2006 Monitoring of Pesticide Drift from Applications to Control Browntail Moth (Full Report)

The following is a summary of a pesticide drift study, conducted by the Maine Board of Pesticides Control (BPC) during May 2006, as required by 22 MRSA § 1445.

I. Goal

These data were collected to help determine whether untreated buffer areas or other requirements are needed to prevent unreasonable pesticide drift into marine water bodies.

II. Background

Written into emergency laws 22 MRSA §1444 and 22 MRSA §1445 were temporary limits on pesticide applications for control of the browntail moth in coastal areas in Cumberland, Sagadahoc and York counties. The statute also required the BPC to perform a drift monitoring project and consult with their Environmental Risk Advisory Committee (ERAC) and the Lobster Conservancy, to evaluate risks and benefits relating to pesticide applications near marine waters. A report from the Board with its findings and recommendations will be made to the joint standing committee of the Legislature having jurisdiction over agriculture, conservation and forestry matters by January 2, 2007.

III. Drift Study Design and Methods

A plan for this drift study was developed April 12, 2006, by nine people representing the BPC, the University of Maine Food Chemical Safety Laboratory, and the Maine Lobstermens' Association. Also giving input to study design via email were two Department of Marine Resources employees.

A. Site Selection

Pesticide applicators from each of the four participating companies chose a property bordering the ocean to be monitored by the BPC. Table 1 below describes these sites, and Table 3 in the Sample Results section displays additional site information.

TABLE 1. 2006 SAMPLING SITES			
DESCRIPTION	BPC SITE DESIGNATION	LATITIUDE[1]	LONGITUDE
Falmouth	03BPCS004	43°43'49.6"	-70°12'24.7"
Harpswell, Lookout Point	03BPCS005	43°48'33.6"	-69°59'36.5"
Freeport	03BPCS006	43°50'01.0"	-70°02'54.5"
Yarmouth, Cousins Island	03BPCS007	43°46'11.8"	-70°08'39.8"

[1] Datum = NAD83

B. Insecticide Application and Sample Collection

Two sites were treated with cyfluthrin (Falmouth and Yarmouth) and the other two sites were treated with permethrin. BPC staff was on site at the time of the applications and recorded weather conditions using a Kestrel 3000 Pocket Weather Meter.

Prior to pesticide treatment, a BPC employee mounted 185-millimeter diameter filter papers to drift card stands at each site to catch any pesticide drift. Water sensitive cards were also used at three of four sites (see Figure 1). New cardboard platform bases were used at each site.

