Fresh Pond Reservation Census Program

2017 Data Collection Summary

Updated May 2020

Program Outline

- Purpose
- Methods
  - Data collection
  - Quality control
  - Data exclusions
  - Data analysis
- Results
  - Annual overview
  - EcoCounter sensor data by site
  - Visual survey results
- Future Goals

Purpose

- To *quantify* and *qualify* users at Fresh Pond Reservation in order to inform management
  - Sensors at reservation entrances, the bike path, and perimeter road give an idea of user distribution throughout the day
  - Multi sensors differentiate between bike and pedestrian users

Methods

Methods • *Data Collection*

- Strategically-placed EcoCounter sensors at entrances and along perimeter road quantified Fresh Pond users
  - EcoCounter Pyro sensors count any heat producing body over 3ft tall
  - EcoCounter Multi sensors differentiate between pedestrians and cyclists
  - Sensors collect data in 15 minute intervals which is saved to an online database
- Visual surveys were conducted at sensor locations to further categorize users at Fresh Pond

EcoCounter Sensors

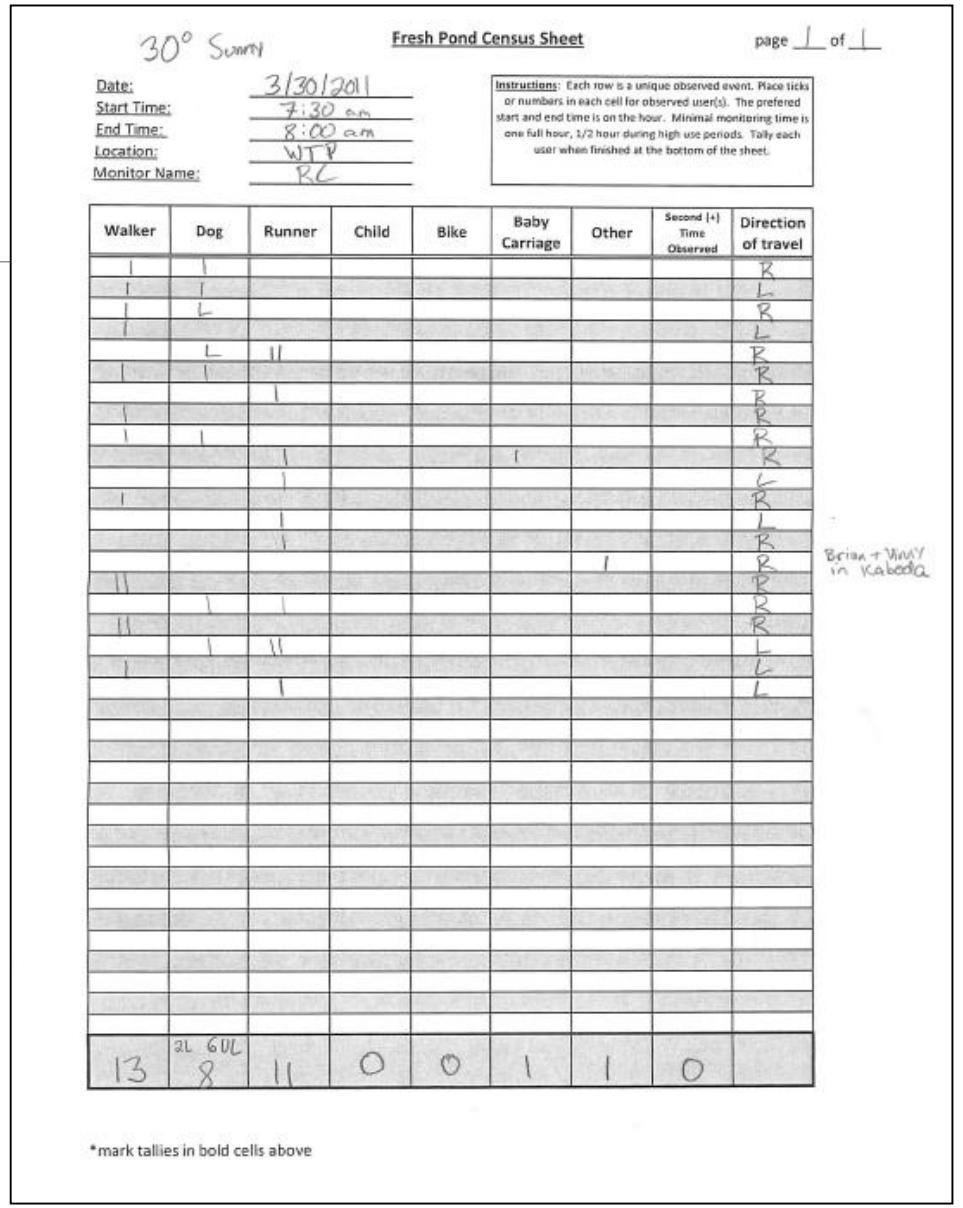
MULTI SENSOR

PYRO SENSOR

Visual Surveys

- Employee or volunteer conducted surveys next to sensor
- Recorded direction of travel and type of users
- Types of users included:
  - Pedestrians
  - Dogs (on/off leash)
  - Cyclists
  - Runners
  - Children
- Real-time feedback with the EcoCounter Android app helped to verify grouped events

Example Survey Datasheet



30° Sunny

Fresh Pond Census Sheet

page 1 of 1

Date: 3/30/2011
Start Time: 7:30 am
End Time: 8:00 am
Location: WTP
Monitor Name: RC

Instructions: Each row is a unique observed event. Place ticks or numbers in each cell for observed user(s). The prefered start and end time is on the hour. Minimal monitoring time is one full hour, 1/2 hour during high use periods. Tally each user when finished at the bottom of the sheet.

Walker	Dog	Runner	Child	Bike	Baby Carriage	Other	Second (+) Time Observed	Direction of travel
13	2L 6UL 8	11	0	0	1	1	0	

Brian + Vinny in Kabodia

*mark tallies in bold cells above

EcoCounter Sensor Locations

Entrances:

