

Navel Orangeworm Program 2023 – Weekly Report

Week Ending – May 26, 2023

California Department of Food & Agriculture
Plant Health and Pest Prevention Services
Integrated Pest Control Branch
5100 Douglas Avenue
Shafter, CA 93263
Phone: (661) 395-2914
Fax: (661) 399-1601

I. Program Updates

Navel Orangeworm Area Wide Program – Multi-Phase Approach

Phase 1 – 2018-2022

Phase 1 was the Initial Phase of the Navel Orangeworm (NOW) Program (Program) with a focus on developing NOW sterile insect technique (SIT) moths, determining their viability during cold storage transfer, performing quality control (QC) on mating propensity and survivability of the sterile moths, developing a trap monitoring program, and collecting preliminary damage data from the orchards participating in the Program's project site.

Phase 2 – 2023

Phase 2 is the Data Phase of the NOW Program. The focus of this phase is controlling variables within the orchards participating in the Program's project site in order to increase the integrity of the field data being collected. During this phase a University of California Cooperative Extension (UCCE) coordinator will take over as a grower point of contact. They will be responsible for coordinating with growers and establishing orchards for the Phase 2 Program project site.

Navel Orangeworm Sterile Insect Technique

The Navel Orangeworm Program utilizes NOW SIT moths obtained from the United States Department of Agriculture (USDA) Phoenix, Arizona Rearing Facility. QC tests are performed on every shipment of NOW SIT moths used for aerial releases.

Aerial releases for 2023 began on Sunday, March 12, with one magazine of approximately 750,000 moths being released daily over two 640-acre orchards in Fresno County, designated as Zones 1 and 3. Beginning on Thursday, April 13, a second magazine of approximately 750,000 moths began being released daily over a single 640-acre orchard, designated as Zone 6. During the period of April 18 to April 23, the second magazine was released daily over two 640-acre orchards, designated as Zones 6 and 7. As of Monday, April 24, the second magazine began being released daily over two 640-acre orchards, designated as Zones 4 and 6.

Ground releases are conducted in lieu of aerial releases only when aerial releases are not possible. Ground releases are limited to one magazine released at one zone per day, along the north and west edges of the release zone.

Listed below are any circumstances which prevented regular releases in 2023:

March 10: No release conducted due to excessive rain preventing access to release sites via air or ground; moth shipment from March 9 held overnight for a second night for potential release on March 11

March 11: No release conducted due to excessive rain preventing access to release sites via air or ground; moth shipment from March 9 was destroyed; moth shipment from March 10 held overnight for a second night for potential release on March 12

March 12: Double release conducted over Zones 1 and 3 with moth shipments from March 10 and 11

March 14: No release conducted due to excessive rain preventing access to release sites via air or ground; moth shipment from March 13 held overnight for a second night for potential release on March 15

March 15: Double release conducted over Zones 1 and 3 with moth shipments from March 13 and 14

March 17: No release conducted due to mechanical issues with release aircraft; moth shipment from March 16 held overnight for a second night for potential release on March 18

March 18: Double release conducted over Zones 1 and 3 with moth shipments from March 16 and 17

April 20: First magazine unintentionally released over Zones 1 and 7 instead of Zones 1 and 3; the second magazine released, per schedule, over Zones 6 and 7

May 10: Ground release conducted at Zone 1 using Mag 1 while release aircraft underwent repairs; Mag 2 from May 9 held overnight for a second night for potential release on May 11; only one magazine transferred through airline for potential release on May 11

May 11: Aerial releases conducted per schedule; Mag 2 from May 9 released over Zones 4 and 6

Navel Orangeworm Trapping

During Phase 1 of the NOW Program, trap monitoring operations began May 5, 2020, with an area wide project site that included a total of four orchards in Fresno County: two 640-acre almond orchards and two 640-acre pistachio orchards. On May 17, 2021, the Area Wide Project site expanded to include four additional orchards in Fresno County: one 640-acre almond orchard, one 640-acre pistachio orchard, one 160-acre almond orchard, and one 160-acre pistachio orchard. All eight orchards, designated as Zones 1 through 8, were serviced on a weekly basis.

For Phase 2 of the NOW Program, the area wide project site will include eight 640-acre orchards; four pistachio and four almond, located in Fresno County. All eight orchards, designated as Zones 1 through 8, have been identified. Trapping is being conducted weekly in Zones 1 through 8.

Listed below are any circumstances which prevented regular trap servicing in 2023:

- Week of March 3: No traps were serviced due to excessive rain preventing access to trap sites
- Week of March 17: Only Zone 1 traps were serviced; Zones 2 - 6 traps not serviced due to excessive rain preventing access to trap sites
- Week of March 24: Only Zone 1 traps were serviced; Zones 2 - 6 traps not serviced due to excessive rain preventing access to trap sites
- Week of March 31: No traps were serviced in Zone 2 due to excessively muddy conditions preventing access to trap sites; trap sites 26 – 36 in Zone 4 were not serviced due to pesticide applications on site
- Week of May 5: No traps were serviced in Zone 7 due to excessively muddy conditions preventing access to trap sites
- Week of May 12: No traps were serviced in Zones 2 and 5 due to pesticide applications on site

II. Project Design

The 2023 Area Wide Project site is being restructured in preparation for Phase 2 of the Program, which will establish more standardized and consistent approaches to mating disruption, sanitation, pesticide usage, and other cultural practices for more comparable data between each orchard set (release site/control site).

Listed below is information related to each orchard within the Program's Phase 2 project site for 2023:

Zone #	Crop Type	Acres	Release/Non-release Site	Date Added to Area Wide Project
Zone 1	Pistachio	640	Release	February 2023
Zone 2	Pistachio	640	Non-release	February 2023
Zone 3	Almond	640	Release	February 2023
Zone 4	Almond	640	Release	February 2023
Zone 5	Pistachio	640	Non-release	March 2023
Zone 6	Pistachio	640	Release	March 2023
Zone 7	Almond	640	Non-release	April 2023
Zone 8	Almond	640	Non-release	April 2023

Each zone has a trap site ratio of approximately 1 trap site per 18 acres for a total of 36 trap sites for each 640-acre zone. Each trap site has one trap baited with pistachio meal bait and one trap baited with NOW pheromone/PPO lures. All traps are serviced on a weekly basis. Servicing includes collecting trap bottoms and replacing with new trap bottoms. Bait/lure changes occur once a month, and trap tops are replaced as needed. Counts are performed on each trap collected to determine number of wild versus sterile captures and male versus female captures.

III. Trap Results for Week Ending on May 26, 2023

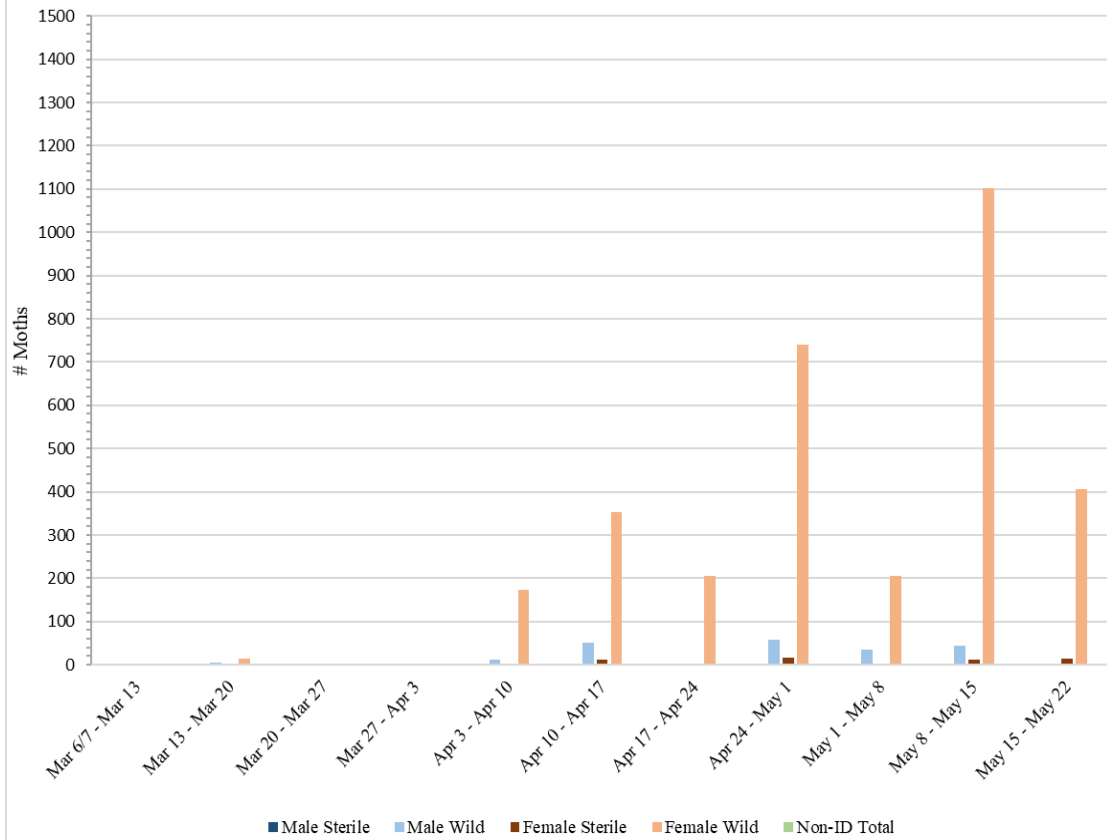
Zone 1 – Pistachio Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were collected from Zone 1 on Monday, May 22.

