

Navel Orangeworm Program 2024 – Weekly Report

Week Ending – March 29, 2024

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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 – 2023-2024

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 be a primary 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) and California Department of Food and Agriculture's (CDFA) Phoenix, Arizona Rearing Facility. QC tests are performed on every shipment of NOW SIT moths used for aerial releases.

Releases of sterile NOW moths began on March 20, 2024, with one magazine of approximately 750,000 sterile moths being released daily over select sites in West Fresno County. CDFA is currently conducting ground releases at select sites until aerial releases are available later in the year. Initially, releases will be conducted exclusively over almond sites and will change to being conducted exclusively over pistachio sites later in the year to prioritize periods of crop-specific vulnerability to NOW damage.

Listed below are any circumstances which prevented regular aerial releases in 2024:

March 20 – March 23: Ground releases conducted while aerial releases were unavailable

March 24: No releases conducted due to excessive rain and muddy field conditions preventing access to release sites

March 25 – March 26: Ground releases conducted while aerial releases were unavailable

March 27: No releases conducted due to release equipment issues

March 28 – March 29: Ground releases conducted while aerial releases were unavailable

Navel Orangeworm Trapping

The Phase 2 Area Wide Project Site for 2024 includes eight 640-acre orchards: four pistachio and four almond, located in Fresno County. Trapping is being conducted weekly year-round in all eight orchards, designated as Zones 1 through 8.

Listed below are any circumstances which prevented regular trap servicing in 2024:

- Week of January 5: No traps were serviced due to excessive rain and muddy conditions preventing access to trap sites
- Week of January 12: No traps were serviced in Zones 4 and 6 due to excessive rain and muddy conditions preventing access to trap sites
- Week of January 26: No traps were serviced due to excessive rain and muddy conditions preventing access to trap sites
- Week of February 2: No traps were serviced in Zones 3 and 7 due to pesticide applications on site
- Week of February 9: No traps were serviced due to excessive rain and muddy conditions preventing access to trap sites
- Week of February 16: No traps were serviced in Zones 4 and 8 due to excessive rain and muddy conditions preventing access to trap sites
- Week of February 23: No traps were serviced in Zones 1, 2, 5, 6, and 7 due to excessive rain and muddy conditions preventing access to trap sites
- Week of March 1: No traps were serviced in Zone 8 due to pesticide applications on site
- Week of March 8: No traps were serviced in Zones 4 and 8 due to excessive rain and muddy conditions preventing access to trap sites; Traps 13 – 36 not serviced in Zone 3 due to pesticide applications on site
- Week of March 15: No traps were serviced in Zone 4 due to pesticide applications on site
- Week of March 22: No traps were serviced in Zones 2 and 5 due to pesticide applications on site
- Week of March 29: No traps were serviced in Zone 4 due to pesticide applications on site

II. Project Design

The Area Wide Project Site was restructured in 2023 in preparation for Phase 2 of the Program. Phase 2 aims to 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).

The 2024 Area Wide Project Site includes eight orchards, all of which were established in 2023 and located in Fresno County, identified as Zones 1 through 8. Listed below is information related to each orchard within the Program's Phase 2 project site for 2024:

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

Each zone has a trap site ratio of approximately one 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 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.

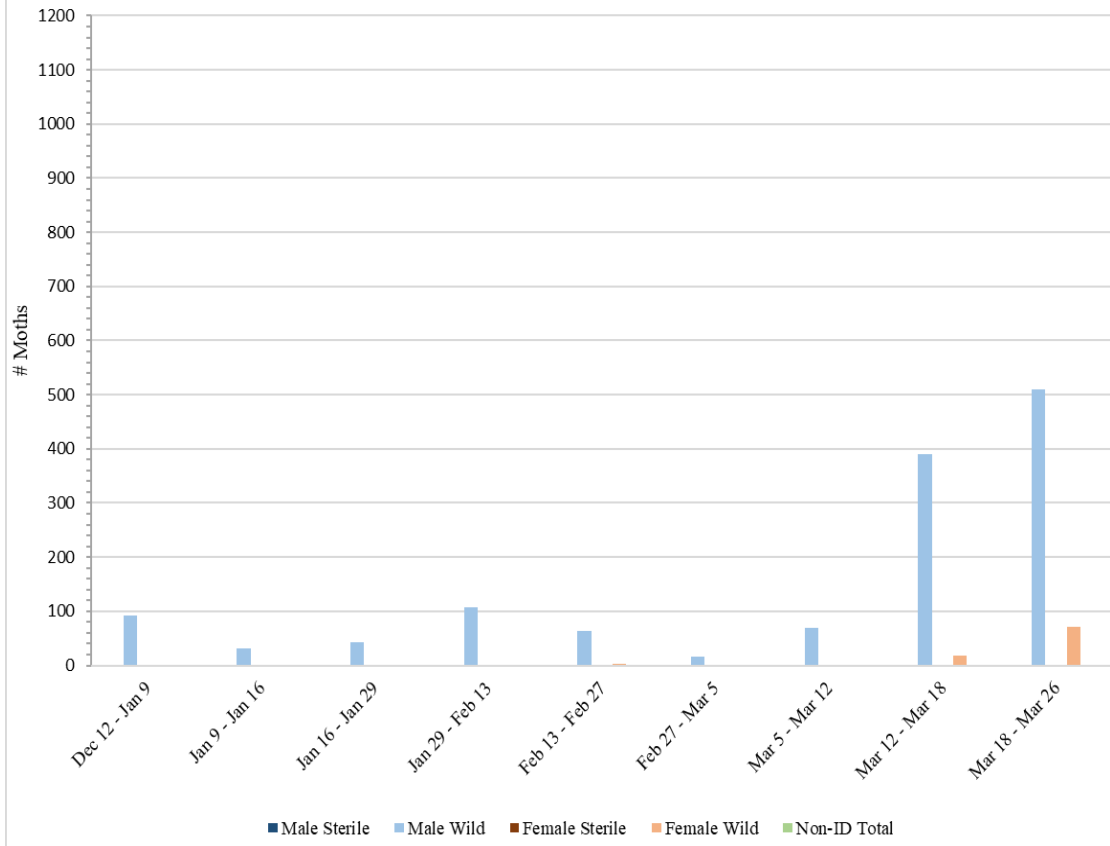
III. Trap Results for Week Ending on March 29, 2024

