 27 in TL**
M. Firestone	57092	27	8/15/99	Rudee Inlet	9/10/99	Rudee Inlet	26	Killed – J. Lawson, Double Recapture, 33.5 in TL ?
W. Seymour	69412	28	5/16/00	Rudee Inlet	5/17/00	Rudee Inlet	1	Killed – K. Eliason, 28.5 in TL
D. Cline	31198	35.5	6/20/01	Myrtle Island Surf	7/13/01	Wreck Island Surf	23	Rel w/o tag – H. Parker, gut hook when tagged, 35 in TL
R. Holtz	31398	28	8/29/01	Lynnhaven River	9/22/01	Lynnhaven Inlet	34	Killed – S. Lauter, 27 in TL
D. Cline	31232	33	5/5/02	Wreck Island Surf	8/10/02	Wreck Island Surf	97	Killed – S. Froehlich, 33 in TL

Tagger	Tag No.	Fish Lth (in.)	Tag Date	Tag Location	Rcap Date	Recapture Location	Days Out	Remarks
D. Cline	38844	34.5	5/5/02	Wreck Island Surf	6/7/04	Inner Middle Ground Shoal	764	Rel w/o tag – D. Poe, 40 in TL, Lg Plast DL Tag
D. Cline	31238	34	5/6/02	Wreck Island Surf	6/1/02	ES Barrier Island Surf	26	**Rel W/NEW TAG – D. Cline, 34 in TL, 36 in TL, SSDT**
R. Guyot	87235	42	6/16/02	Middle Ground	6/12/03	Inner Middle Ground Shoal	361	**Rel W/TAG – C. Brown, 42 in TL, SSDT**
D. Cline	87969	36	8/31/02	Wreck Island Surf	9/18/02	Wreck Island Surf	18	**Rel W/TAG – D. Cline**
D. Cline	103002	49	9/14/02	Wreck Island Surf	9/14/02	Wreck Island Surf	0	**Rel W/NEW TAG – D. Cline, 49 in TL, SSDT**
D. Cline	103012	48	9/17/02	Wreck Island Surf	9/30/02	Wreck Island Surf	13	**Rel W/TAG – D. Cline, 48 in TL, SSDT (SSDT)**
D. Cline	103081	48	10/7/03	Smith Island Surf	10/20/03	Smith Island Surf	13	**Rel W/TAG – D. Cline, 48 in TL, SSDT**
D. Cline	103038	44	5/26/03	Ship Shoal Surf	6/17/03	Inner Middle Ground Shoal	22	Rel w/o tag – J. Collier, 49 in TL, SSDT
D. Cline	38844	34.5	5/5/02	Wreck Island Surf	6/7/04	Inner Middle Ground Shoal	764	Rel w/o tag – D. Poe, 40 in TL, Lg Plast DL Tag
D. Cline	103050	41	5/31/03	Ship Shoal Island Surf	6/15/04	Inner Middle Ground Shoal	381	Rel w/o tag – J. Sparrow, 48 in TL, SSDT
R. Guyot	103636	43	6/12/03	Inner Middle Ground Shoal	6/18/04	Inner Middle Ground Shoal	372	**Rel W/TAG – K. Ringer, 45 in TL, SSDT**