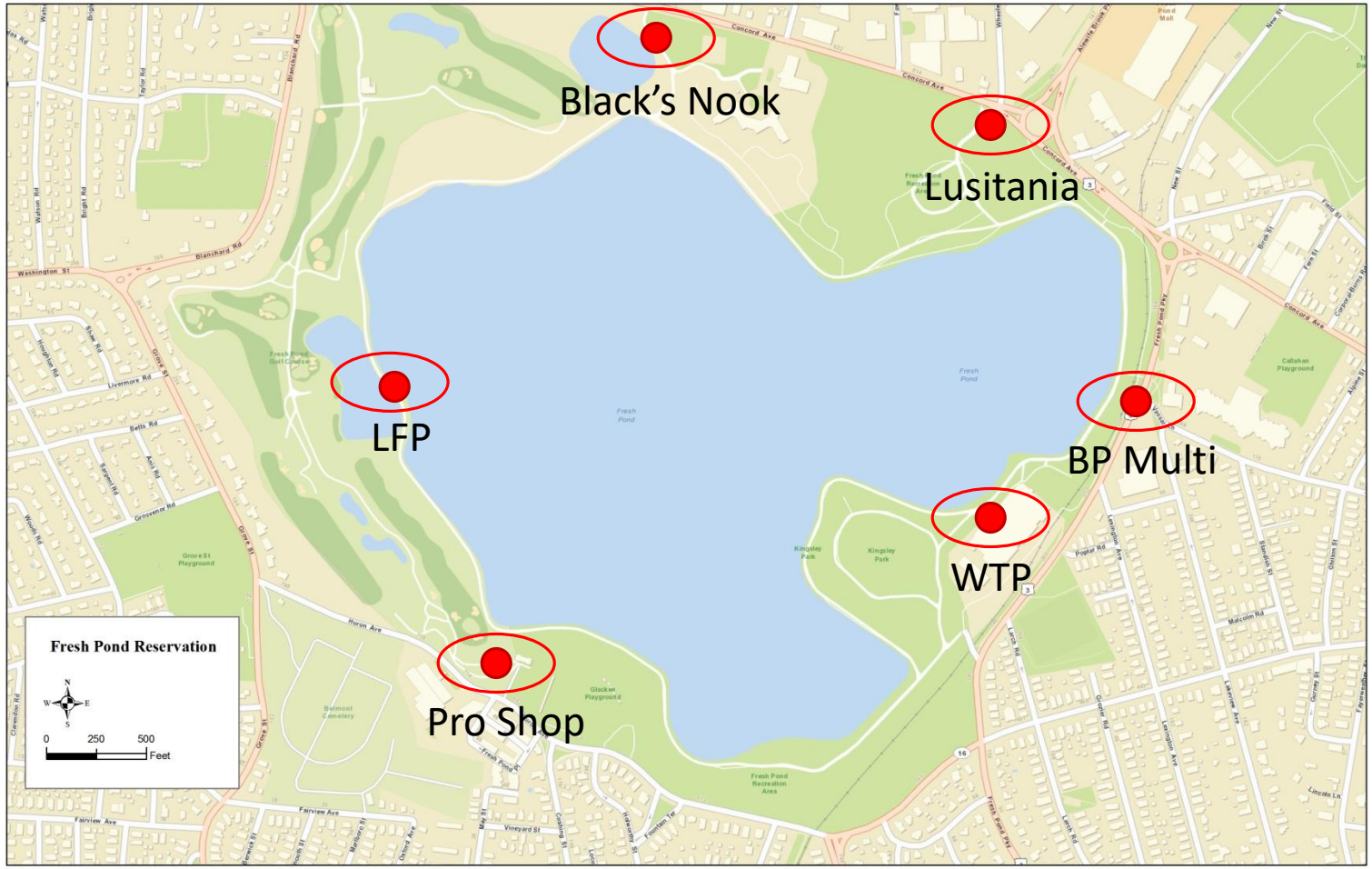
Black's Nook, Lusitania, and Pro Shop

Perimeter Road:

LFP and WTP

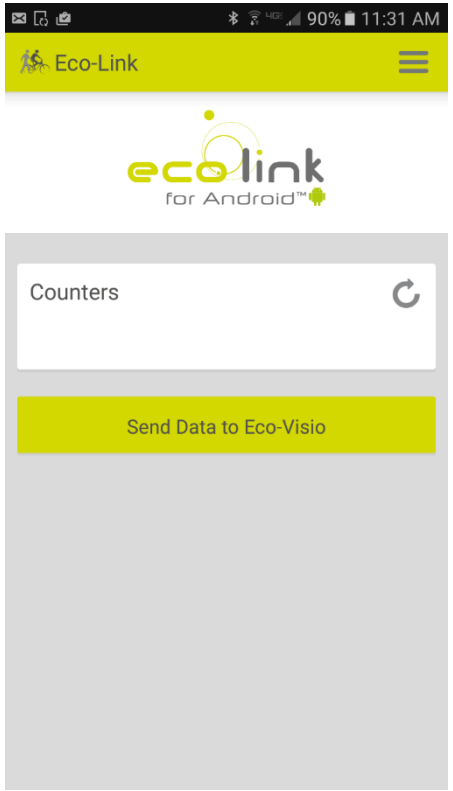
Multi Sensors:

WTP and BP Multi



Methods • *Quality Control*

- Sensors were visited weekly and checked for physical damage or environmental changes
- Data were downloaded and screened for anomalies weekly
- Sensor data were compared against visual survey data to identify any incongruities



EcoCounter Data Collection App

Methods • *2017 Data Exclusions*

Data exclusions were necessary when sensors recorded erroneous counts or when censors were offline for repairs

WTP Multi
- 1/11-1/13: Temporary issue with pedestrian and cyclists counts after sensor replacement
- 8/23/2017: Battery replacement

Lusitania
- 1/8-1/10 and 2/10-2/11: Abnormally high counts due to snow
- 6/28-7/5: Bug and web blocking sensor
- 12/26- 1/11/18: Abnormally high counts, likely environmental interference

Black's Nook
- 11/30: Brief abnormally high counts, likely someone standing in front of sensor

BP Multi
- 2/28, 4/20-5/25: Interference from construction caused abnormal counts, replaced battery

Methods • *Data Exclusions or Errors, All Years*

Sensor	2011	2012	2013	2014	2015	2016	2017
LFP	• Installed 1/6 • 8/1-9/28	• 11/13-1/2	• 2/4-2/19	• 1/17-1/22 • 4/15-4/23	• 2/2-2/4 • 2/9-2/11		
WTP	• Installed 1/7 • 11/7-12/1	• 6/29-7/26 • 11/15-12/3	• Bike counter installed 11/18	• 2/16-3/21 (Out counts only. Total counts unaffected.) • 7/1-10/31 • 11/4-11/6	• 1/27 • 2/2-2/4 • 2/9-2/11 • 2/15-2/17 • 2/19 • 6/30	• 2/2-3/3 (periodic anomalous bike counts excluded) • 7/3 • 7/5 • 11/14-12/14 (periodic anomalous bike counts excluded)	• 1/11-1/13 • 8/23
Black's Nook		• Installed 10/26 • 12/3-12/31	• 1/1-1/2 • 4/4-5/8	• 16-Apr			• 11/30
Lusitania				• Installed 4/11	• 2/9-2/11		• 1/8-1/10 • 2/10-2/11 • 6/28-7/5 • 12/26-1/11/18
BP Multi			• Installed 11/19	• 4/16	• 2/2-2/4 • 2/15-2/17 • 2/19 • 8/4-8/5 • 8/24	• 7/11 • 8/15 • 9/26	• 2/28 • 4/20-5/25
Pro Shop				• Installed 6/27	• 2/9-2/11		