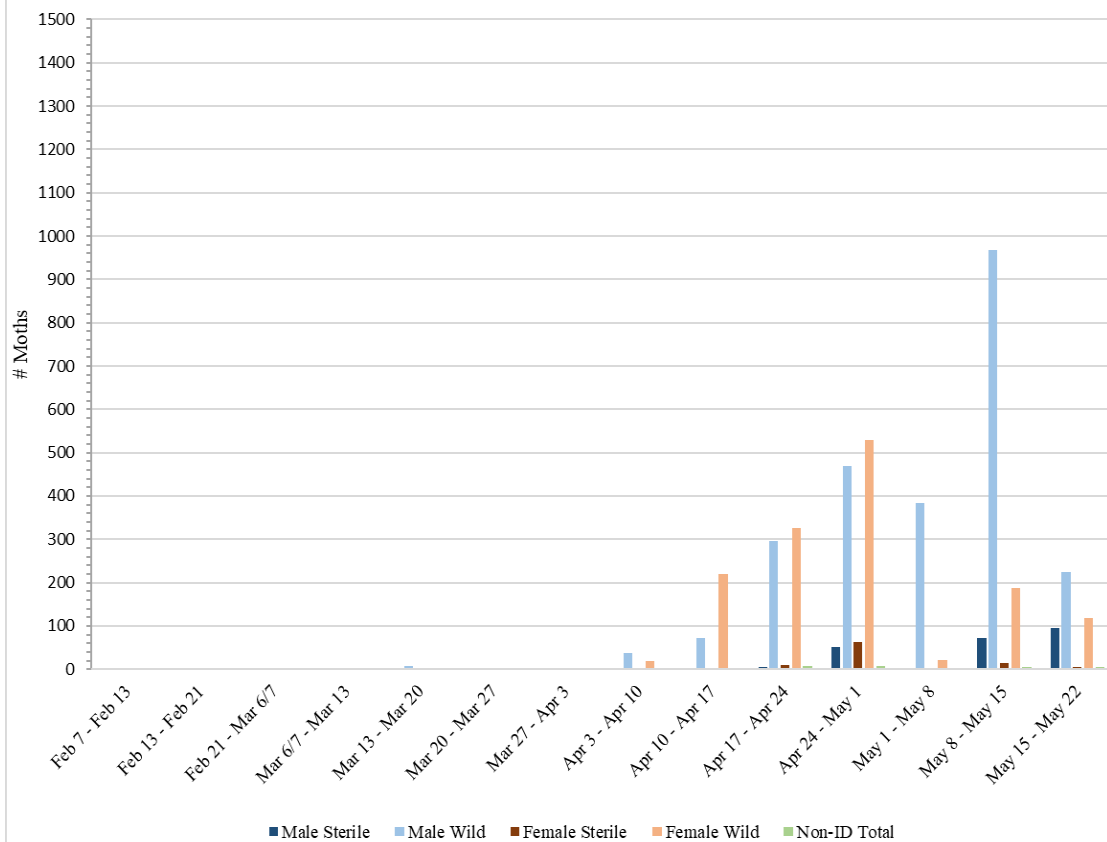
Zone 1 – Pistachio								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
² Mar 6/7 – Mar 13	2	0	0	0	1	1	2	0
Mar 13 – Mar 20	8	0	6	6	0	14	14	0
Mar 20 – Mar 27	8	0	0	0	1	0	1	0
Mar 27 – Apr 3	8	0	1	1	0	0	0	0
Apr 3 – Apr 10	8	0	13	13	0	174	174	0
Apr 10 – Apr 17	8	3	51	54	12	352	364	1
Apr 17 – Apr 24	8	0	0	0	1	206	207	0
Apr 24 – May 1	8	0	59	59	16	740	756	0
May 1 – May 8	8	0	35	35	1	206	207	0
May 8 – May 15	8	3	43	46	12	1101	1113	2
May 15 – May 22	8	0	1	1	15	406	421	1
² Traps 1-18 placed on March 6; Traps 19-36 placed on March 7								

Zone 1 – Pistachio								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
Feb 7 - Feb 13	0	0	0	0	0	0	0	0
Feb 13 – Feb 21	0	0	0	0	0	0	0	0
¹ Feb 21 – Mar 6/7	0	0	0	0	0	0	0	0
² Mar 6/7 – Mar 13	2	0	0	0	1	0	1	0
Mar 13 – Mar 20	8	0	7	7	1	1	2	0
Mar 20 – Mar 27	8	0	1	1	0	2	2	0
Mar 27 – Apr 3	8	0	2	2	0	0	0	0
Apr 3 – Apr 10	8	3	37	40	0	19	19	0
Apr 10 – Apr 17	8	0	72	72	0	220	220	0
Apr 17 – Apr 24	8	5	296	301	10	325	335	8
Apr 24 – May 1	8	52	468	520	63	528	591	7
May 1 – May 8	8	0	383	383	0	21	21	0
May 8 – May 15	8	72	967	1039	14	187	201	4
May 15 – May 22	8	95	225	320	5	117	122	5
¹ No traps were serviced in Zone 1 during the week of March 3 due to excessive rain preventing access								