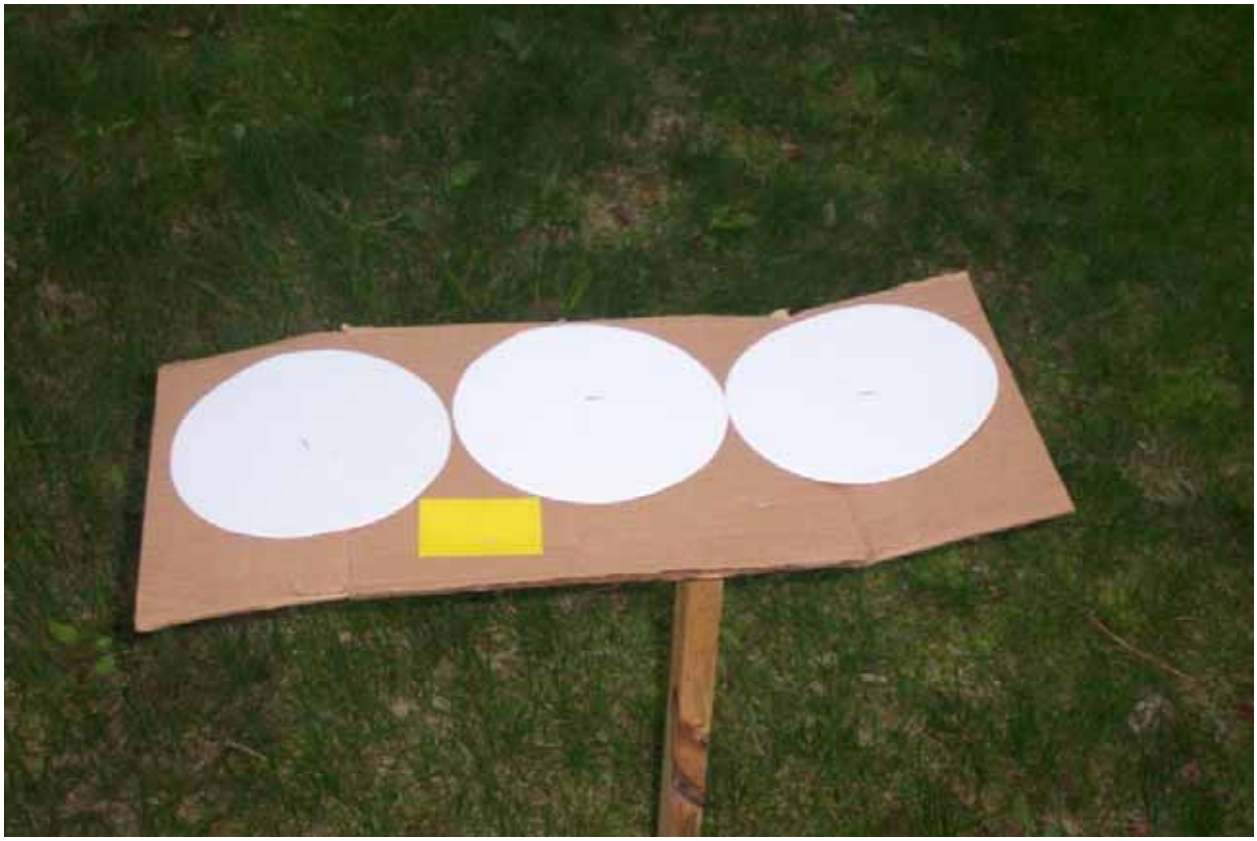

Figure 1. Drift card triplicates and yellow water sensitive card

Refer to Figures 2 through 5 below for diagrams showing the layout of drift cards in relation to the pesticide spray target areas, direction of spray, and wind direction. These four diagrams are not to scale. Small circles represent drift cards; two circles side by side are duplicates, and three circles side by side are triplicates. The sample ID (a number in the 700s) is listed next to each drift card.