Methods • *Data Analysis*

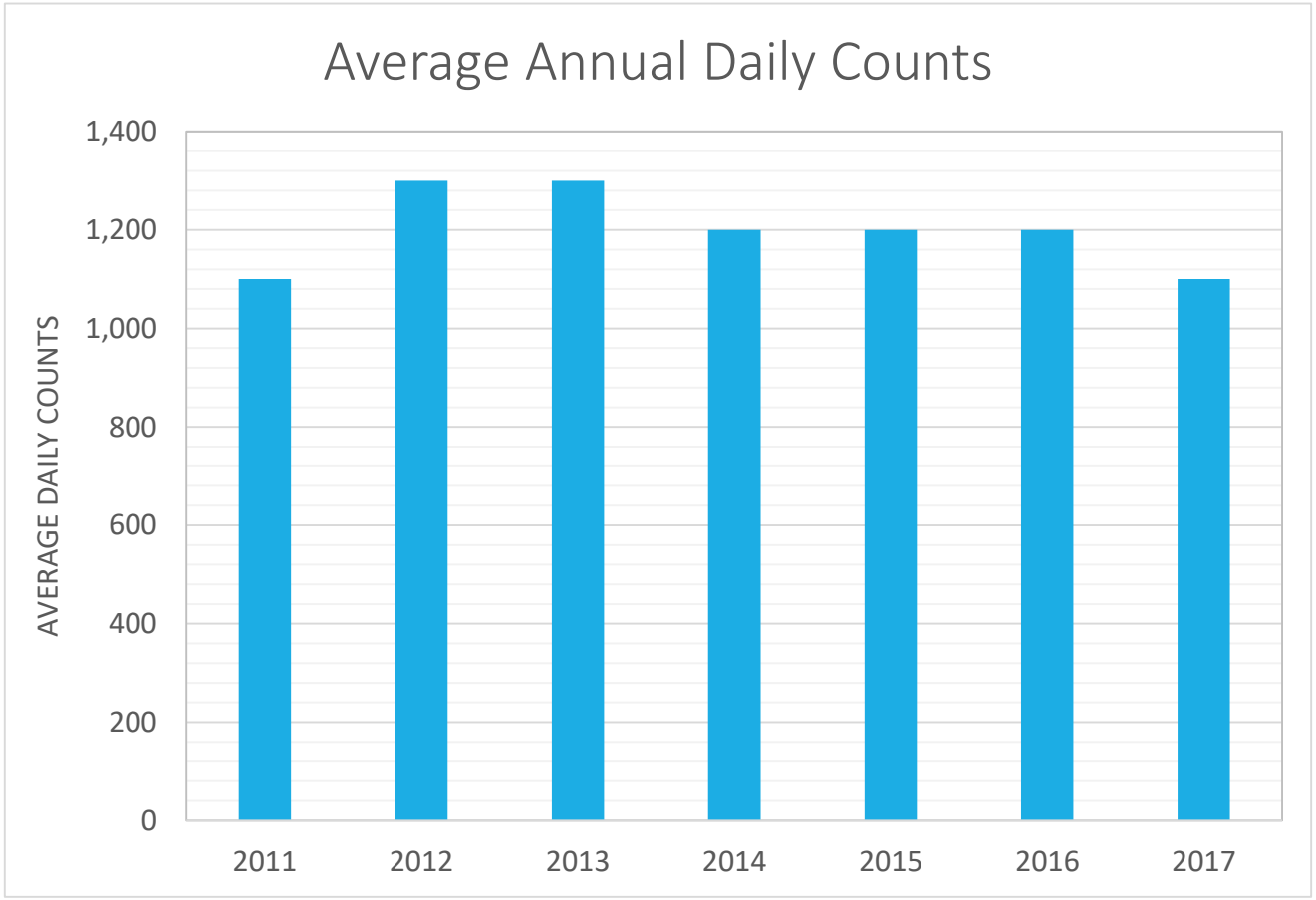
- Sensor results were grouped by location as being representative of the Entrances or the Perimeter Road
- Multi sensors were used to quantify cyclists separately from pedestrians
- Data were analyzed on yearly, monthly, daily, and hourly time scales to understand trends
- Data were presented as total counts (total of In and Out counts)
  - Counts may include users who pass sensors multiple times
- Visual surveys were compared to EcoCounter data to estimate sensor error and to characterize types of users

Results· *Annual Overview*

Results • *Daily Overview*

Year	Average Annual Daily Counts*
2011	1,100
2012	1,300
2013	1,300
2014	1,200
2015	1,200
2016	1,200
2017	1,100

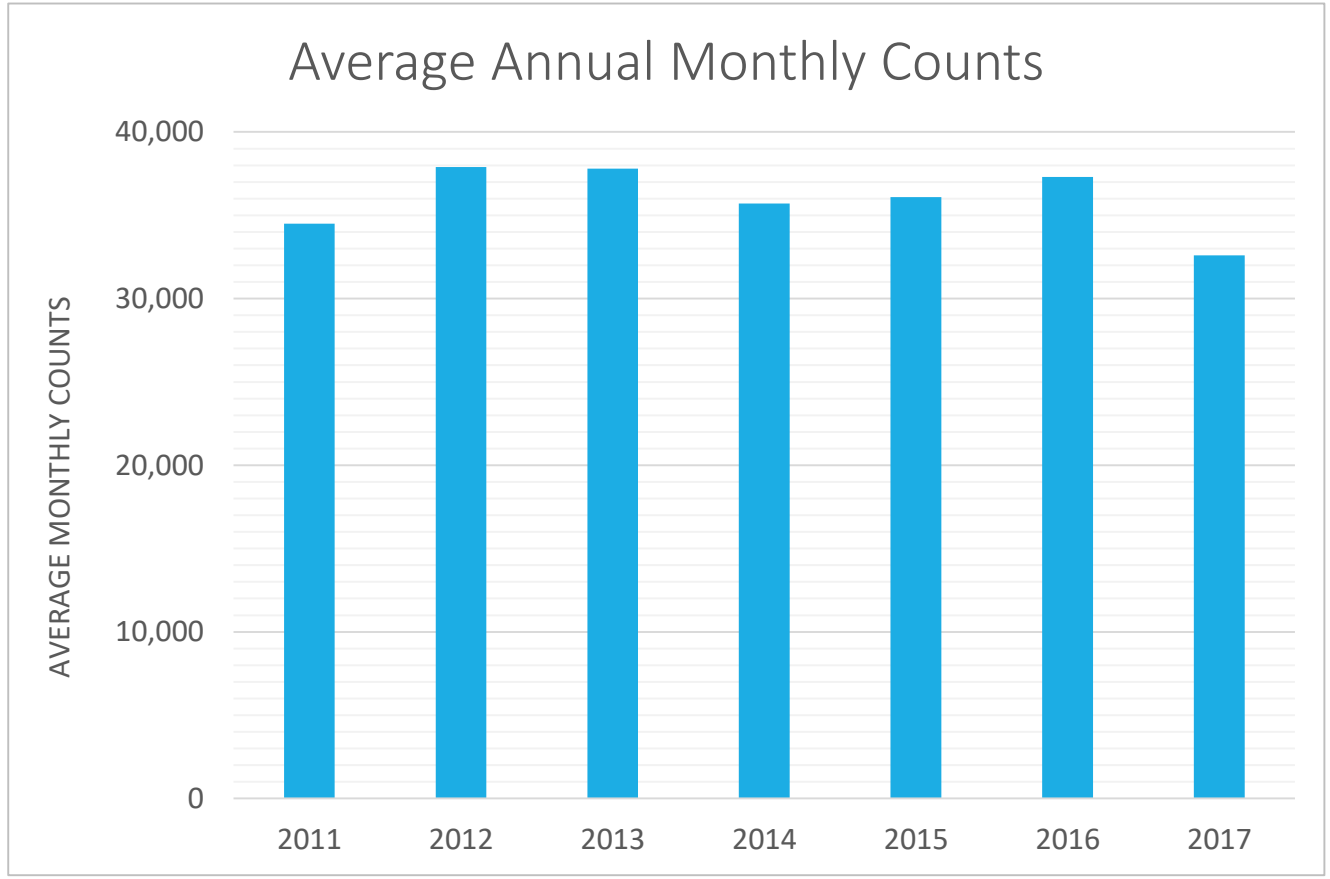
*Average of the daily averages from WTP Multi (pedestrians and cyclists) and LFP



Results • *Monthly Overview*

Year	Average Annual Monthly Counts*
2011	34,500
2012	37,900
2013	37,800
2014	35,700
2015	36,100
2016	37,300
2017	32,600