Zone 1 - Pistachio Orchard - Meal Baited Traps



Zone 1 - Pistachio Orchard - Pheromone/PPO Baited Traps

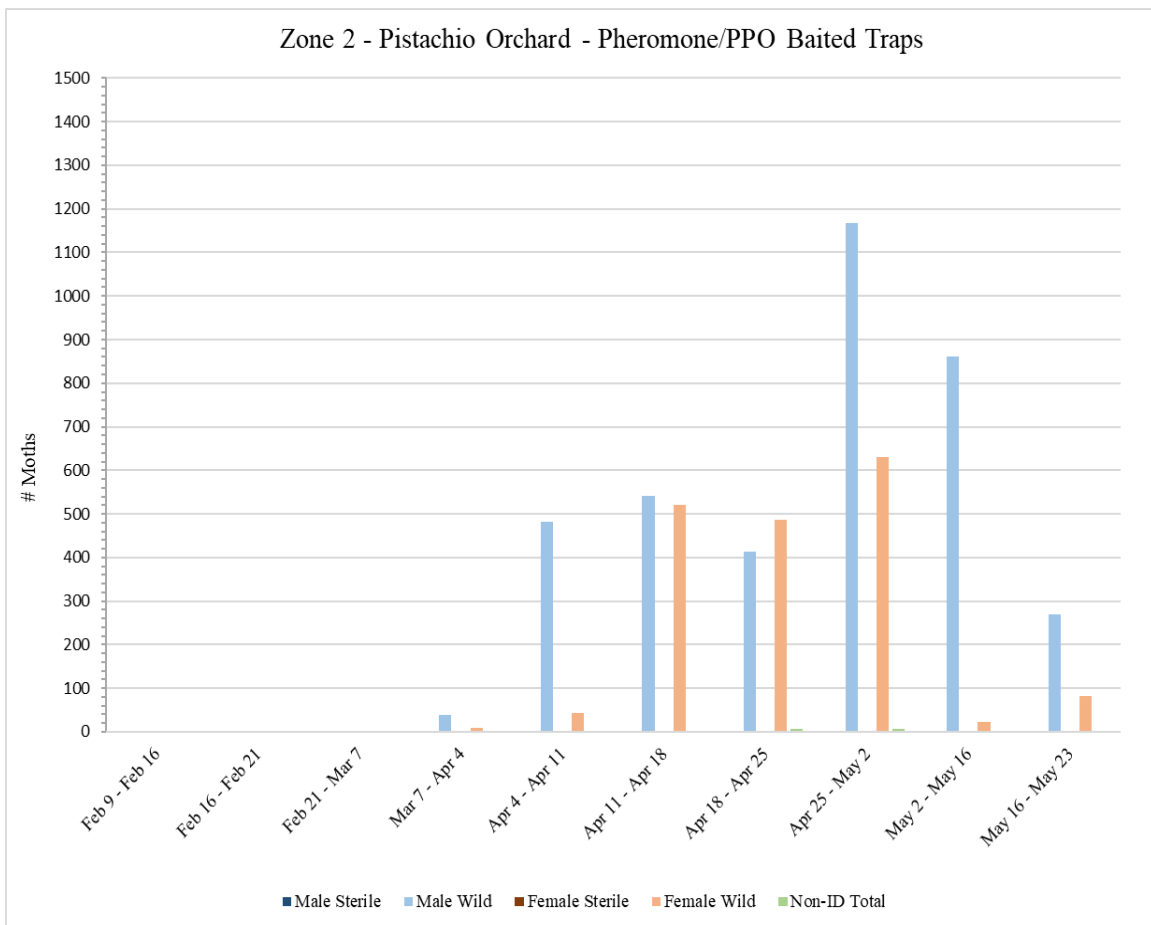
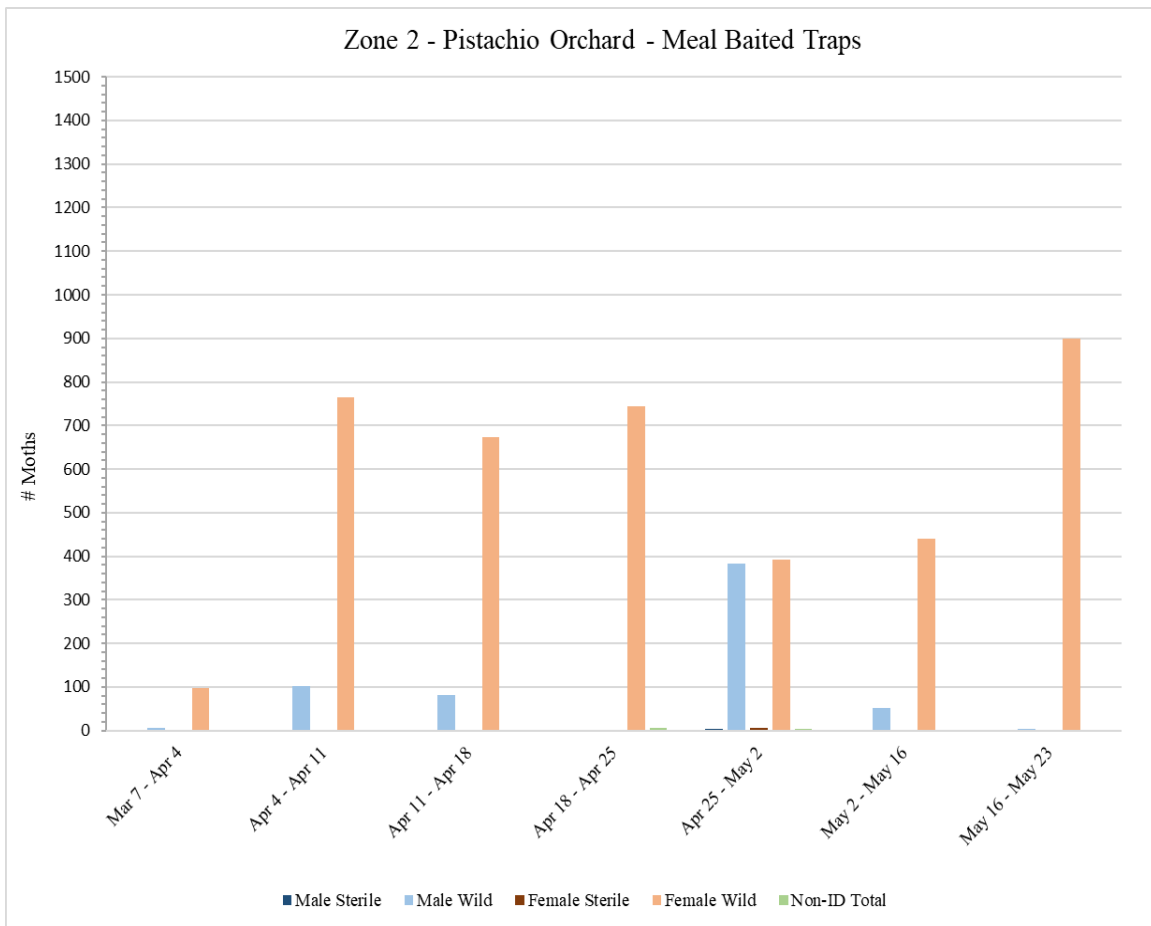


Zone 2 – Pistachio Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were collected from Zone 2 on Tuesday, May 23.

Zone 2 - Pistachio								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
² Mar 7 – Apr 4	0	0	6	6	0	97	97	0
Apr 4 – Apr 11	0	0	102	102	0	765	765	0
Apr 11 – Apr 18	0	0	81	81	0	674	674	0
Apr 18 – Apr 25	0	0	0	0	0	744	744	6
Apr 25 – May 2	0	4	382	386	6	392	398	5
³ May 2 – May 16	0	0	51	51	0	441	441	2
May 16 – May 23	0	0	4	4	0	900	900	0
² No traps were serviced in Zone 2 during the weeks of March 17, March 24, and March 31 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 2 during the week of May 12 due to pesticide applications on site								

Zone 2 - Pistachio								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
Feb 9 - Feb 16	0	0	0	0	0	0	0	0
Feb 16 – Feb 21	0	0	0	0	0	0	0	0
¹ Feb 21 – Mar 7	0	0	0	0	0	0	0	0
² Mar 7 – Apr 4	0	0	38	38	0	9	9	0
Apr 4 – Apr 11	0	0	482	482	0	44	44	0
Apr 11 – Apr 18	0	0	542	542	0	521	521	0
Apr 18 – Apr 25	0	1	413	414	0	487	487	6
Apr 25 – May 2	0	0	1168	1168	0	630	630	6
³ May 2 – May 16	0	0	860	860	0	23	23	1
May 16 – May 23	0	0	269	269	0	81	81	0
¹ No traps were serviced in Zone 2 during the week of March 3 due to excessive rain preventing access								
² No traps were serviced in Zone 2 during the weeks of March 17, March 24, and March 31 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 2 during the week of May 12 due to pesticide applications on site								



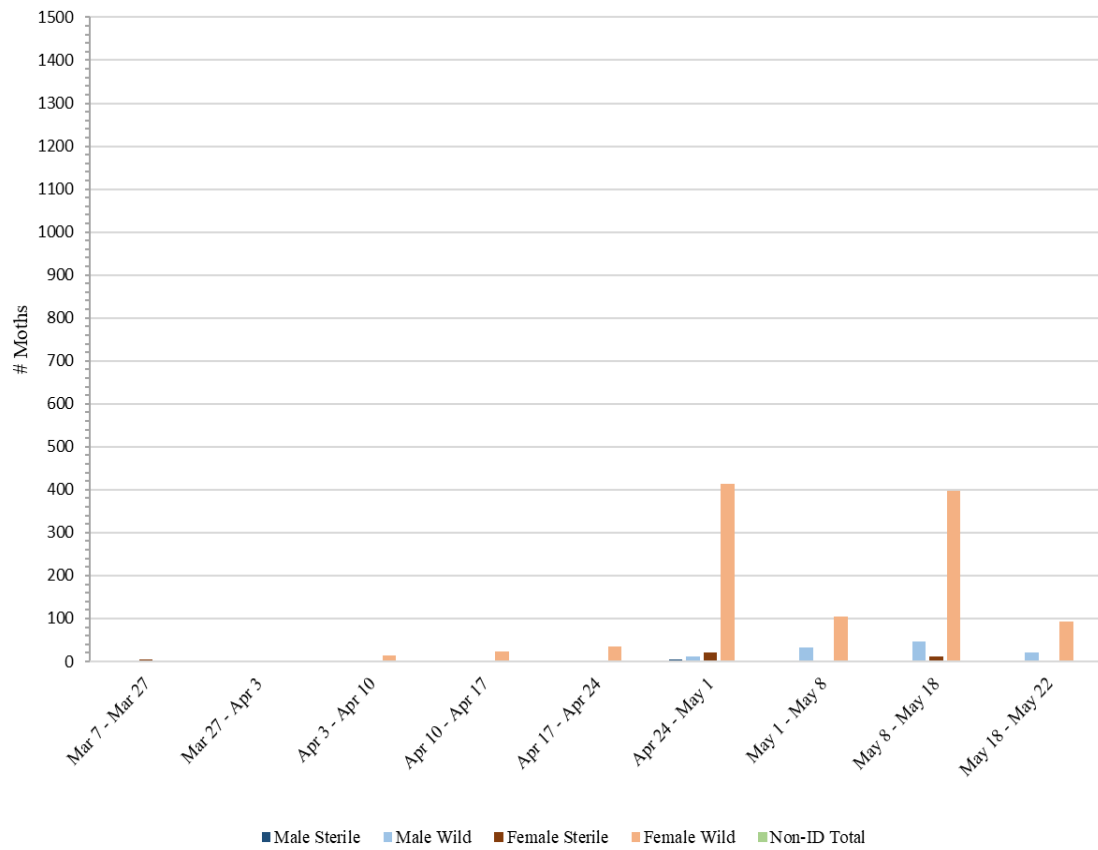
Zone 3 – Almond Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were collected from Zone 3 on Monday, May 22.