Zone 1 – Pistachio Orchard

A total of **35** pheromone/PPO lure-baited traps were collected from Zone 1 on Tuesday, March 26. Trap number 32 was missing.

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
¹ Dec 12 – Jan 9	0	0	93	93	0	0	0	0
Jan 9 – Jan 16	0	0	31	31	0	0	0	0
² Jan 16 – Jan 29	0	0	43	43	0	0	0	0
³ Jan 29 – Feb 13	0	0	107	107	0	1	1	0
⁴ Feb 13 – Feb 27	0	0	63	63	0	2	2	0
Feb 27 – Mar 5	0	0	16	16	0	0	0	0
Mar 5 – Mar 12	0	0	69	69	0	1	1	1
Mar 12 – Mar 18	0	0	390	390	0	19	19	0
Mar 18 – Mar 26	0	0	509	509	0	72	72	1
¹ No traps were serviced in Zone 1 during the weeks of December 22, December 29, and January 5 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 1 during the week of January 26 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 1 during the week of February 9 due to excessive rain and muddy conditions preventing access								
⁴ No traps were serviced in Zone 1 during the week of February 23 due to excessive rain and muddy conditions preventing access								

Zone 1 - Pistachio Orchard - Pheromone/PPO Baited Traps

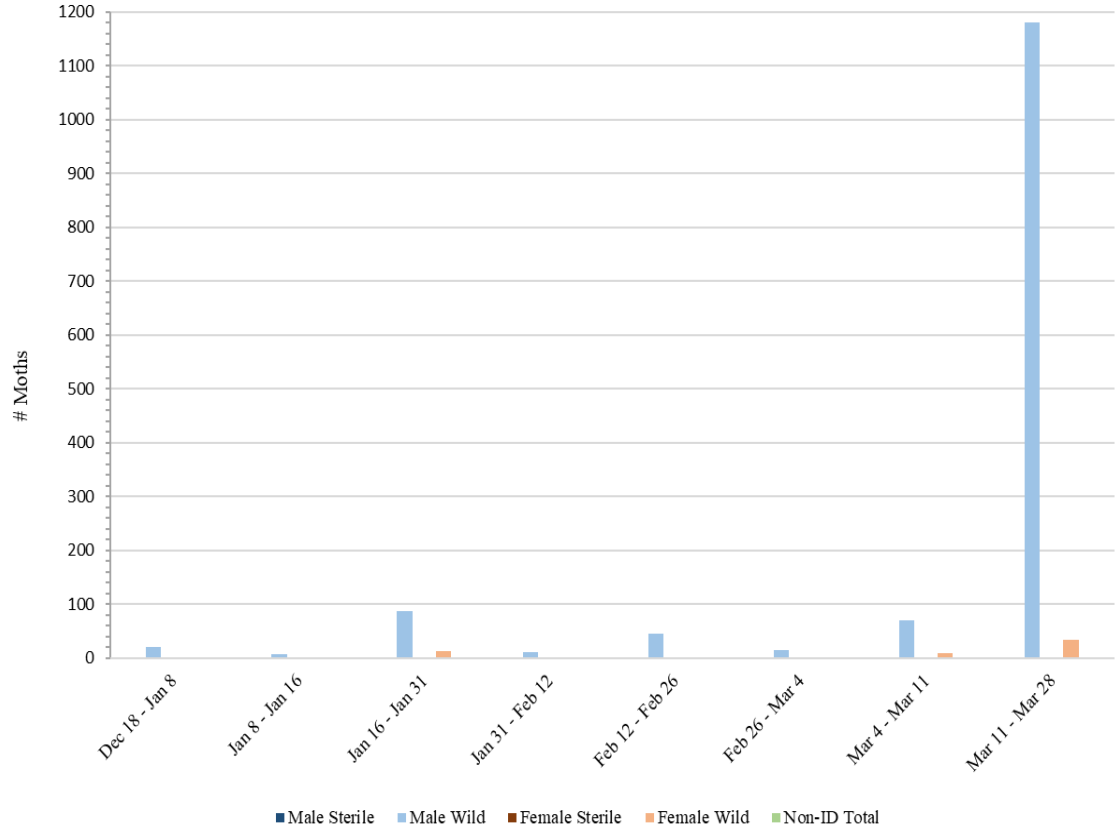


Zone 2 – Pistachio Orchard

A total of **36** pheromone/PPO lure-baited traps were collected from Zone 2 on Thursday, March 28.