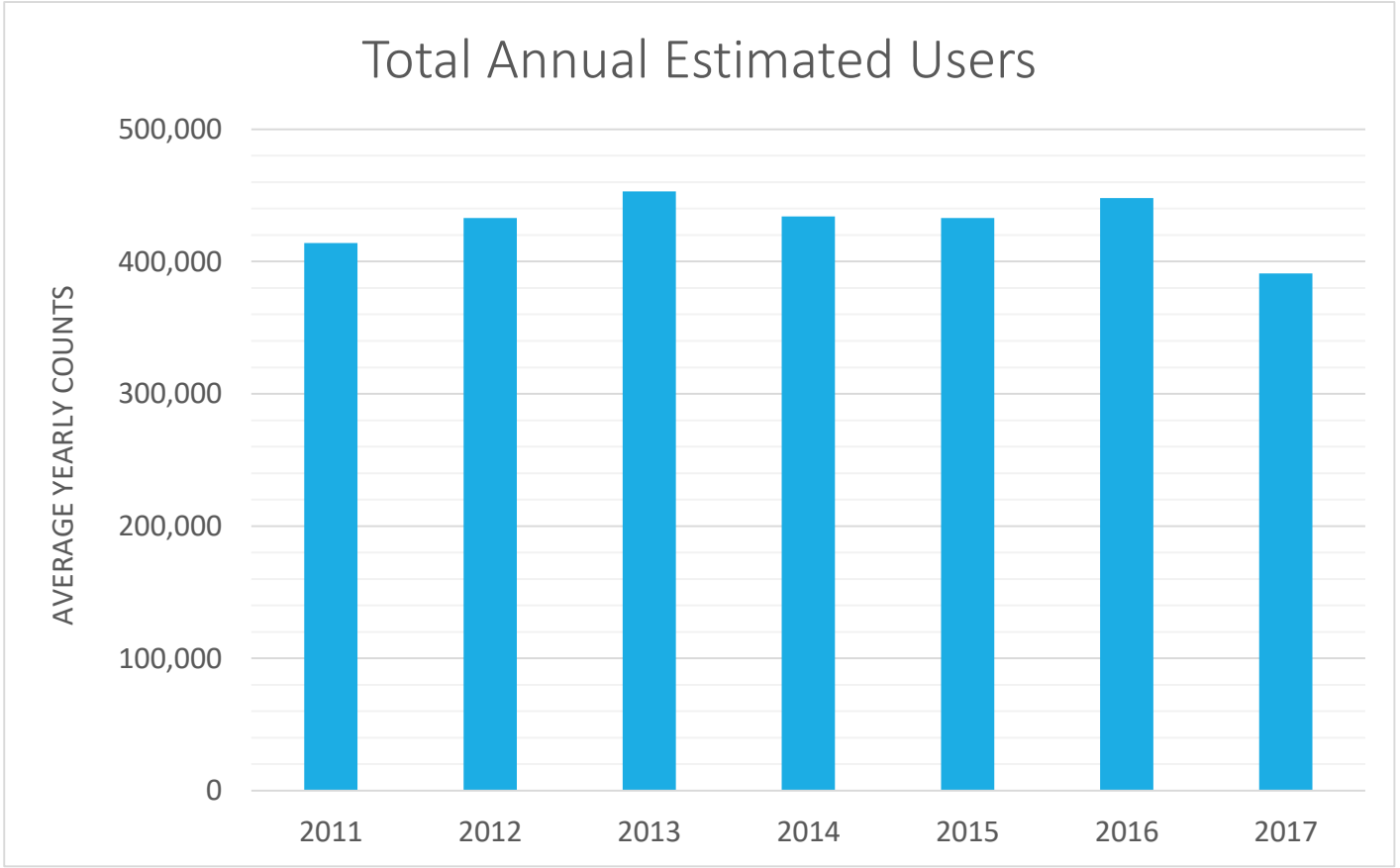
*Average of the monthly averages from WTP Multi (pedestrians and cyclists) and LFP



Results • *Annual Overview*

Year	Total Annual Estimated Users*
2011	414,000
2012	433,000
2013	453,000
2014	434,000
2015	433,000
2016	448,000
2017	391,000

*Sum of the monthly averaged total counts of WTP Multi (pedestrians and cyclists) and LFP



Results • *Overview Summary*

- Estimated annual, monthly, and daily totals suggest fewer users at Fresh Pond Reservation in 2017
- Data from the BP Multi sensor and anecdotal evidence from Reservation Rangers suggest a change in user patterns due to the Perimeter Road and Community Gardens construction detour
  - Users likely often used the bike path and treatment plant driveway to walk between the upper and lower parking lots, instead of the Perimeter Road, decreasing total counts at the WTP Multi sensor
  - This conclusion is also supported by the fact that the number of users at the WTP site dropped off considerably starting in May of 2017 (the construction detour began on May 25, 2017). However, the number of users at the LFP sensor did not appear to change in response to the construction detour.
- Therefore, the total estimated counts, which average counts form WTP and LFP, likely underestimate Fresh Pond Reservations users in 2017