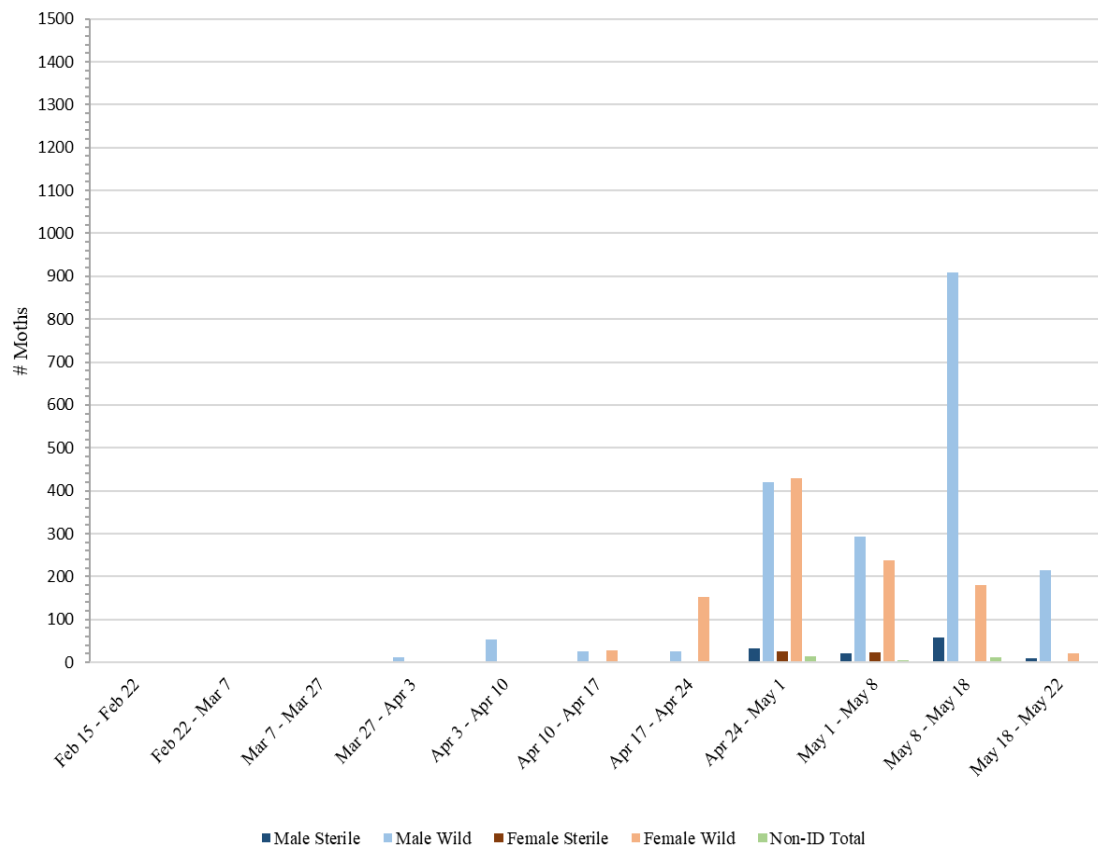
Zone 3 - Almond								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	*Non-ID Total
² Mar 7 – Mar 27	17	0	0	0	4	0	4	0
Mar 27 – Apr 3	8	0	0	0	0	1	1	0
Apr 3 – Apr 10	8	0	0	0	0	13	13	0
Apr 10 – Apr 17	8	0	0	0	0	22	22	0
Apr 17 – Apr 24	7	0	0	0	3	34	37	0
Apr 24 – May 1	8	4	12	16	20	413	433	1
May 1 – May 8	8	0	32	32	0	105	105	0
May 8 – May 18	10	0	47	47	11	397	408	2
May 18 – May 22	5	1	20	21	0	92	92	0
² No traps were serviced in Zone 3 during the weeks of March 17 and March 24 due to excessive rain preventing access								

Zone 3 - Almond								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	*Non-ID Total
Feb 15 - Feb 22	0	0	0	0	0	0	0	0
¹ Feb 22 – Mar 7	0	0	0	0	0	0	0	0
² Mar 7 – Mar 27	17	1	1	2	0	0	0	0
Mar 27 – Apr 3	8	0	12	12	0	0	0	0
Apr 3 – Apr 10	8	1	53	54	0	1	1	0
Apr 10 – Apr 17	8	1	25	26	1	29	30	3
Apr 17 – Apr 24	7	3	26	29	2	152	154	0
Apr 24 – May 1	8	32	420	452	25	429	454	14
May 1 – May 8	8	22	292	314	23	238	261	5
May 8 – May 18	10	57	909	966	0	179	179	12
May 18 – May 22	5	9	215	224	0	21	21	0
¹ No traps were serviced in Zone 3 during the week of March 3 due to excessive rain preventing access								
¹ No traps were serviced in Zone 3 during the weeks of March 17 and March 24 due to excessive rain preventing access								

Zone 3 - Almond Orchard - Meal Baited Traps



Zone 3 - Almond Orchard - Pheromone/PPO Baited Traps

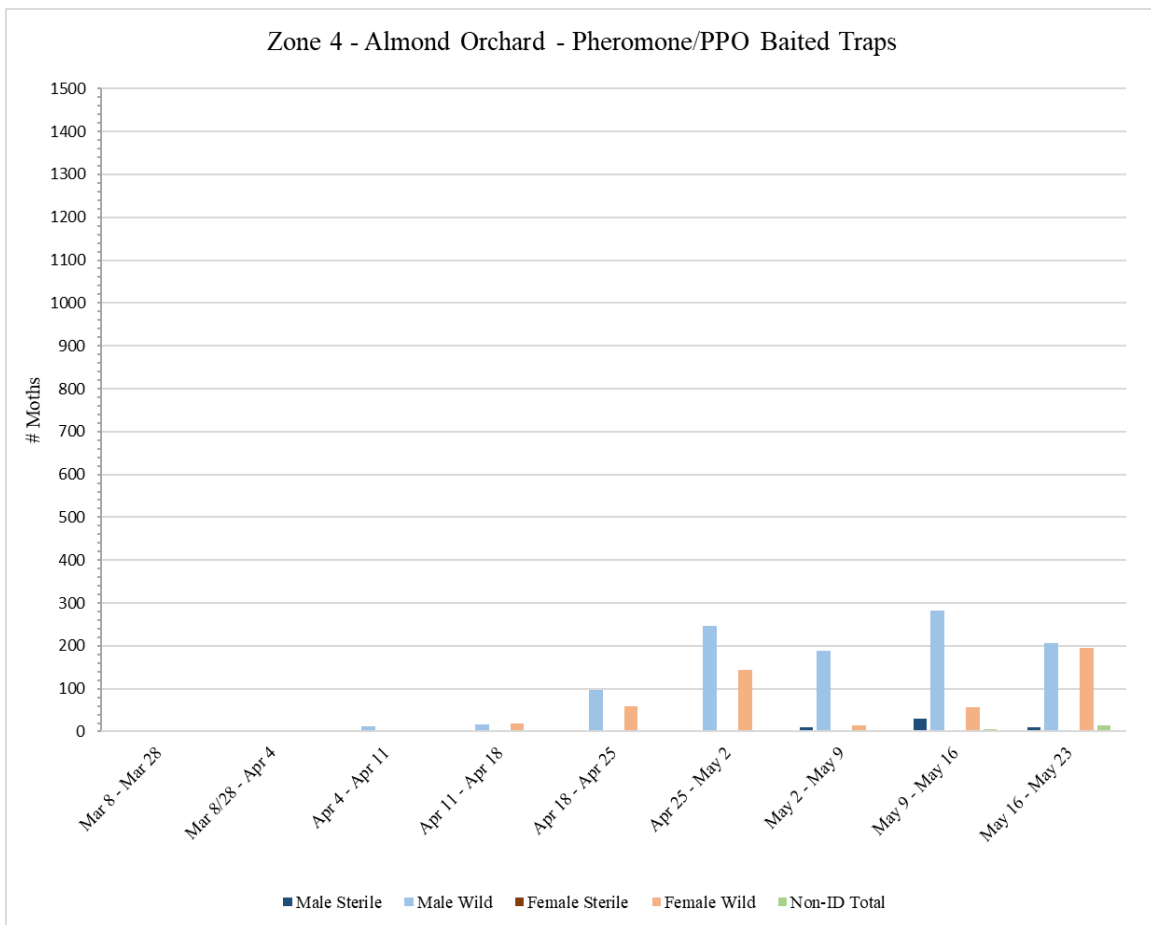
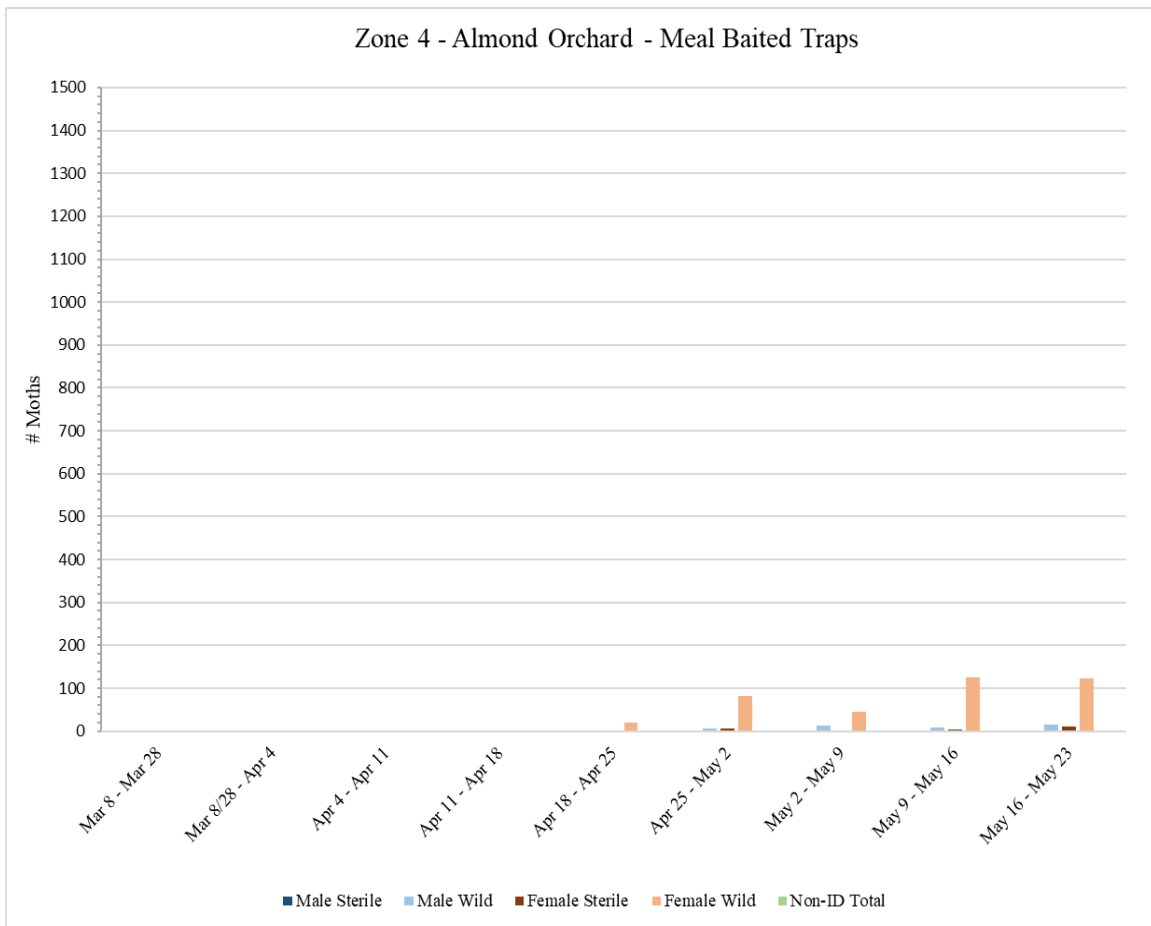