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
¹ Dec 18 – Jan 8	0	0	21	21	0	0	0	0
Jan 8 – Jan 16	0	0	7	7	0	0	0	0
² Jan 16 – Jan 31	0	0	87	87	0	12	12	0
³ Jan 31 – Feb 12	0	0	11	11	0	0	0	0
⁴ Feb 12 – Feb 26	0	0	45	45	0	0	0	0
Feb 26 – Mar 4	0	0	14	14	0	0	0	0
Mar 4 – Mar 11	0	0	69	69	0	8	8	0
⁵ Mar 11 – Mar 28	0	0	1180	1180	0	33	33	2
¹ No traps were serviced in Zone 2 during the weeks of December 29 and January 5 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 2 during the week of January 26 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 2 during the week of February 9 due to excessive rain and muddy conditions preventing access								
⁴ No traps were serviced in Zone 2 during the week of February 23 due to excessive rain and muddy conditions preventing access								
⁵ No traps were serviced in Zone 2 during the week of March 22 due to pesticide applications on site								

Zone 2 - Pistachio Orchard - Pheromone/PPO Baited Traps

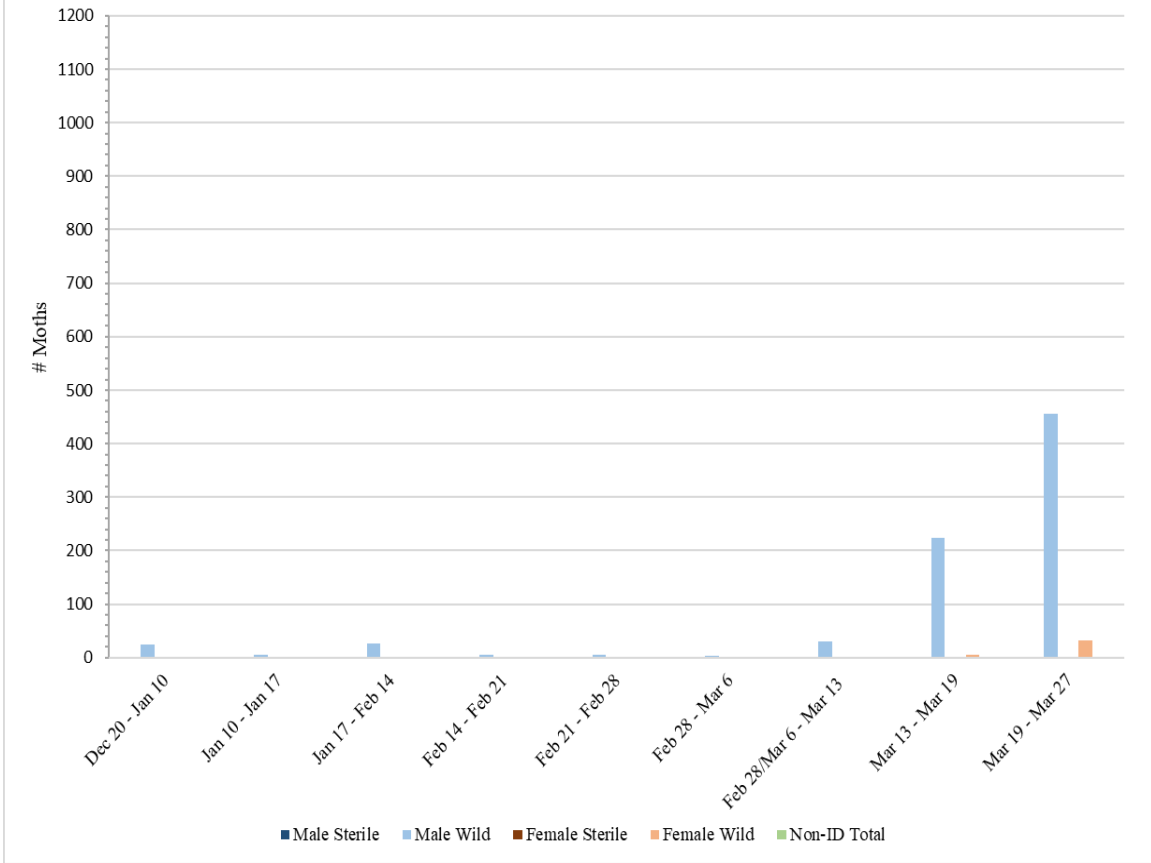


Zone 3 – Almond Orchard

A total of **36** pheromone/PPO lure-baited traps were collected from Zone 3 on Wednesday, March 27.

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
¹ Dec 20 – Jan 10	0	0	24	24	0	0	0	0
Jan 10 – Jan 17	0	0	5	5	0	0	0	0
² Jan 17 – Feb 14	0	0	26	26	0	0	0	2
Feb 14 – Feb 21	0	0	5	5	0	0	0	0
Feb 21 – Feb 28	0	0	5	5	0	0	0	0
³ Feb 28 – Mar 6	0	0	3	3	0	0	0	0
⁴ Feb 28/Mar 6 – Mar 13	0	0	31	31	0	0	0	0
Mar 13 – Mar 19	0	0	223	223	0	6	6	0
Mar 19 – Mar 27	0	0	455	455	0	32	32	1
¹ No traps were serviced in Zone 3 during the weeks of December 29 and January 5 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 3 during the weeks of January 26 and February 9 due to excessive rain and muddy conditions preventing access; No traps were serviced in Zone 3 during the week of February 2 due to pesticide applications on site								
³ Traps 13 - 36 not serviced in Zone 3 during the week of March 8 due to pesticide applications on site								
⁴ Traps 13 - 36 in field since February 28								