Results • *Perimeter Road Sensors*

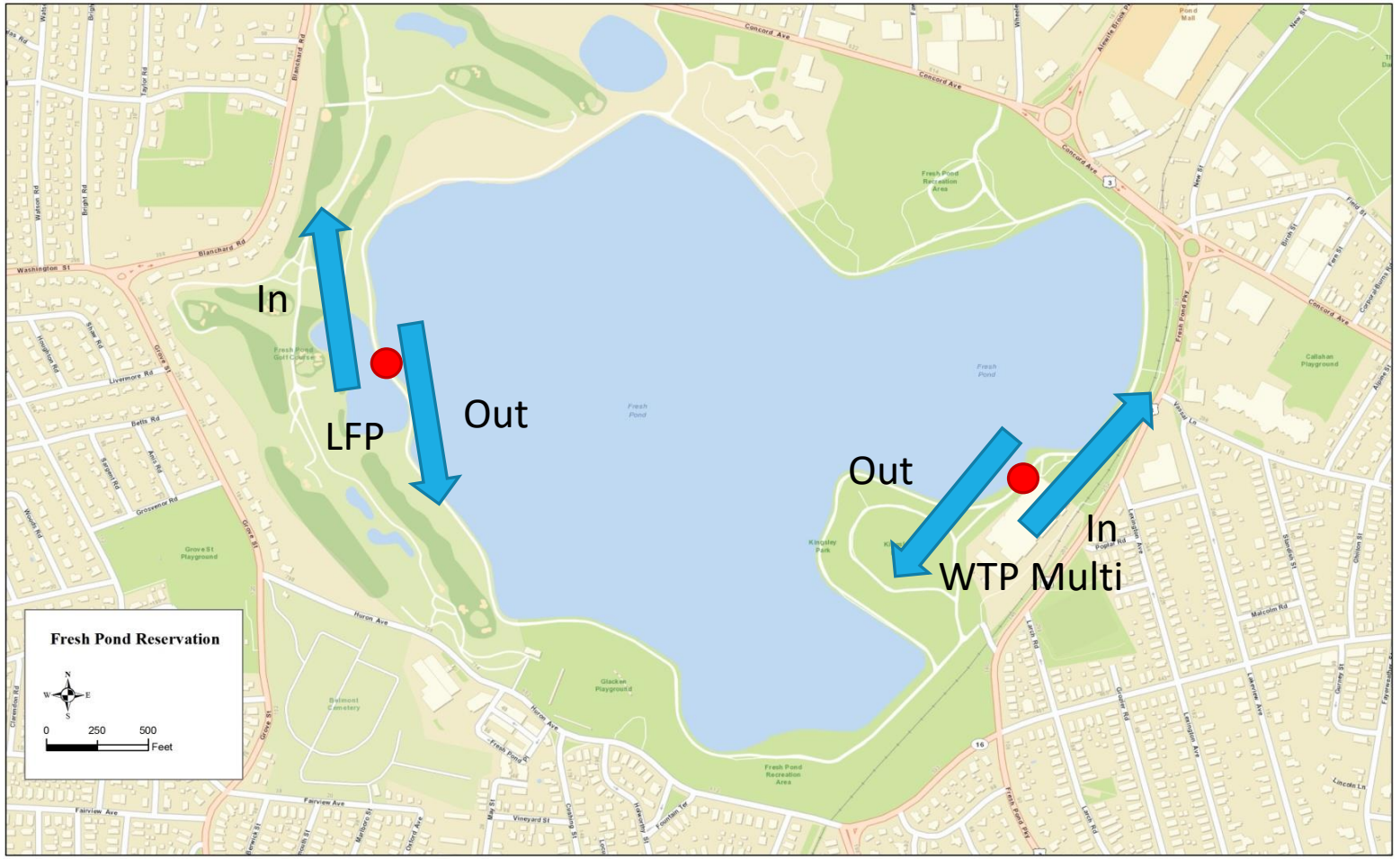
Perimeter Road EcoCounter Sensors

Little Fresh Pond (LFP)

- Directional

Water Treatment Plant Multi

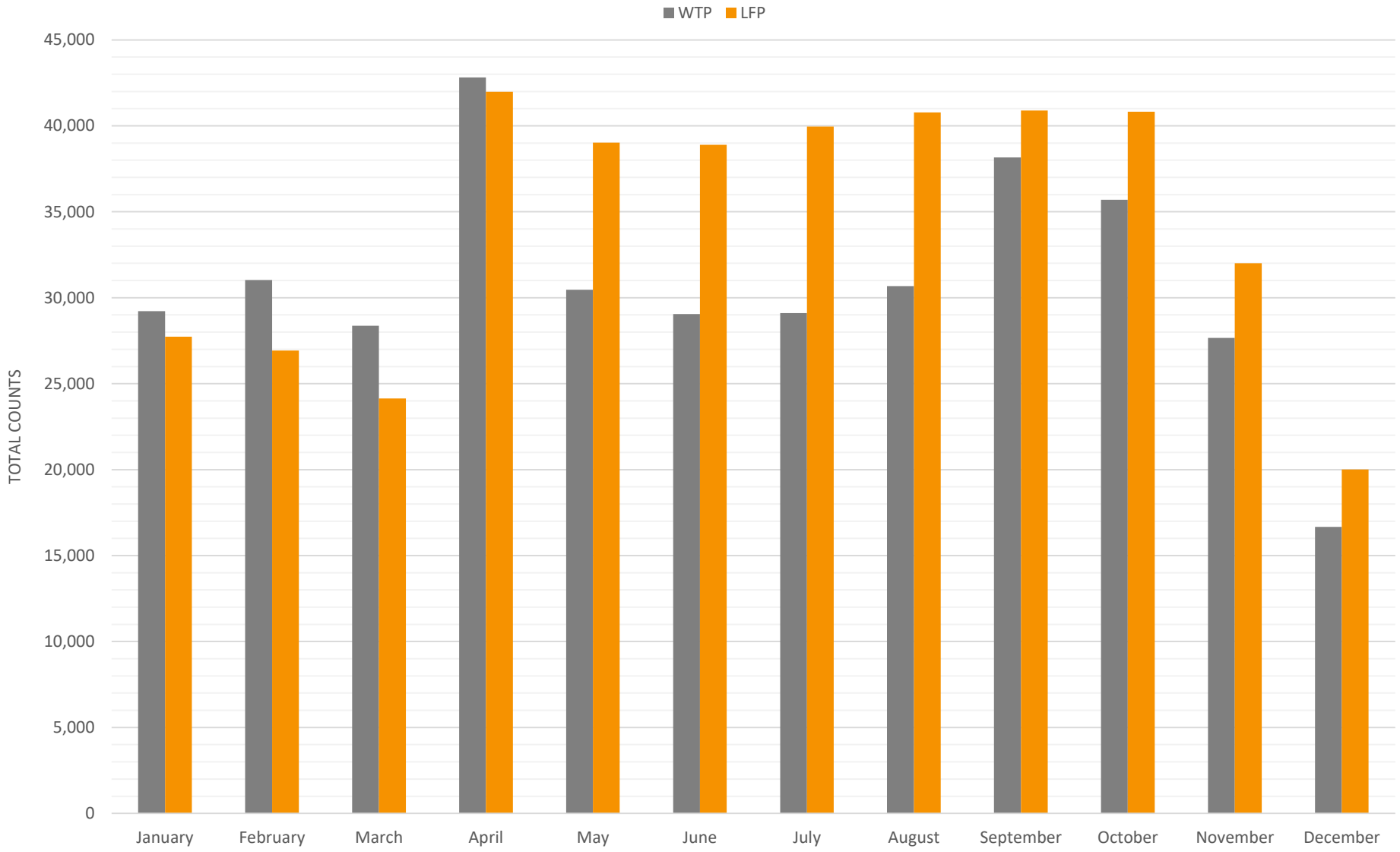
- Directional
- Differentiates between pedestrians and cyclists