Zone 4 – Almond Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were collected from Zone 4 on Tuesday, May 23.

Zone 4 - Almond								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
¹ Mar 8 – Mar 28	0	0	0	0	0	0	0	0
² Mar 8/28 – Apr 4	0	0	0	0	0	0	0	0
Apr 4 – Apr 11	0	0	0	0	0	0	0	0
Apr 11 – Apr 18	0	0	1	1	0	2	2	0
Apr 18 – Apr 25	2	0	0	0	0	20	20	0
Apr 25 – May 2	8	0	6	6	7	81	88	0
May 2 – May 9	8	0	13	13	1	44	45	0
May 9 – May 16	7	0	9	9	4	126	130	0
May 16 – May 23	8	1	16	17	11	124	135	1
¹ No traps were serviced in Zone 4 during the weeks of March 17 and March 24 due to excessive rain preventing access; traps 26 – 36 not serviced in Zone 4 during the week of March 31 due to pesticide applications on site ² Traps 26 – 36 in field since March 8								

Zone 4 - Almond								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
¹ Mar 8 – Mar 28	0	0	0	0	0	0	0	0
² Mar 8/28 – Apr 4	0	0	1	1	0	0	0	0
Apr 4 – Apr 11	0	0	12	12	0	0	0	0
Apr 11 – Apr 18	0	0	16	16	0	20	20	0
Apr 18 – Apr 25	2	0	96	96	0	60	60	0
Apr 25 – May 2	8	4	246	250	2	145	147	2
May 2 – May 9	8	9	188	197	1	15	16	0
May 9 – May 16	7	29	283	312	0	57	57	6
May 16 – May 23	8	11	207	218	3	195	198	15
¹ No traps were serviced in Zone 4 during the weeks of March 17 and March 24 due to excessive rain preventing access; traps 26 – 36 not serviced in Zone 4 during the week of March 31 due to pesticide applications on site ² Traps 26 – 36 in field since March 8								



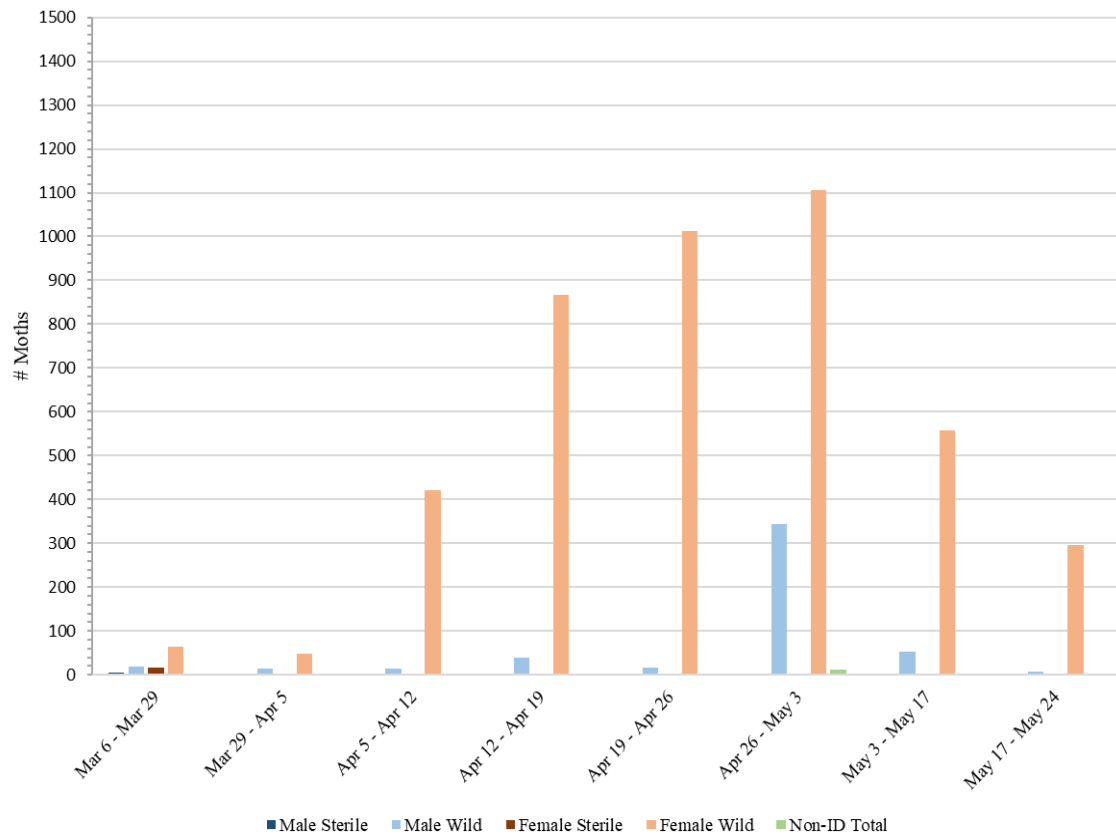
Zone 5 – Pistachio Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were collected from Zone 5 on Wednesday, May 24.