Zone 3 - Almond Orchard - Pheromone/PPO Baited Traps

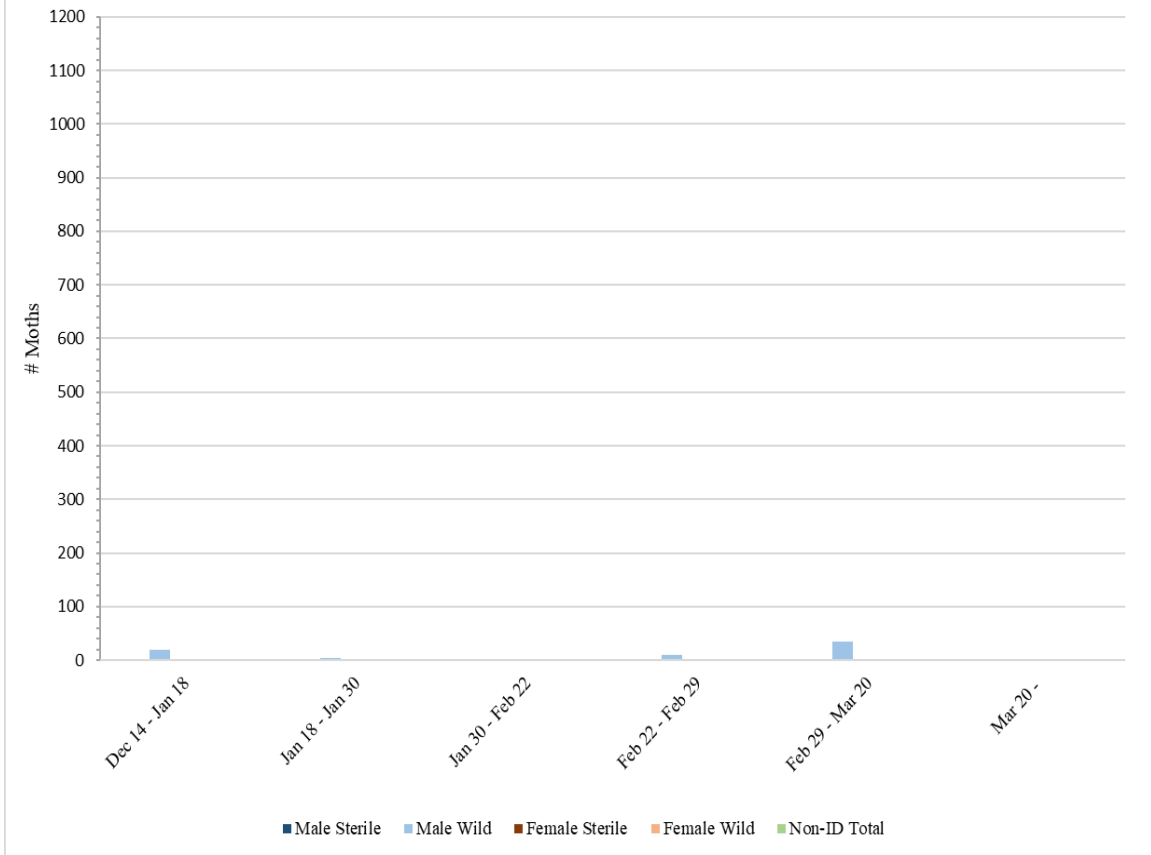


Zone 4 – Almond Orchard

No traps were collected from Zone 4 during the week of March 29 due to pesticide applications on site.

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 Dec 14 – Jan 18	0	0	20	20	0	1	1	0
² Jan 18 – Jan 30	0	0	4	4	0	0	0	0
³ Jan 30 – Feb 22	0	0	3	3	0	0	0	1
Feb 22 – Feb 29	0	0	10	10	0	0	0	0
⁴ Feb 29 – Mar 20	0	0	35	35	0	0	0	0
⁵ Mar 20 -								
¹ No traps were serviced in Zone 4 during the weeks of December 22, December 29, January 5, and January 12 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 4 during the week of January 26 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 4 during the weeks of February 9 and February 16 due to excessive rain and muddy conditions preventing access								
⁴ No traps were serviced in Zone 4 during the week of March 8 due to excessive rain and muddy conditions preventing access; No traps were serviced in Zone 4 during the week of March 15 due to pesticide applications on site								
⁵ No traps were serviced in Zone 4 during the week of March 29 due to pesticide applications on site								