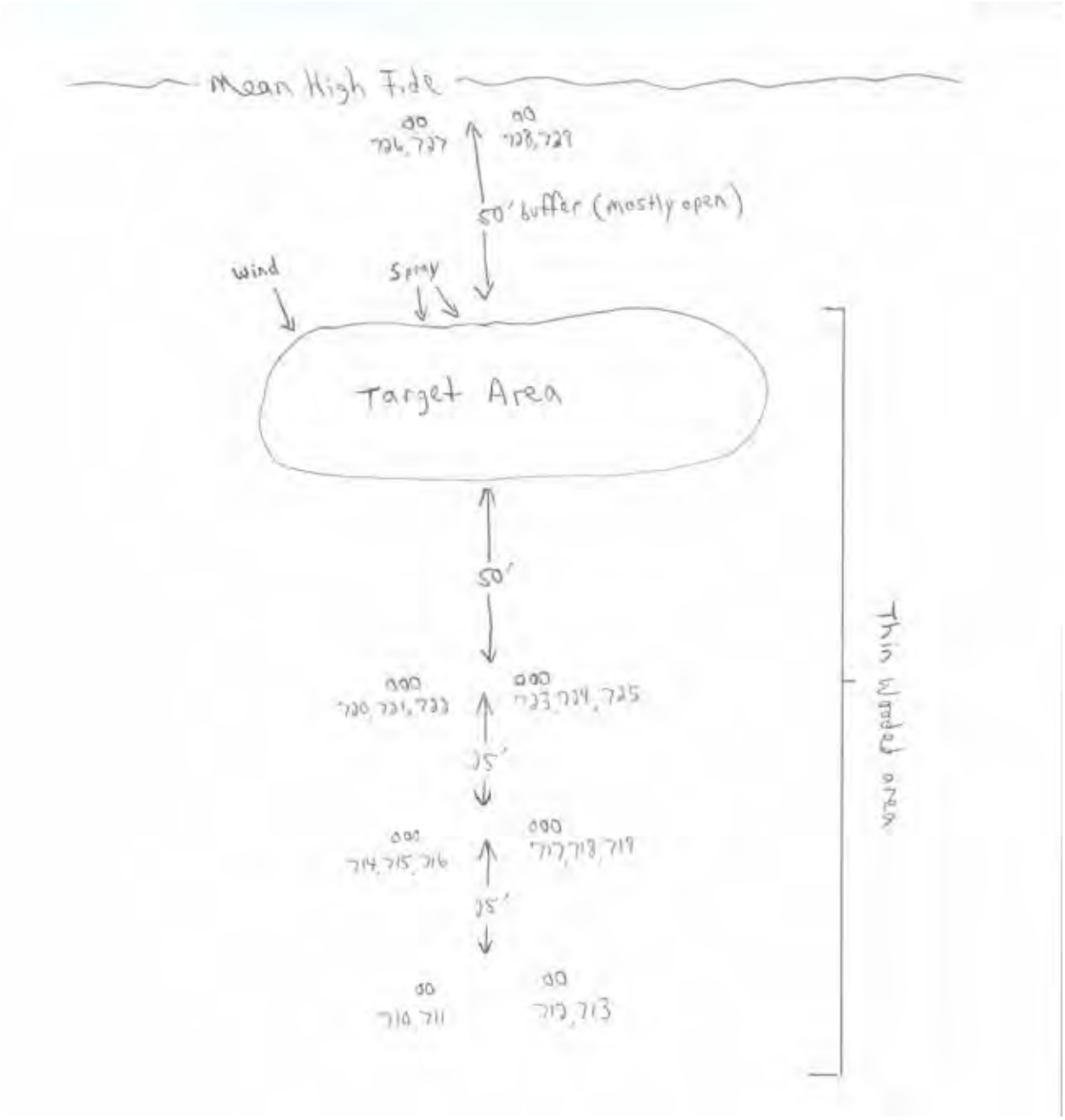

Figure 2. Falmouth Site

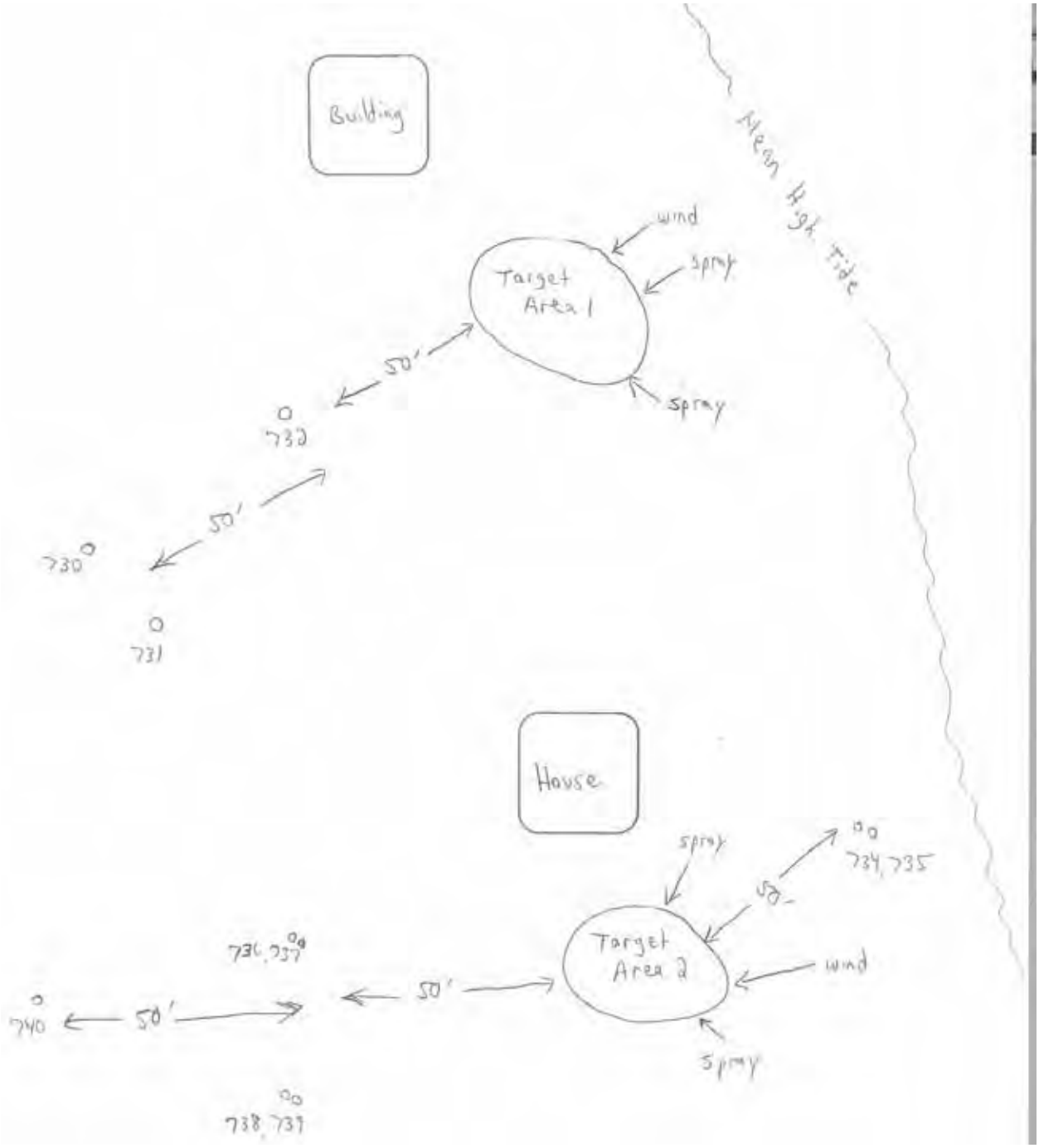

Figure 3. Harpswell Site

Figure 4. Freeport Site

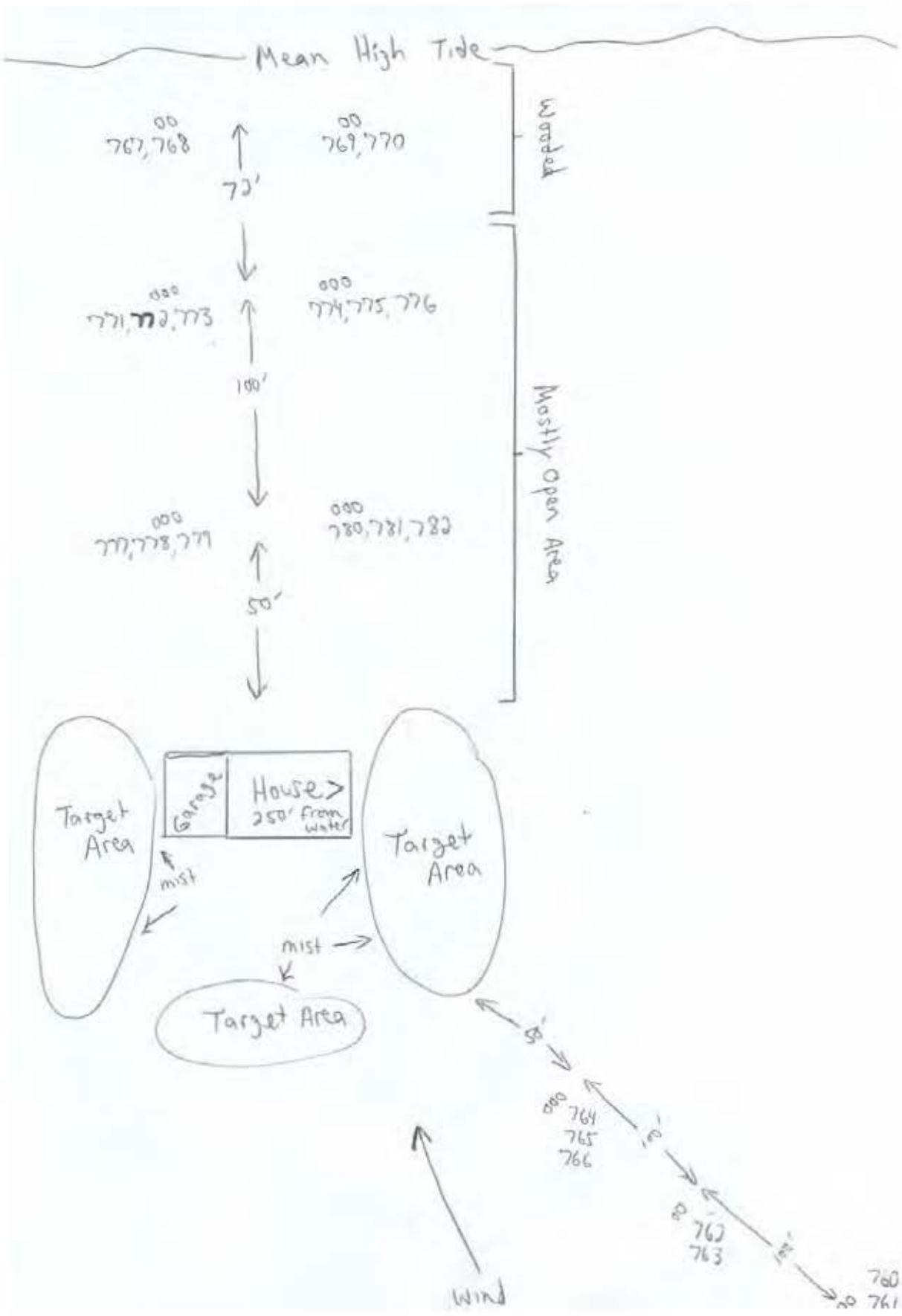

Figure 5. Yarmouth Site

Photographs were taken of each pesticide application. After each spray event all of the samples were collected in 120 ml amber glass jars (one drift card per jar) and placed immediately in iced coolers. This was done to preserve the samples by preventing exposure to sunlight and maintaining cool temperatures. A new pair of latex gloves was worn for the collection of each drift card. Samples were delivered to the University of Maine at Orono, Food Chemical Safety Laboratory within 72 hours of collection, or within one week if frozen. BPC standard operating procedures for the collection of environmental samples and chain-of-custody procedures were observed throughout the sampling program.

C. Analytical Methodology

The University of Maine, Food Chemical Safety Laboratory performed the sample analyses using ethyl acetate extraction and a gas chromatograph/ mass spectrometer (GC/MS). The limit of quantification (LOQ) for cyfluthrin was 125ng (0.47 ng/cm^2) and LOQ for permethrin was 15ng (0.05 ng/cm^2).

D. Quality Assurance/Quality Control (QA/QC) Procedures

The University of Maine, Food Chemical Safety Laboratory maintains a quality assurance project plan (QAPP) with QA/QC protocols for the Board of Pesticides Control and the United States Environmental Protection Agency for the analysis of samples used in the enforcement of state and federal pesticide regulations. In addition, all related BPC standard operating procedures were followed, including the collection of field blanks and sample duplicates on at least a 1 in 20 basis. In many cases triplicates were used.