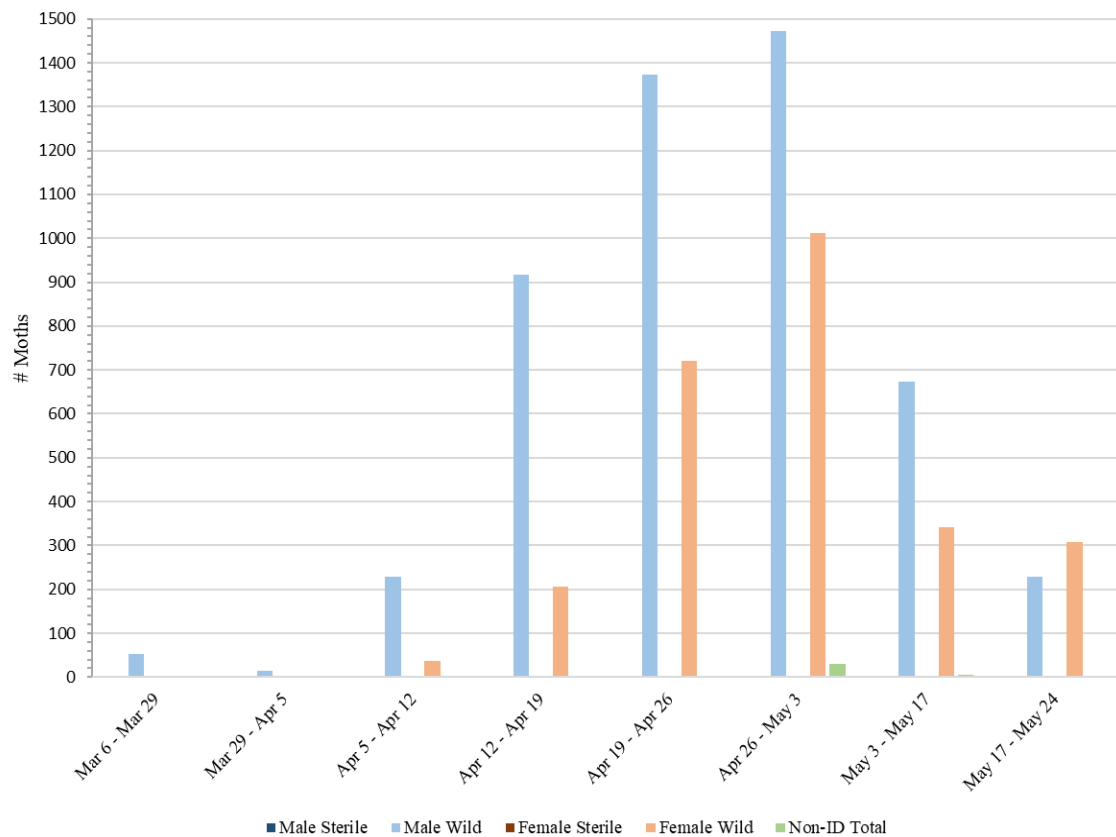
Zone 5 - Pistachio								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
¹ Mar 8 – Mar 29	0	6	19	25	16	65	81	1
Mar 29 – Apr 5	0	0	15	15	0	47	47	0
Apr 5 – Apr 12	0	0	13	13	0	422	422	0
Apr 12 – Apr 19	0	0	38	38	1	868	869	3
Apr 19 – Apr 26	0	0	17	17	1	1012	1013	0
Apr 26 – May 3	0	0	343	343	1	1105	1106	12
² May 3 – May 17	0	0	52	52	0	557	557	0
May 17 – May 24	0	0	8	8	0	297	297	0
¹ No traps were serviced in Zone 5 during the weeks of March 17 and March 24 due to excessive rain preventing access								
² No traps were serviced in Zone 5 during the week of May 12 due to pesticide applications on site								

Zone 5 - Pistachio								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
¹ Mar 8 – Mar 29	0	0	52	52	0	2	2	1
Mar 29 – Apr 5	0	0	14	14	0	0	0	0
Apr 5 – Apr 12	0	0	229	229	0	37	37	0
Apr 12 – Apr 19	0	0	916	916	0	207	207	1
Apr 19 – Apr 26	0	0	1373	1373	0	721	721	2
Apr 26 – May 3	0	1	1473	1474	0	1011	1011	31
² May 3 – May 17	0	0	674	674	0	341	341	6
May 17 – May 24	0	0	229	229	0	308	308	0
¹ No traps were serviced in Zone 5 during the weeks of March 17 and March 24 due to excessive rain preventing access								
² No traps were serviced in Zone 5 during the week of May 12 due to pesticide applications on site								

Zone 5 - Pistachio Orchard - Meal Baited Traps



Zone 5 - Pistachio Orchard - Pheromone/PPO Baited Traps



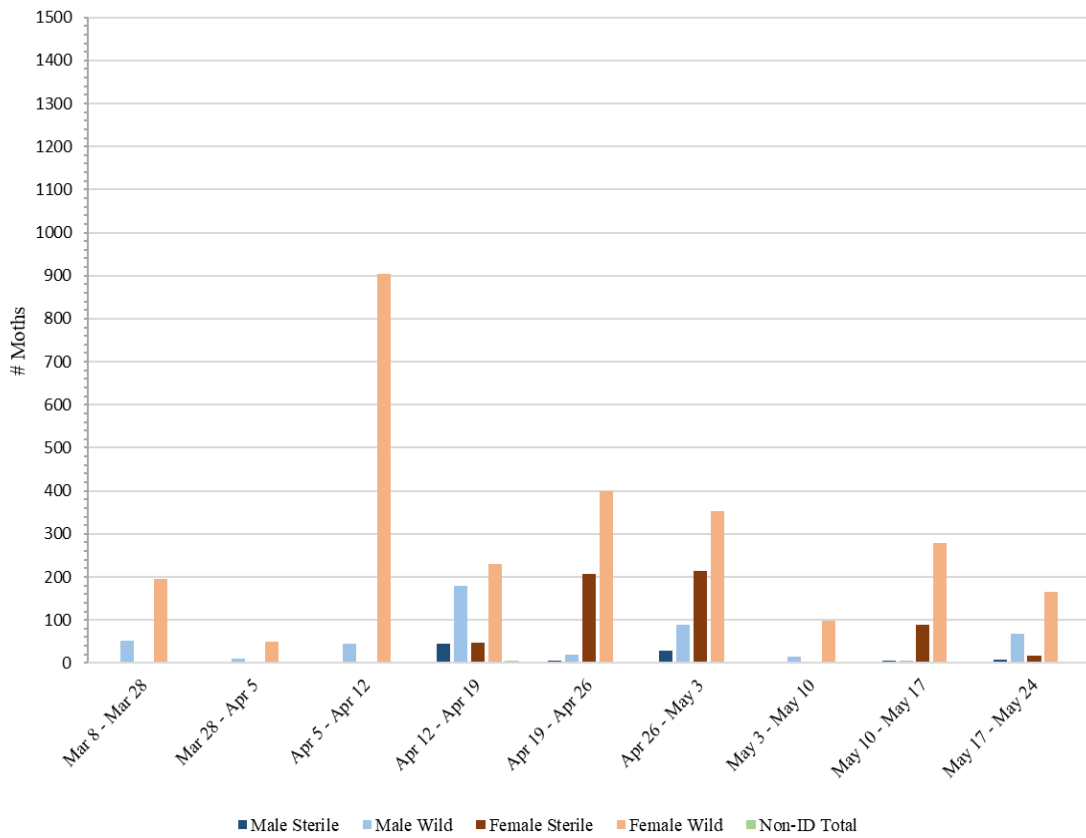
Zone 6 – Pistachio Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were collected from Zone 6 on Wednesday, May 24.