Zone 4 - Almond Orchard - Pheromone/PPO Baited Traps

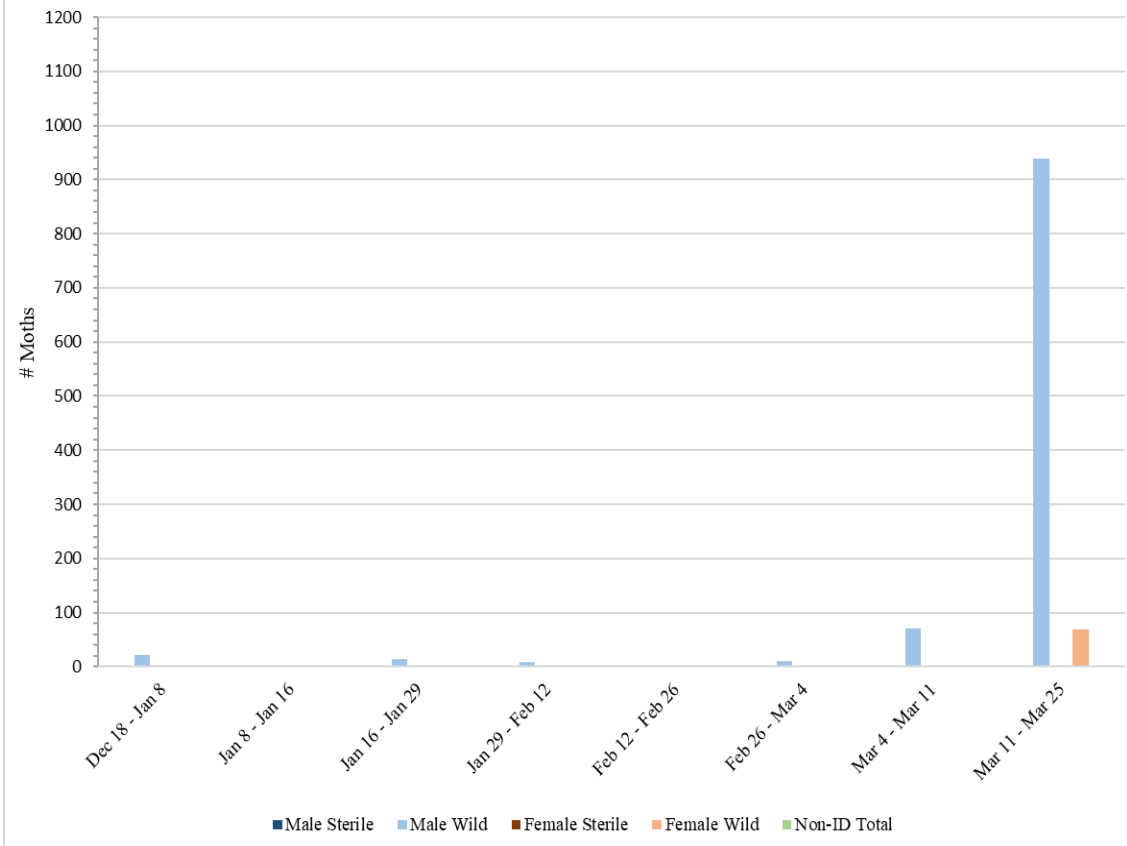


Zone 5 – Pistachio Orchard

A total of **36** pheromone/PPO lure-baited traps were collected from Zone 5 on Monday, March 25.

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 Dec 18 – Jan 8	0	0	21	21	0	0	0	0
Jan 8 – Jan 16	0	0	2	2	0	0	0	0
² Jan 16 – Jan 29	0	0	14	14	0	1	1	0
³ Jan 29 – Feb 12	0	0	8	8	0	0	0	0
⁴ Feb 12 – Feb 26	0	0	0	0	0	0	0	0
Feb 26 – Mar 4	0	0	11	11	0	0	0	0
Mar 4 – Mar 11	0	0	70	70	0	1	1	0
⁵ Mar 11 – Mar 25	0	0	938	938	0	68	68	0
¹ No traps were serviced in Zone 5 during the weeks of December 29 and January 5 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 5 during the week of January 26 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 5 during the week of February 9 due to excessive rain and muddy conditions preventing access								
⁴ No traps were serviced in Zone 5 during the week of February 23 due to excessive rain and muddy conditions preventing access								
⁵ No traps were serviced in Zone 5 during the week of March 22 due to pesticide applications on site								