IV. Sample Results

The drift card results from this study are displayed in Table 2 below. Sample IDs that are listed beside each other and of the same font size are duplicates or triplicates. Results for the yellow water sensitive cards matched laboratory results below. Water sensitive cards showed small blue dots representing drift, in areas where drift did occur (see Figure 16 for an example).

Table 2. 2006 Sample Information			
	up wind or down wind	**distance from target (ft)**	**results (ng/cm^2)**
Falmouth Sample IDs, May 18*			
710	down	100	ND
711	down	100	ND
712	down	100	0.5
713	down	100	missing
714	down	75	ND
715	down	75	ND
716	down	75	ND

717	down	75	ND
718	down	75	ND
719	down	75	ND
720	down	50	ND
721	down	50	ND
722	down	50	ND
723	down	50	ND
724	down	50	0.56
725	down	50	ND
726	up	50	0.68
727	up	50	ND
728	up	50	ND
729	up	50	ND
Harpswell 1 Sample IDs, May 23*			
730	down	100	18.51
731	down	100	20.83
732	down	50	210.49
733 (water sensitive card only)			
Harpswell 2 Sample IDs, May 23*			
734	up	50	ND
735	up	50	ND
736	down	50	3.07
737	down	50	2.06
738	down	50	209.84
739	down	50	170.09
740	down	100	0.15
741 (water sensitive card only)			
Freeport Sample IDs, May 24*			
742	up	50	ND
743	up	50	0.09
744	up	50	0.06
745	down	50	123.27
746	down	50	146.32
747	down	50	230.41
748	down	50	21.97
749	down	50	15.86
750	down	50	53.44
751	down	150	0.19
752	down	150	0.32
753	down	150	0.31
754	down	150	0.38
755	down	250	11.4
756	down	250	3.83
757	down	250	ND

758	down	250	ND
759 (blank)			missing
Yarmouth Sample IDs, May 26*			
760	up	250	ND
761	up	250	ND
762	up	150	ND
763	up	150	ND
764	up	50	ND
765	up	50	0.56
766	up	50	ND
767	down	222	ND
768	down	222	ND
769	down	222	ND
770	down	222	ND
771	down	150	ND
772	down	150	0.74
773	down	150	0.49
774	down	150	0.87
775	down	150	1.02
776	down	150	0.7
777	down	50	3.47
778	down	50	2.55
779	down	50	3.24
780	down	50	4.27
781	down	50	4.23
782	down	50	3.31
783 (blank)			ND

Table 3. Site Information

	*Falmouth, May 18	*Harpswell 1, May 23	*Harpswell 2, May 23	*Freeport, May 24	*Yarmouth, May 26
Pesticide used	Tempo, cyfluthrin	Astro, permethrin	Astro, permethrin	Astro, permethrin	Tempo, cyfluthrin
EPA Reg. No.	432-1363	279-3141	279-3141	279-3141	432-1363
Pesticide dilution rate	2 oz/ 100 gal	6 oz./ 100 gal	6 oz./ 100 gal	5 oz./ 100 gal	5 oz./ 100 gal
Amount of diluted pesticide used on site	8 gal	25 gal	10 gal	50 gal	15 gal
Drift adjuvant added?	Yes, Direct (polyvinal polymer)	Yes, Lesco Spreader Sticker	Yes, Lesco Spreader Sticker	No	No
Time of spray	7:18-7:21AM	Early AM	Early AM	6:30	5:18-5:25AM
Height of trees	40'	82.5'	74' (several red oaks)	40-55'	40-50'
Size of treated area	area of three trees	a few trees	a few trees	trees around perimeter of house	property perimeter trees