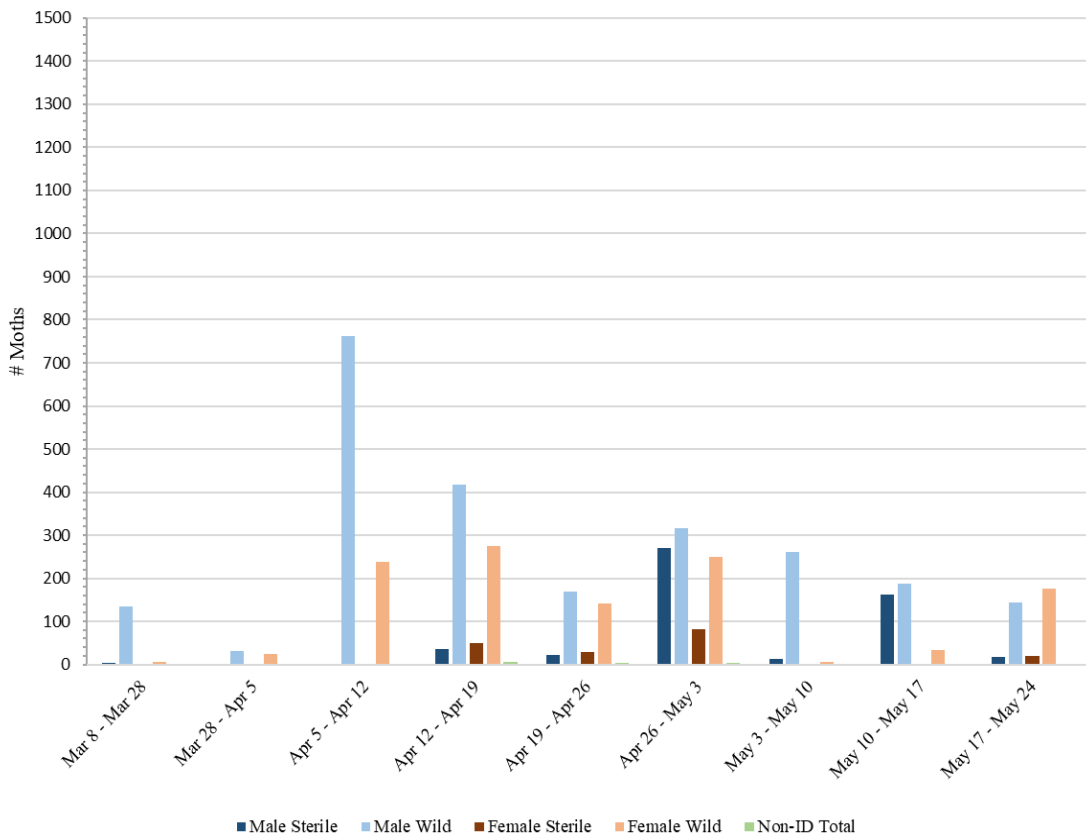
Zone 6 - Pistachio								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
¹ Mar 8 – Mar 28	0	0	51	51	0	196	196	2
Mar 28 – Apr 5	0	0	11	11	0	50	50	0
Apr 5 – Apr 12	0	0	44	44	0	904	904	0
Apr 12 – Apr 19	7	45	179	224	47	229	276	6
Apr 19 – Apr 26	8	6	19	25	206	400	606	1
Apr 26 – May 3	8	29	90	119	215	353	568	2
May 3 – May 10	7	0	14	14	1	97	98	0
May 10 – May 17	7	5	5	10	90	279	369	0
May 17 – May 24	8	7	68	75	16	165	181	0
¹ No traps were serviced in Zone 6 during the weeks of March 17 and March 24 due to excessive rain preventing access								

Zone 6 - Pistachio								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
¹ Mar 8 – Mar 28	0	3	135	138	0	7	7	2
Mar 28 – Apr 5	0	0	31	31	0	25	25	0
Apr 5 – Apr 12	0	0	761	761	0	238	238	2
Apr 12 – Apr 19	7	35	417	452	49	274	323	7
Apr 19 – Apr 26	8	21	169	190	29	142	171	3
Apr 26 – May 3	8	271	317	588	82	249	331	4
May 3 – May 10	7	14	260	274	1	6	7	0
May 10 – May 17	7	162	187	349	0	33	33	0
May 17 – May 24	8	18	143	161	20	176	196	2
¹ No traps were serviced in Zone 6 during the weeks of March 17 and March 24 due to excessive rain preventing access								

Zone 6 - Pistachio Orchard - Meal Baited Traps



Zone 6 - Pistachio Orchard - Phoromone/PPO Baited Traps



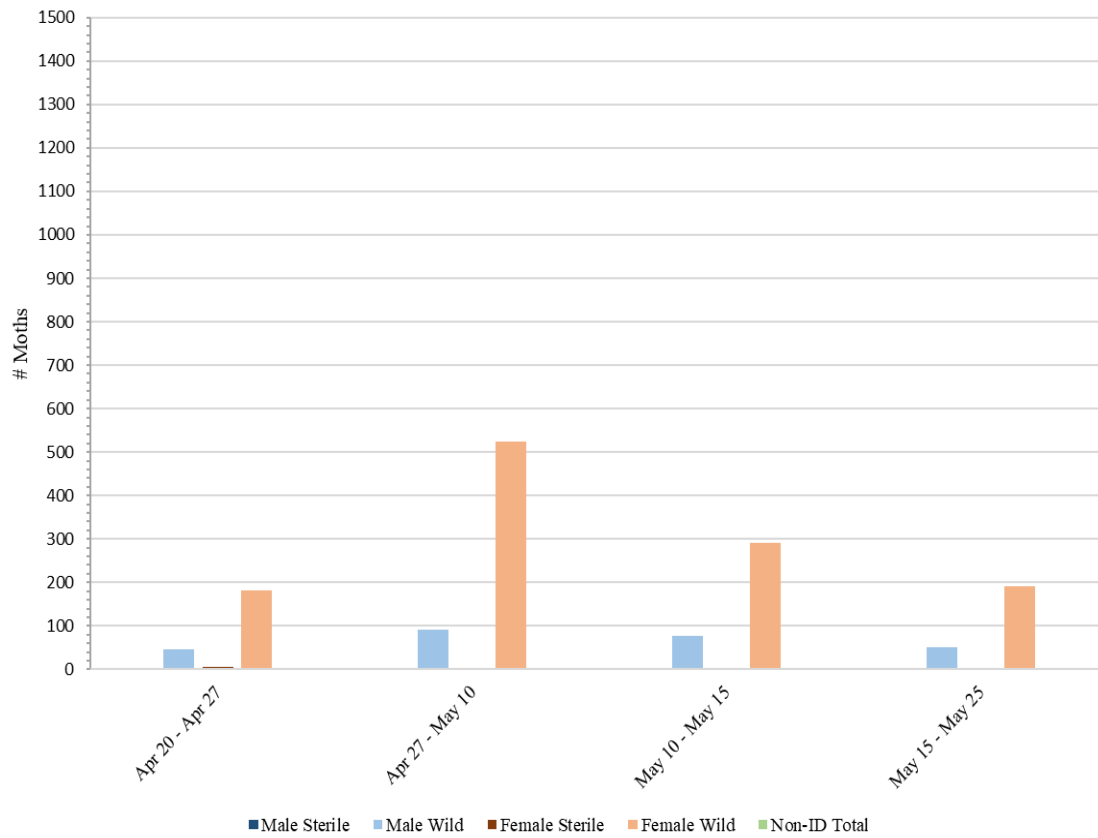
Zone 7 – Almond Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were collected from Zone 7 on Thursday, May 25.

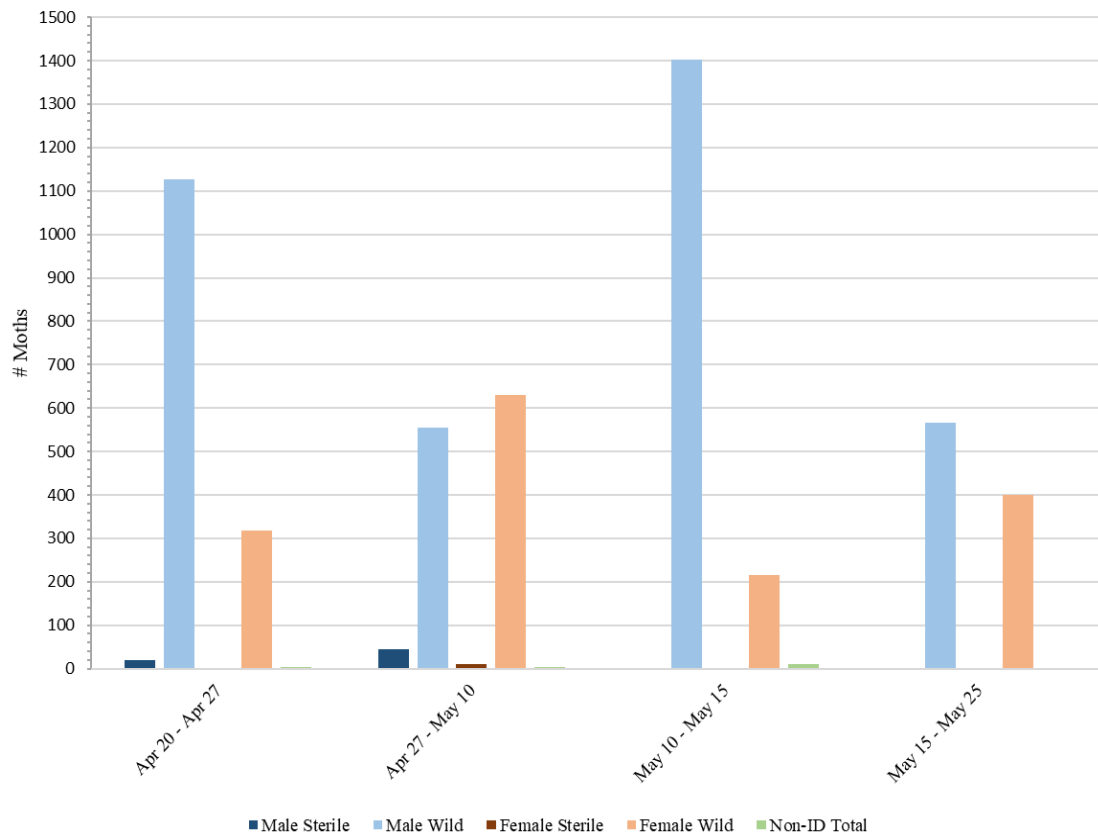
Zone 7 - Almond								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
Apr 20 - Apr 27	4	0	46	46	5	182	187	0
¹ Apr 27 – May 10	0	0	92	92	2	525	527	4
May 10 – May 15	0	0	76	76	0	291	291	1
May 15 – May 25	0	0	51	51	0	190	190	0
¹ No traps were serviced in Zone 7 during the week of May 5 due to excessive muddy conditions preventing access								