Zone 5 - Pistachio Orchard - Pheromone/PPO Baited Traps

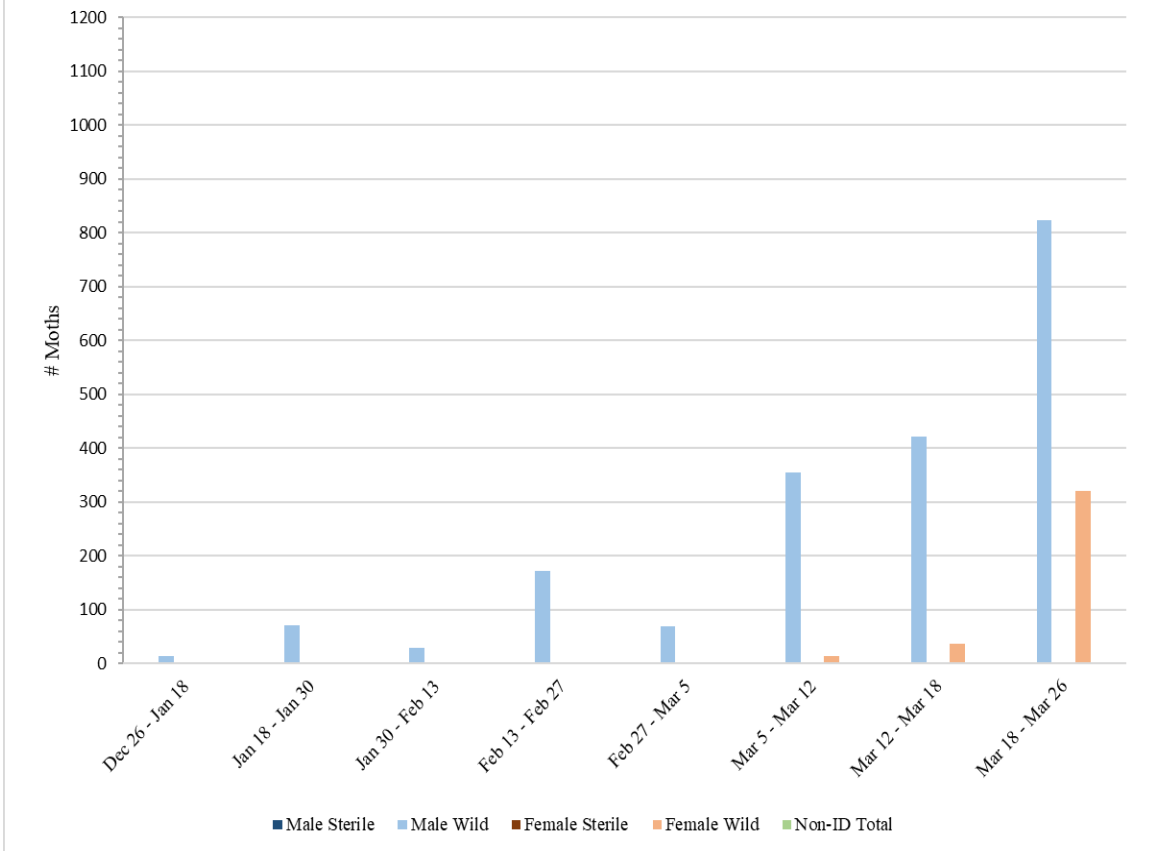


Zone 6 – Pistachio Orchard

A total of **36** pheromone/PPO lure-baited traps were collected from Zone 6 on Tuesday, March 26.

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 Dec 26 – Jan 18	0	0	14	14	0	0	0	0
² Jan 18 – Jan 30	0	0	71	71	0	0	0	0
³ Jan 30 – Feb 13	0	0	28	28	0	2	2	0
⁴ Feb 13 – Feb 27	0	0	172	172	0	1	1	0
Feb 27 – Mar 5	0	0	68	68	0	2	2	1
Mar 5 – Mar 12	0	0	355	355	0	13	13	0
Mar 12 – Mar 18	0	0	422	422	0	36	36	0
Mar 18 – Mar 26	0	0	823	823	0	321	321	2
¹ No traps were serviced in Zone 6 during the weeks of January 5 and January 12 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 6 during the week of January 26 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 6 during the week of February 9 due to excessive rain and muddy conditions preventing access								
⁴ No traps were serviced in Zone 6 during the week of February 23 due to excessive rain and muddy conditions preventing access								

Zone 6 - Pistachio Orchard - Phoromone/PPO Baited Traps

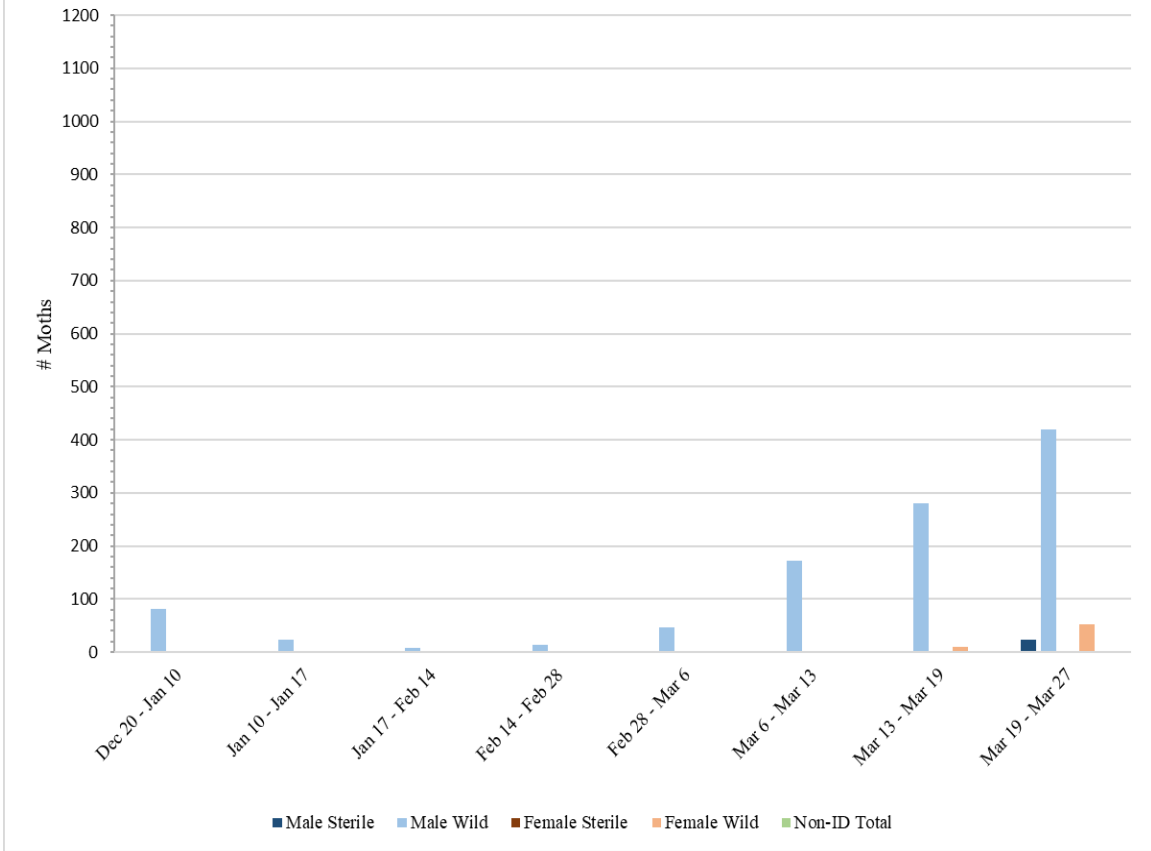


Zone 7 – Almond Orchard

A total of **36** pheromone/PPO lure-baited traps were collected from Zone 7 on Wednesday, March 27.