Tagger	Tag No.	Fish Lth (in.)	Tag Date	Tag Location	Rcap Date	Recapture Location	Days Out	Remarks
J. Johnson	103733	45	6/16/03	Ship Shoal Channel Surf	6/7/04	Wreck Island Surf	357	**Rel W/TAG – J. Johnson, 45 in TL, SSDT**
D. Cline	103088	43	10/16/03	Cobb Island Surf	10/6/04	Hog Island Surf	356	Rel w/o tag – M. Gillett, 43.5 in TL, SSDT
D. Cline	103041	45	5/26/03	Off Ship Shoal Island Sandbar	6/13/05	Off Frisco, NC 2.5 mi	749	Rel w/o tag – S. Jones, Charter-Chaser, not meas. SSDT
D. Cline	103560	48.5	5/13/04	Smith Island Surf, N. End	6/14/05	Cobb Island Surf, S. End	397	**Rel W/TAG – B. Vaughan, 48.5 in TL, SSDT**
D. Cline	103816	32	10/8/04	Smith Island Surf N. End	6/30/05	Wreck Island Surf	265	Rel w/o tag – A. Smith, 36.5 in TL, SSDT
D. Miller	104638	48	6/8/05	Inner Middle Ground 9 ft. Shoal	10/13/05	Sandbridge, Little Island Pier	127	Rel w/o tag – R. Hall, 51 in TL, SSDT
D. Casady	104917	48	10/12/05	Sandbridge, Little Island Pier	11/6/05	Avon Pier, Avon, NC	25	**Rel W/TAG – L. Scarborough, not meas. SSDT**
J. Johnson	140939	38	5/11/06	Ship Shoal Island Surf	6/22/06	Cobb Island Surf	42	Rel w/o tag – G. Kohler, 40 in TL, TB Tag
D. Harris	103705	36	7/16/05	Inner Middle Ground Shoal	6/8/06	Smith Island Inlet	327	**Rel W/TAG – W. Gooch, 37 in TL, SSDT**
J. Young	130946	44	8/7/05	Inner Middle Ground Shoal	8/22/07	Smith Island Inlet	745	Killed – J. Seaman, 53 in TL, TB Tag
D. Poe	104570	45.5	9/24/05	Sandbridge, Little Island Pier	11/30/07	Rodanthe, NC Surf	797	Tag on Beach – G. Fritter, SSDT

Tagger	Tag No.	Fish Lth (in.)	Tag Date	Tag Location	Rcap Date	Recapture Location	Days Out	Remarks
D. Casady	104721	43	9/26/05	Sandbridge, Little Island Pier	8/12/07	Pamlico River, NC	685	Rel w/o tag – A Parker, 50 in TL, SSDT
D. Casady	104926	47.5	10/16/05	Sandbridge, Little Island Pier	6/19/07	Neuse River, NC	611	Rel w/o tag – D. Mason, 39 in TL, SSDT
M. Rinck	104410	41	7/14/06	Inner Middle Ground Shoal	7/12/07	Rodanthe, NC Surf	363	Tag on Beach, no fish - K. Price, SSDT
W. Seymour	160753	50	10/1/06	Off Sandbridge Oceanfront	5/26/07	Off Smith Island	237	**Rel W/NEW TAG – B. Griffith, 52 in TL, TB Tag Removed SSDT**
J. Johnson	179201	32	9/1/07	Ship Shoal Island Surf	10/3/07	Ship Shoal Island Surf	32	**Rel W/TAG – B. Vaughan, 31.25 in TL, TB Tag**

Table 3. Information for adult red drum tagged in North Carolina waters and recovered in Virginia. Data courtesy of J. Lucy, Virginia Institute of Marine Science.

Tag No.	Fish Lth (in.)	NC Tag Date	NC Tag Location	VA Rcp Date	Rcp Lth (in.)	VA Recapture Location	Days Out	Dist. Move (mi.)
D00365	47.0	11/1/86	Croatan/Roanoke Sound	9/16/87	48	North of Cape Charles, ES	319	120
D01850	42.5	5/19/88	Ocracoke Inlet	5/26/91	43	Chesapeake Bay Bridge Tunnel	1102	162
D01489	42.0	11/6/88	Avon Fishing Pier	10/6/90	41	Assateague Island, ES	699	188
D08556	51.0	11/8/90	Ramp 30 Hatteras Island	8/23/91	54	Chesapeake Bay Bridge Tunnel	288	106
D08445	51.5	11/7/91	Avon Fishing Pier	9/17/93	53	Hunting Creek, Parksley, ES Bay	680	170
D09009	47.5	4/8/95	Ocracoke Island, N. End Surf	7/15/95	ND	Chesapeake Bay Bridge tunnel	98	145
D31039	44	8/19/01	Neuse River Mouth	10/14/02	44	Sandbridge Fishing Pier	421	130
D52184	46	10/27/03	Avon Fishing Pier	10/4/05	46	Sandbridge Fishing Pier	708	100
D53654	30.3	10/7/04	Ocracoke Inlet	8/19/05	33	Myrtle Island, S. ES	316	190
D54599	41	11/10/05	Avon Fishing Pier	5/23/06	41	Fisherman's Island S. ES	194	125
D55598	44	11/10/05	Avon Fishing Pier	9/19/06	44	Ocean, 1 mi. N VA/MD line	313	185
D38542	46	5/4/06	Cape Point (Hatteras)	8/2/06	46	Chesapeake Bay Bridge Tunnel, 4th Island	90	132