Zone 7 - Almond								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
Apr 20 - Apr 27	4	19	1126	1145	0	319	319	4
¹ Apr 27 – May 10	0	44	554	598	10	630	640	3
May 10 – May 15	0	0	1403	1403	0	215	215	10
May 15 – May 25	0	0	567	567	0	399	399	0
¹ No traps were serviced in Zone 7 during the week of May 5 due to excessive muddy conditions preventing access								

Zone 7 - Almond Orchard - Meal Baited Traps



Zone 7 - Almond Orchard - Pheromone/PPO Baited Traps



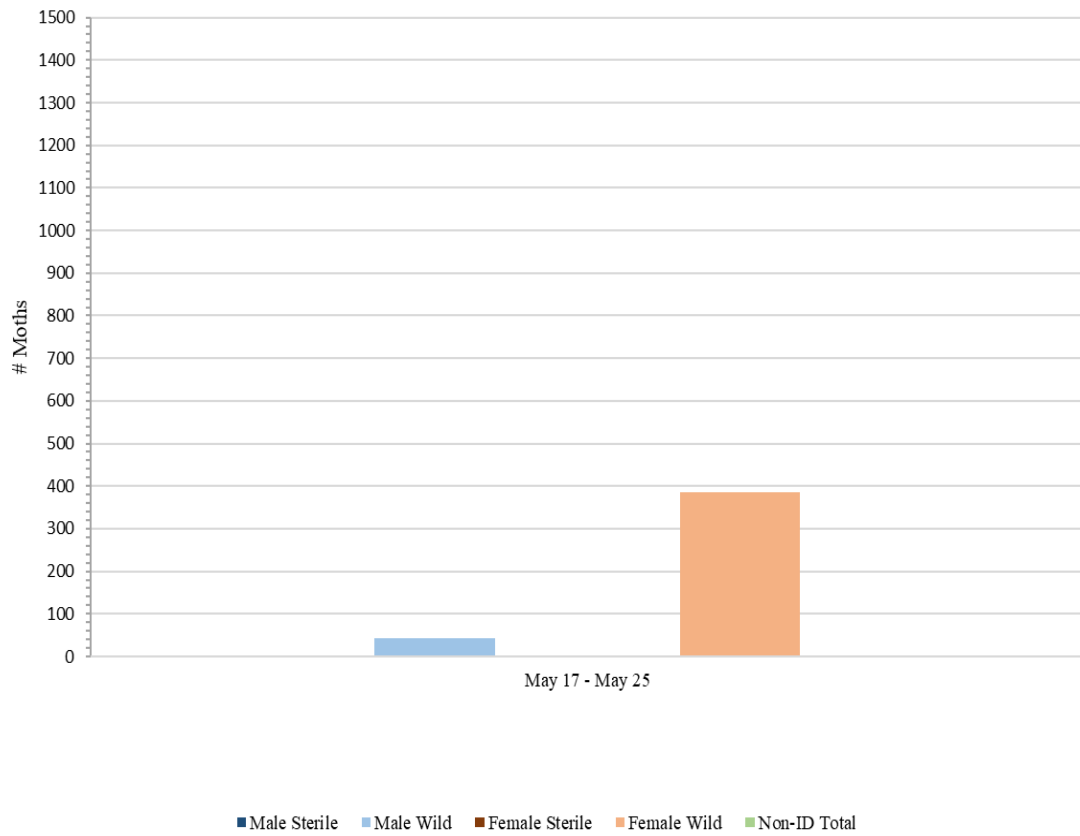
Zone 8 – Almond Orchard

A total of **36** meal-baited traps and **36** pheromone/PPO lure-baited traps were deployed in Zone 8 on Thursday, May 25.

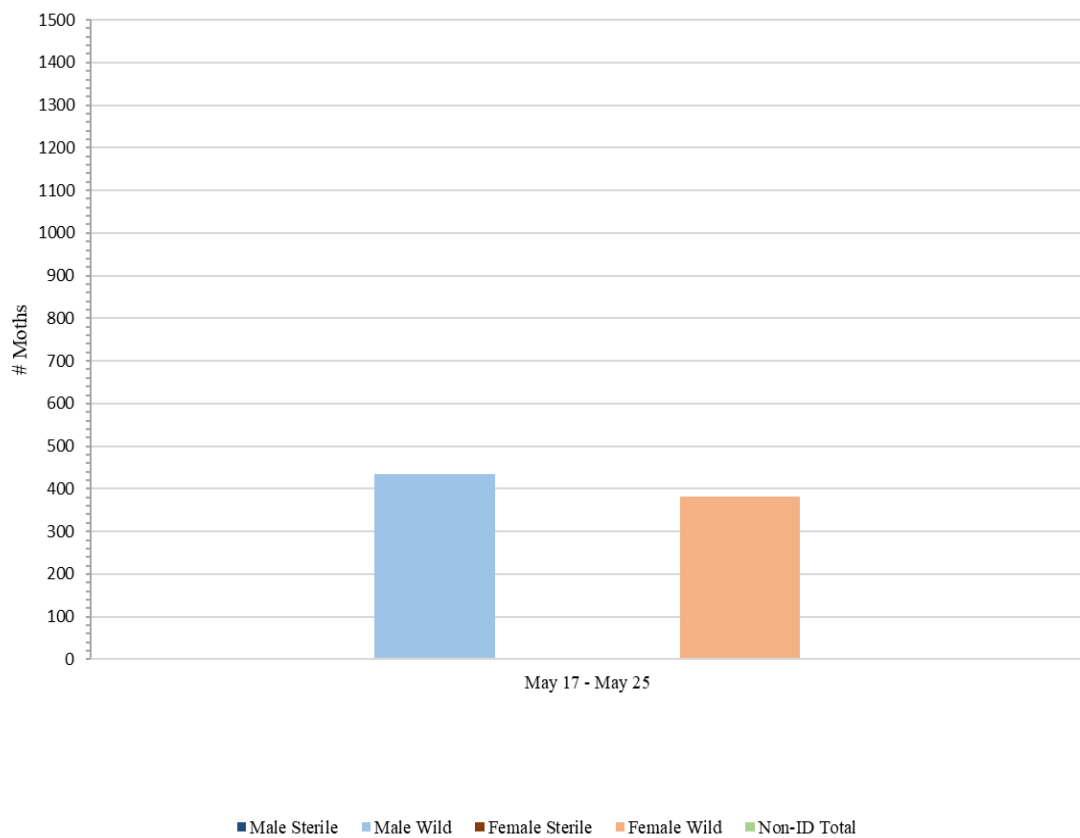
Zone 8 - Almond								
Meal Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
May 17 - May 25	0	0	43	43	1	386	387	0

Zone 8 - Almond								
Pheromone/PPO Lure Baited Traps								
Dates Traps in Field	# of Releases During Trap Period	Male Sterile	Male Wild	Male Total	Female Sterile	Female Wild	Female Total	Non-ID Total
May 17 - May 25	0	0	434	434	0	383	383	0

Zone 8 - Almond Orchard - Meal Baited Traps



Zone 8 - Almond Orchard - Pheromone/PPO Baited Traps



IV. Quality Control

QC tests are performed on samples taken from each shipment of sterile NOW moths. These tests include: zero-hour mortality rates, zero-hour mating dissections, forty-eight-hour mating dissections, seven-day longevity monitoring, and crush tests. Throughout the span of a week, Monday through Sunday, the results of each test are averaged. Below are the QC results from samples of sterile NOW moths for Mag 1, released over Zones 1 and 3, and Mag 2, primarily released over Zones 4 and 6, during the week of Monday, May 15, 2023 to Sunday, May 21, 2023:

Mag 1:

- 1% of moths from samples found dead at zero hour
- 1% of moths from samples found to have mated at zero hour
- 28% of moths from samples found to have mated after forty-eight hours
- 71% of moths from samples remained alive after seven days in BioChamber
- 99% of moths from samples found to have distinct red dye markings

Mag 2:

- 1% of moths from samples found dead at zero hour
- 0% of moths from samples found to have mated at zero hour
- 55% of moths from samples found to have mated after forty-eight hours
- 47% of moths from samples remained alive after seven days in BioChamber
- 95% of moths from samples found to have distinct red dye markings