2017 Perimeter Road Summary

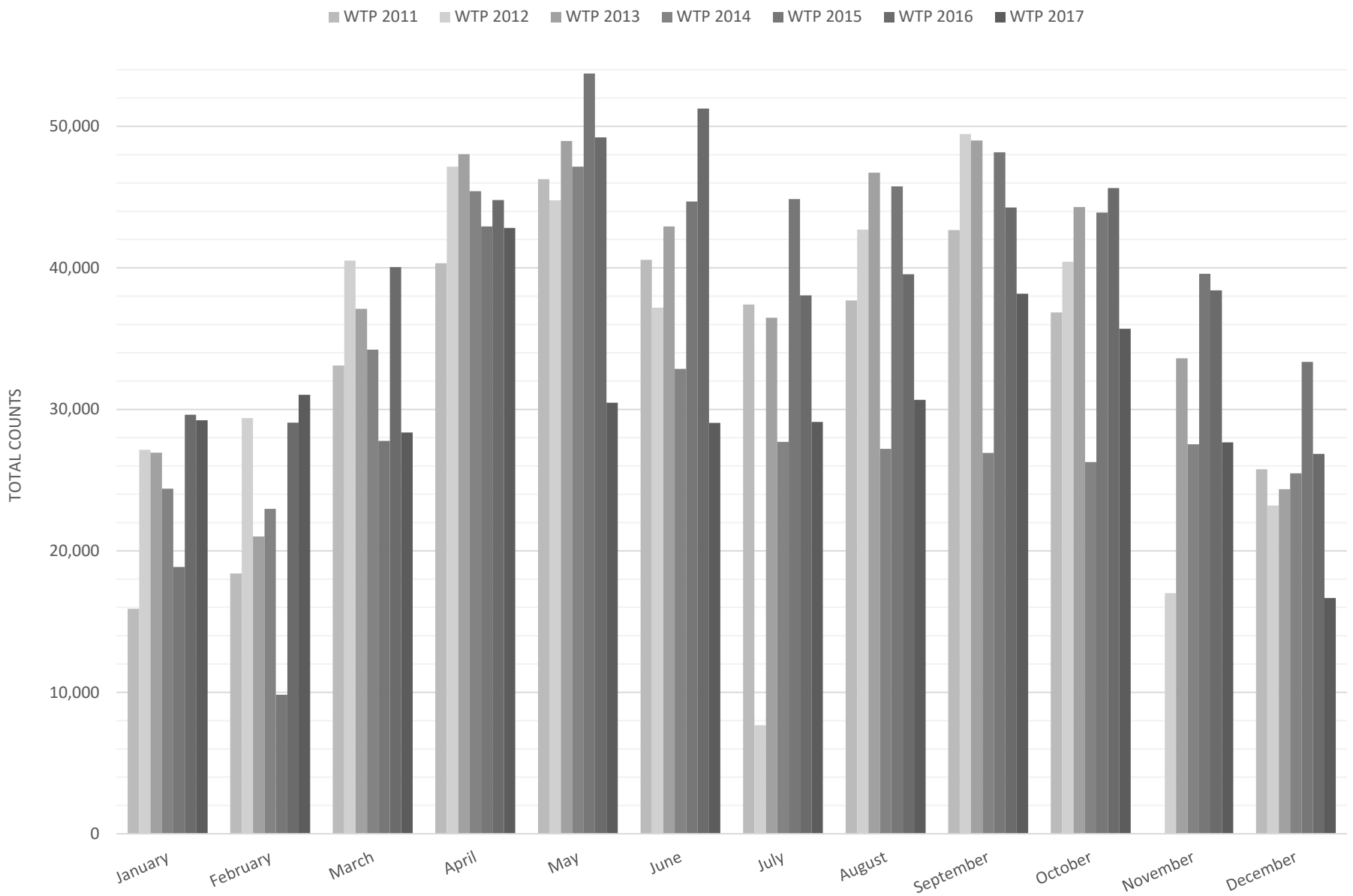
- April and September were the busiest months
- June and July had a lower number of users than other warm months, likely due to people being away on vacations
- Winter months had the lowest number of users
- Saturdays and Sundays had more users than weekdays
- Mid morning (9:00-12:00) and afternoon (15:00-17:00) were the busiest times of day
- WTP Multi had a drop in users starting in May, likely because of the construction detour