Tag No.	Fish Lth (in.)	NC Tag Date	NC Tag Location	VA Rcp Date	Rcp Lth (in.)	VA Recapture Location	Days Out	Dist. Move (mi.)
D53270	42.5	8/24/06	Neuse River Mouth	5/17/07	44	Fisherman's Island S. ES	267	154
D52216	43	11/4/04	Avon Fishing Pier	6/23/07	ND	Tag found on Ft. Story Beach, Cape Henry	961	113

Figure 1. Temperature and depth records for a 37 inch striped bass caught, tagged with a Microwave Telemetry X-tag, and released 26 January 2008. The fish was deeply hooked with a J hook and clearly survived. Note the movement of the fish to the warmer surface waters at daybreak on 7 February 2008.

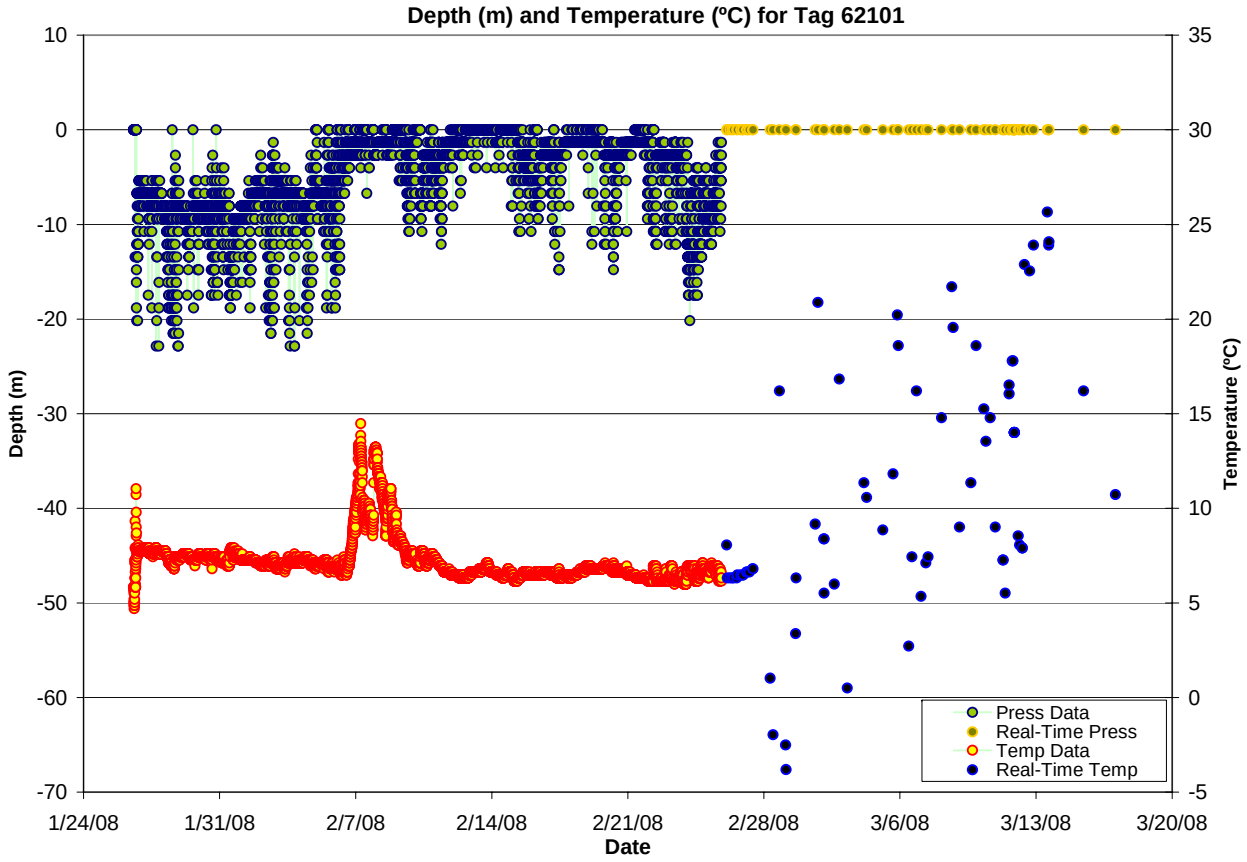

Figure 2. Striped bass with a Microwave Telemetry X-Tag implanted below the base of the dorsal fin. Photo courtesy of Dr. Ken Neill.