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
¹ Dec 20 – Jan 10	0	0	81	81	0	0	0	0
Jan 10 – Jan 17	0	0	24	24	0	1	1	0
² Jan 17 – Feb 14	0	0	8	8	0	0	0	0
³ Feb 14 – Feb 28	0	0	14	14	0	0	0	0
Feb 28 – Mar 6	0	0	46	46	0	0	0	0
Mar 6 – Mar 13	0	0	173	173	0	0	0	0
Mar 13 – Mar 19	0	0	280	280	0	10	10	0
Mar 19 – Mar 27	3	23	419	442	3	53	56	0
¹ No traps were serviced in Zone 7 during the weeks of December 29 and January 5 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 7 during the weeks of January 26 and February 9 due to excessive rain and muddy conditions preventing access; No traps were serviced in Zone 7 during the week of February 2 due to pesticide applications on site								
³ No traps were serviced in Zone 7 during the week of February 23 due to excessive rain and muddy conditions preventing access								

Zone 7 - Almond Orchard - Pheromone/PPO Baited Traps

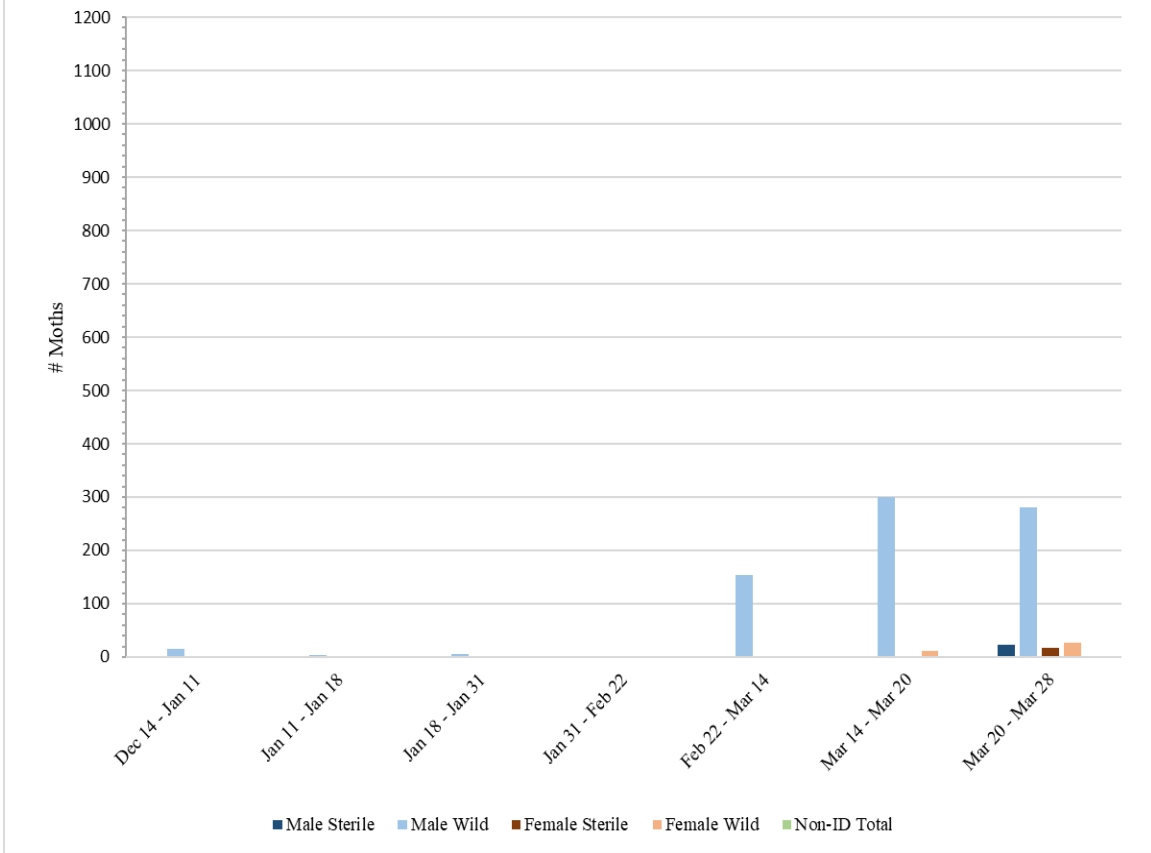


Zone 8 – Almond Orchard

A total of **36** pheromone/PPO lure-baited traps were collected from Zone 8 on Thursday, March 28.

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
¹ Dec 14 – Jan 11	0	0	16	16	0	0	0	0
Jan 11 – Jan 18	0	0	3	3	0	0	0	0
² Jan 18 – Jan 31	0	0	6	6	0	0	0	0
³ Jan 31 – Feb 22	0	0	2	2	0	0	0	0
⁴ Feb 22 – Mar 14	0	0	153	153	0	1	1	0
Mar 14 – Mar 20	0	0	299	299	0	11	11	0
Mar 20 – Mar 28	3	22	281	303	17	27	44	1
¹ No traps were serviced in Zone 8 during the weeks of December 22, December 29, and January 5 due to excessive rain and muddy conditions preventing access								
² No traps were serviced in Zone 8 during the week of January 26 due to excessive rain and muddy conditions preventing access								
³ No traps were serviced in Zone 8 during the weeks of February 9 and February 16 due to excessive rain and muddy conditions preventing access								
⁴ No traps were serviced in Zone 8 during the week of March 1 due to pesticide applications on site; No traps were serviced in Zone 8 during the week of March 8 due to excessive rain and muddy conditions preventing access								

Zone 8 - Almond Orchard - Pheromone/PPO Baited Traps



IV. NOW Degree Days

NOW Degree days begin to accumulate when ambient temperatures remain between the lower threshold of 55° F and the upper threshold of 93.9° F. Using data from weather stations nearest to the trap sites, courtesy of the UC IPM website - https://ipm.ucanr.edu/PHENOLOGY/ma-navel_orangeworm.html, the chart below shows daily and total accumulated degree days since January 1, 2024. The model uses a double triangle and vertical cutoff method of calculating degree days.