Monthly Eco-Counter Results
Perimeter Road, 2017



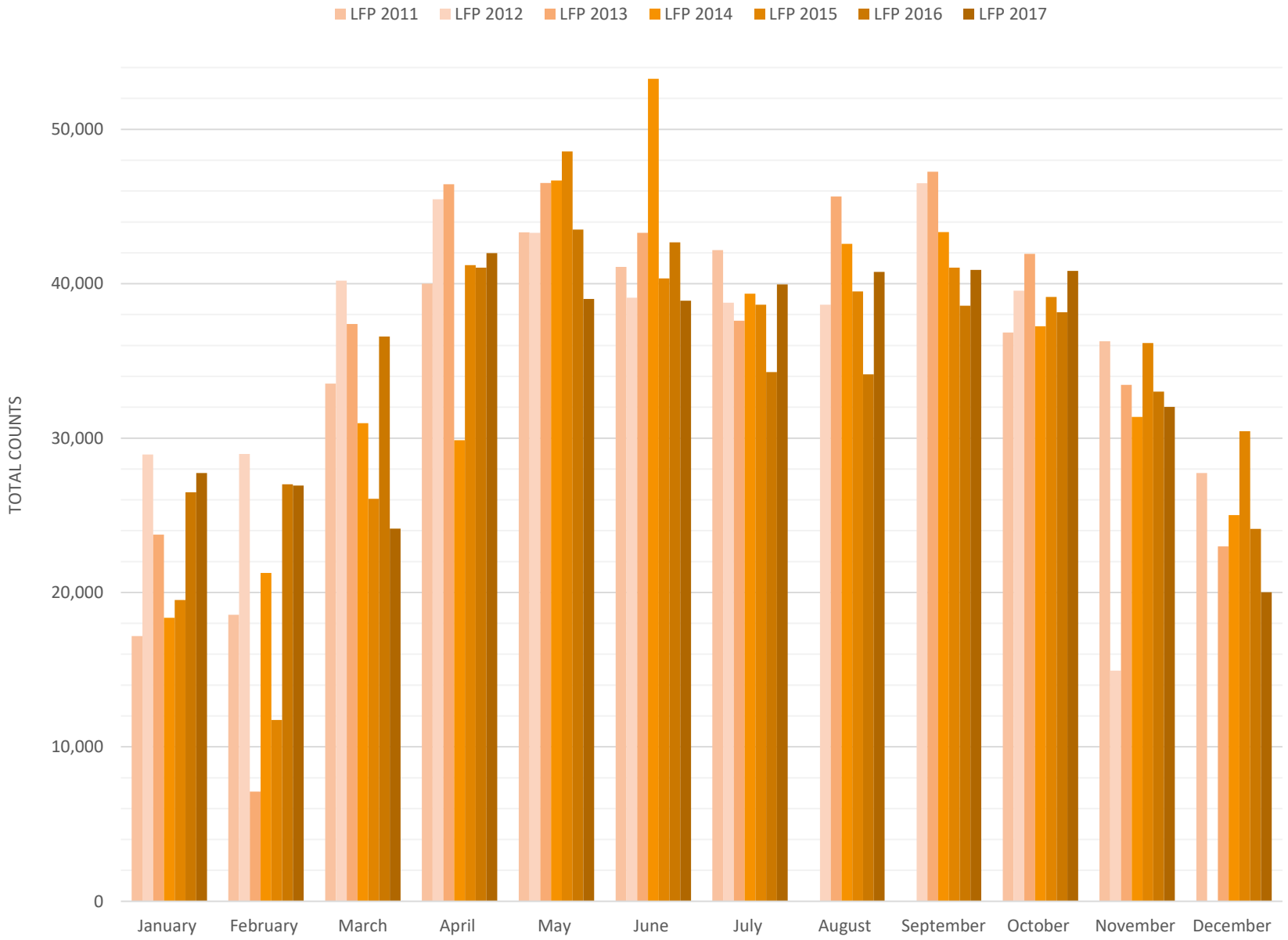
Data errors detailed on slides 10 & 11

WTP Sensor, Monthly Results 2011 - 2017



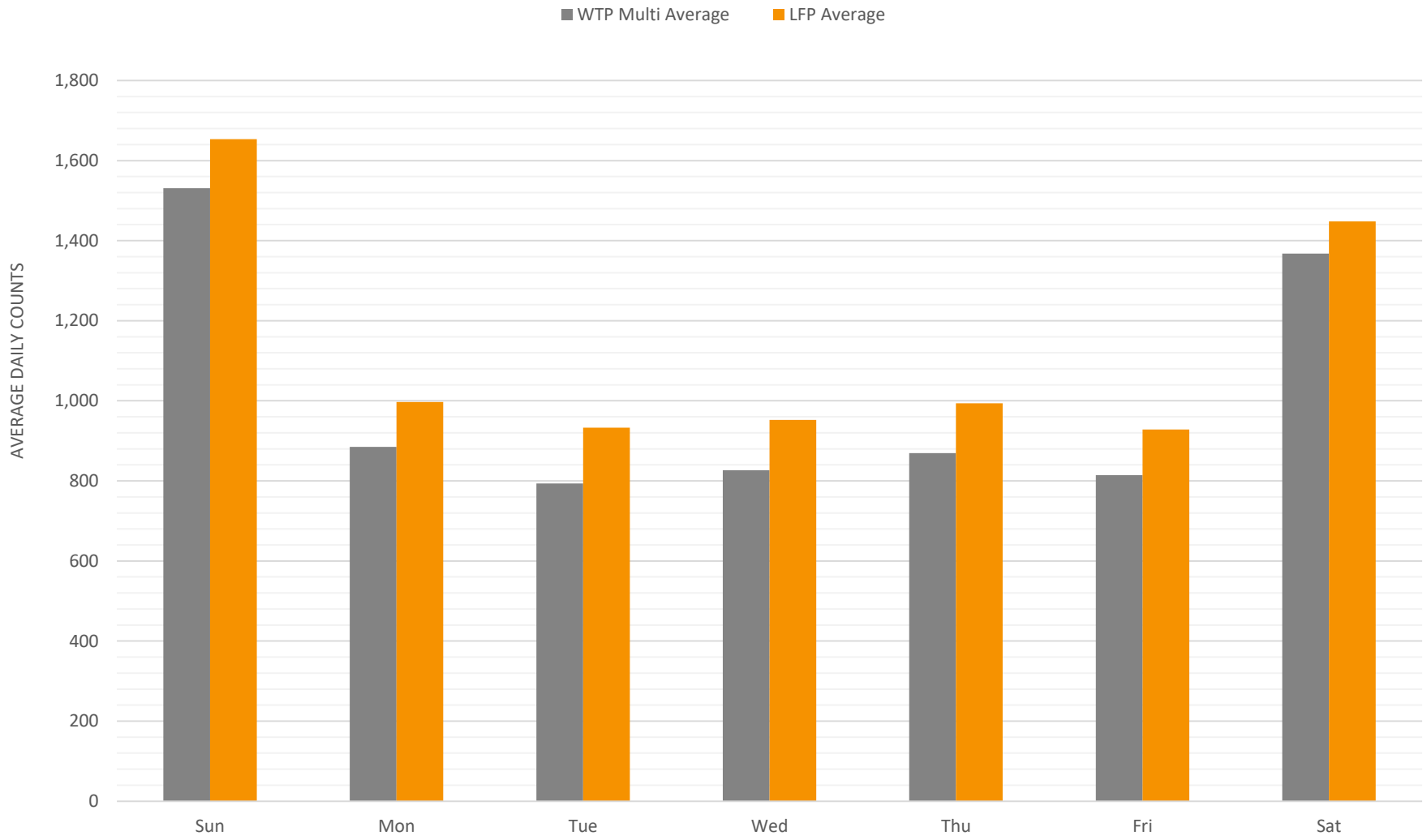
Data errors detailed on slides 10 & 11

LFP Sensor, Monthly Results 2011 - 2017



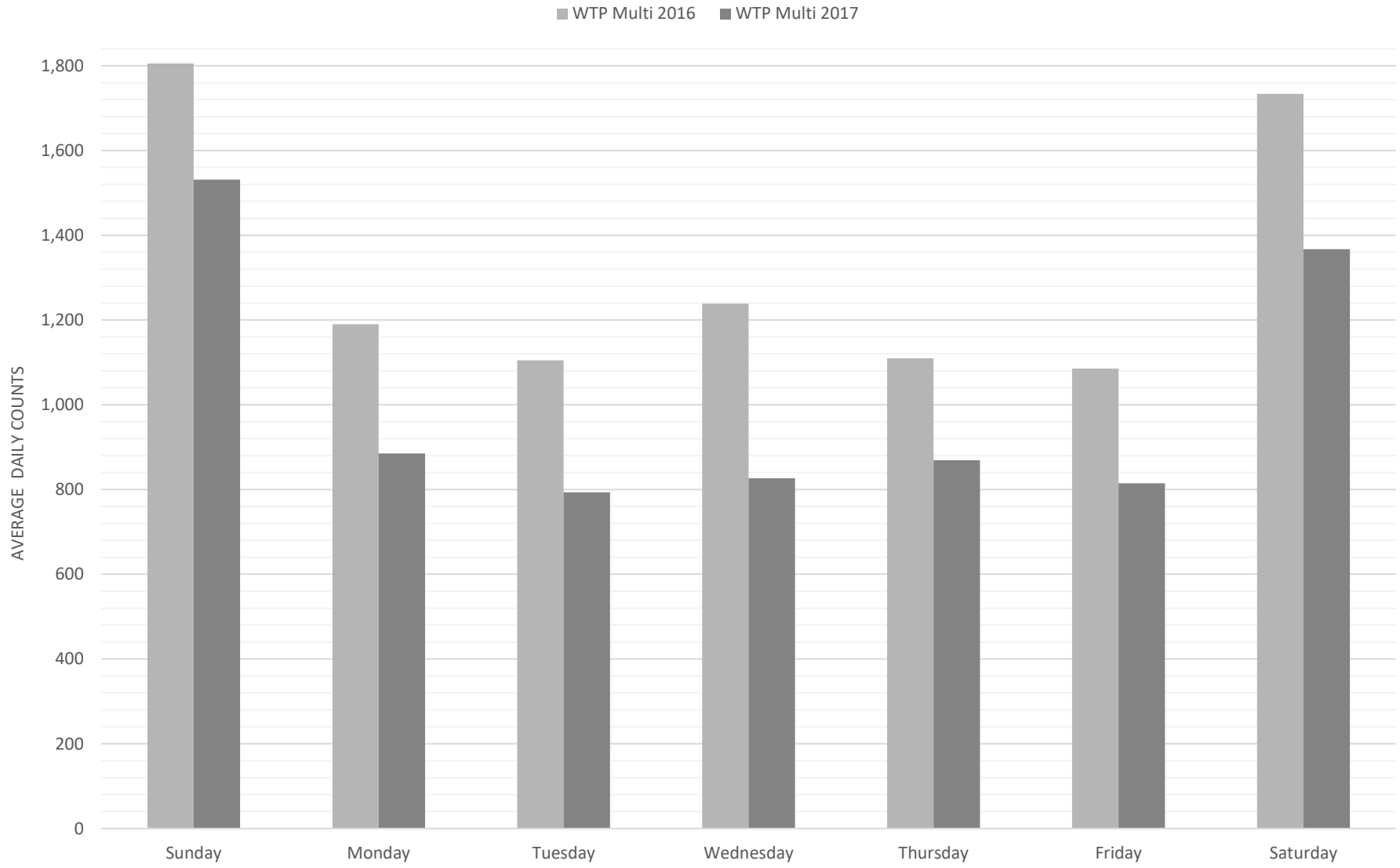
Data errors detailed on slides 10 & 11

Average Daily Counts
Perimeter Road Sensors 2017