Wind speed	calm, not registering on Kestrel	4.9 mph ave, 7.5 max	4.9 mph ave, 7.5 max	1.7 mph ave, 4 max	calm, not registering on Kestrel
Wind direction	from E, away from water	off water	off water	toward water but very calm (treated area > 250' from water)	hard to tell at first but toward water (from NE)(treated trees were 250'from water)
Temperature	50 F	47.9 F	47.9 F	50.7 F	51 F
Humidity		79%	79%	96%	86%
Cloud cover	full clouds	light clouds, really no blue sky	light clouds, really no blue sky	light clouds, partly clear	part clear
Time of weather recording	7AM	6:50AM	6:50AM	5:40AM	5:25AM
Appliction equipment	hydraulic sprayer, nozzle size 14, 500 psi, 12 gpm	hydraulic sprayer, nozzle size 16, 400 psi, 50 gpm max	hydraulic sprayer, nozzle size 16, 500 psi, 50 gpm max	hydraulic sprayer, #12 disk, 800 psi, 20 gpm max	mist blower
Notes	this common area where drift cards were set up was wooded but trees had been thinned, no water sensitive cards used - too wet	some drift cards blew off stands before they could be collected (extra staples used next time). Water sensitive cards used	some drift cards blew off stands before they could be collected (extra staples used next time). Water sensitive cards used	water sensitive cards used	mist blower pointed in different directions as moved around perimeter. Water sensitive cards used

V. Discussion and Conclusions

Temporary laws in effect during these applications, requiring a 50’ no spray buffer next to the high tide line, and for applications within 250’ of the water, requiring pesticide spray to be directed away from the water and requiring the wind to be away from the water, appear to protect marine water from drift. However, one up wind sample near the water (sample 726 in Falmouth) was found to have a level of pesticide near the limit of quantification, but this could have been a lab error since its duplicate did not detect any pesticide, or might have been a result of the calm morning.

Two duplicate drift cards in Freeport (samples 743 and 744), up wind of the target, were found to have low levels of pesticide. During this spray event the hydraulic sprayer was briefly turned in the direction of the up wind samples to spray part of a tree. If the wind died down during this moment, that could explain the pesticide drifting over to the up wind cards 50’ away. The target area at this site was greater than 250’ from the water so the direction of spray did not have to be in a particular direction (see Figure 4). Other up wind samples in this study did not detect pesticide.

This study found evidence that detectable levels of pesticide residues are capable of drifting down wind after an application, as expected. According to these results, low levels of pesticides can drift at least 250’ from the target.

Some samples did not show pesticide drifting that far, however, and that could be due to trees outside of the target intercepting the drift before it landed on the cards, lack of wind, or other variables.

In conclusion, the BPC recommends that the temporary browntail moth spray requirements be extended for upcoming spray seasons, including the requirement that wind must be away from the water. In addition, the BPC also recommends that browntail moth pesticide applications be prohibited when wind speed is less than 2 miles per hour (see the January 2, 2007 BPC memo to the legislature for other BPC recommendations not directly related to this drift study).

Appendix. Site Photos

Figure 6. Nozzle used in Falmouth.

Figure 7. Falmouth target area is three trees about 50' from water and drift cards were set up further away from the water (down wind), and at water's edge.

Figure 8. Falmouth application.

Figure 9. Harpswell application.

Figure 10. Freeport target area is trees around house, all greater than 250' from water.

Figure 11. Freeport application.

Figure 12. Freeport drift cards.

Figure 13. More Freeport application. Sprayer pointed toward drift cards.

Figure 14. Freeport drift cards set up across lawn. Pine trees may have caught some drift before it reached cards.

Figure 15. Yarmouth drift cards set up in this area. Ocean is down this hill over 250' from target area. Slight movement of air toward the water during this spray event.

Figure 16. Water sensitive cards from the Freeport site from left to right: 250', 150', and 50' downwind from target. Very small liquid droplets are just barely visible on the yellow cards that were 250' and 150' from the target.