Weather Station Location: Five Points, Fresno

Date	Air Temperatures (°F)		Degree Days	
	Min	Max	Daily	Accumulated
1/1/2024	43	57	0.15	0.15
1/2/2024	44	53	0.00	0.15
1/3/2024	42	58	0.25	0.40
1/4/2024	37	54	0.00	0.40
1/5/2024	37	56	0.02	0.42
1/6/2024	34	50	0.00	0.42
1/7/2024	33	52	0.00	0.42
1/8/2024	29	53	0.00	0.42
1/9/2024	28	56	0.04	0.46
1/10/2024	47	59	0.48	0.93
1/11/2024	31	54	0.00	0.93
1/12/2024	26	54	0.00	0.93
1/13/2024	34	51	0.00	0.93
1/14/2024	40	62	1.32	2.26
1/15/2024	46	56	0.05	2.30
1/16/2024	45	51	0.00	2.30
1/17/2024	37	57	0.10	2.41
1/18/2024	38	59	0.46	2.86
1/19/2024	44	62	1.91	4.77
1/20/2024	52	64	2.44	7.21
1/21/2024	37	56	0.05	7.26
1/22/2024	49	60	1.09	8.34
1/23/2024	48	62	1.75	10.09
1/24/2024	48	57	0.18	10.28
1/25/2024	43	62	1.20	11.48
1/26/2024	40	63	1.50	12.97
1/27/2024	43	62	1.26	14.23
1/28/2024	42	68	3.19	17.42
1/29/2024	41	73	4.85	22.27
1/30/2024	38	61	1.29	23.56
1/31/2024	51	71	5.87	29.42
2/1/2024	47	62	1.50	30.92
2/2/2024	44	60	0.69	31.61
2/3/2024	39	55	0.00	31.61
2/4/2024	47	59	0.62	32.23
2/5/2024	45	63	1.78	34.01
2/6/2024	45	58	0.31	34.31
2/7/2024	41	56	0.03	34.34
2/8/2024	39	53	0.00	34.34
2/9/2024	35	55	0.00	34.34

2/10/2024	36	56	0.02	34.37
2/11/2024	31	61	0.63	35.00
2/12/2024	34	62	0.91	35.91
2/13/2024	36	63	1.26	37.17
2/14/2024	39	65	2.15	39.32
2/15/2024	44	60	0.76	40.08
2/16/2024	43	62	1.52	41.60
2/17/2024	48	61	1.38	42.98
2/18/2024	48	67	4.01	46.99
2/19/2024	50	67	3.92	50.91
2/20/2024	47	66	2.76	53.67
2/21/2024	40	65	2.04	55.71
2/22/2024	41	65	2.13	57.84
2/23/2024	42	64	1.84	59.68
2/24/2024	42	71	4.27	63.95
2/25/2024	40	72	4.84	68.79
2/26/2024	44	61	1.06	69.85
2/27/2024	44	62	1.19	71.04
2/28/2024	38	69	3.33	74.37
2/29/2024	41	66	2.59	76.95
3/1/2024	44	66	3.06	80.01
3/2/2024	48	56	0.05	80.06
3/3/2024	43	60	0.65	80.71
3/4/2024	38	60	0.73	81.44
3/5/2024	46	66	2.83	84.27
3/6/2024	43	66	2.91	87.18
3/7/2024	47	63	1.67	88.84
3/8/2024	39	67	2.67	91.51
3/9/2024	41	68	3.40	94.92
3/10/2024	45	68	3.46	98.38
3/11/2024	42	68	3.74	102.12
3/12/2024	48	67	3.46	105.58
3/13/2024	44	70	4.04	109.61
3/14/2024	40	68	3.13	112.75
3/15/2024	42	70	3.71	116.46
3/16/2024	37	73	4.86	121.32
3/17/2024	42	74	5.64	126.96
3/18/2024	42	77	7.36	134.33
3/19/2024	46	79	8.73	143.05
3/20/2024	46	79	8.73	151.78
3/21/2024	46	74	6.69	158.47
3/22/2024	48	79	8.65	167.12
3/23/2024	43	64	1.81	168.93
3/24/2024	40	62	1.07	169.99
3/25/2024	38	67	2.48	172.48
3/26/2024	38	68	2.92	175.39
3/27/2024	40	73	6.14	181.53
3/28/2024	51	65	3.10	184.63
3/29/2024	46	63	1.88	186.51

V. 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, primarily released over Zones 7 and 8, during the week of Monday, March 18, 2024 to Sunday, March 24, 2024:

- 0% of moths from samples found dead at zero hour
- 1% of moths from samples found to have mated at zero hour
- 57% of moths from samples found to have mated after forty-eight hours
- 84% of moths from samples remained alive after seven days in BioChamber
- 86% of moths from samples found to have distinct red dye markings