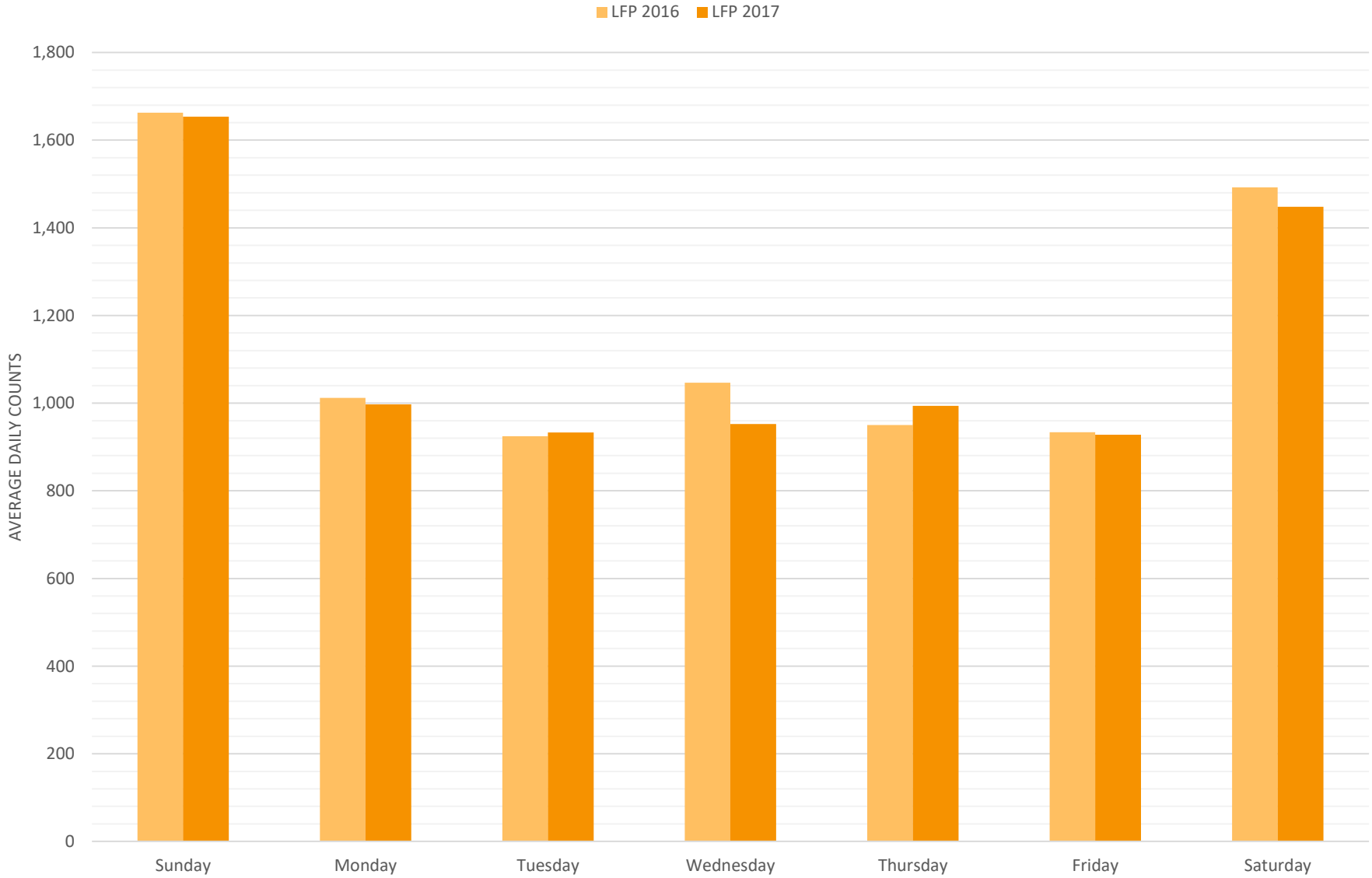
Data errors detailed on slides 10 & 11

Average Daily Counts
WTP Multi 2016, 2017



Data errors detailed on slides 10 & 11

Average Daily Counts
Little Fresh Pond 2016, 2017



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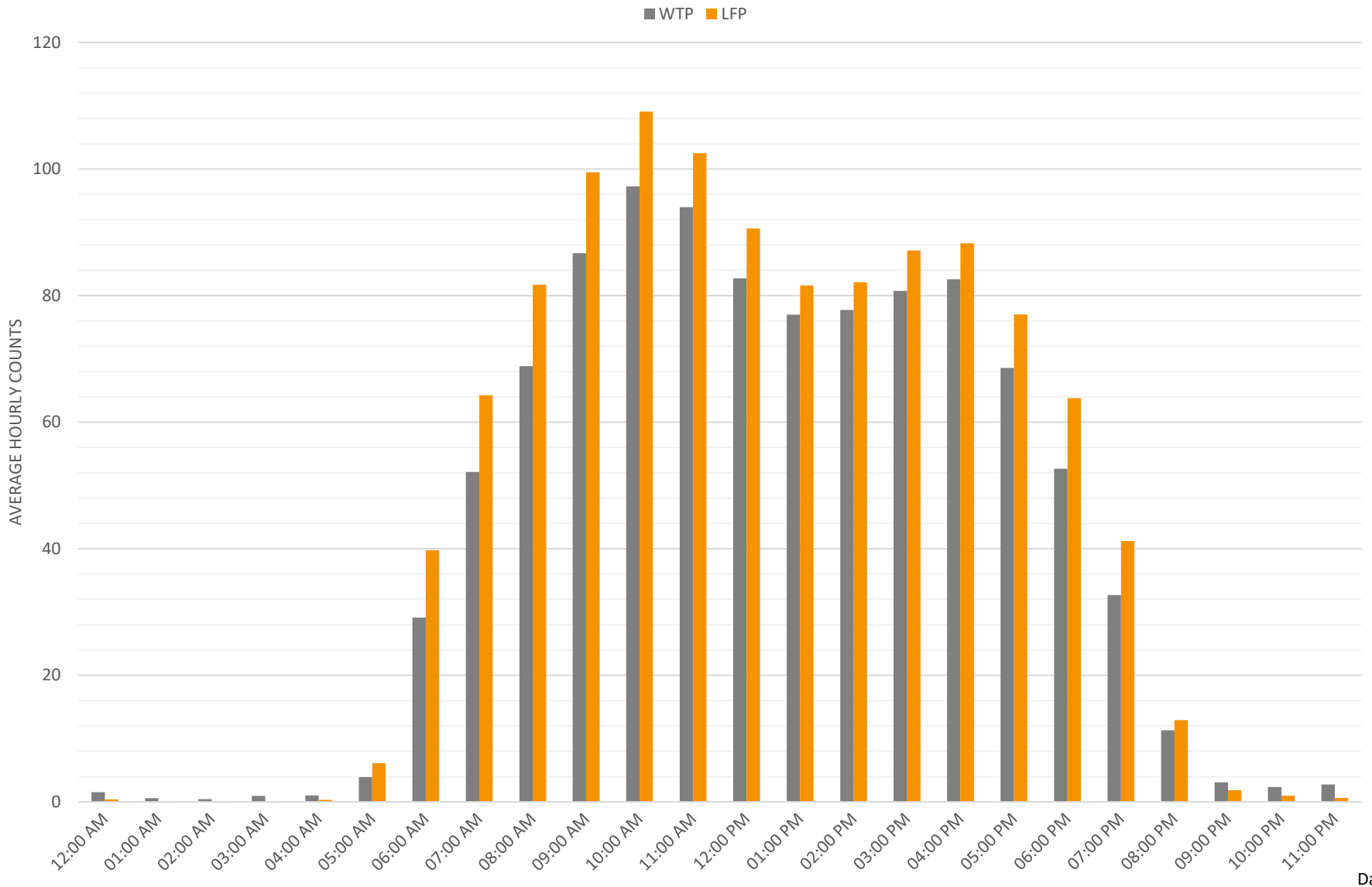
Average Hourly Counts
Perimeter Road 2017



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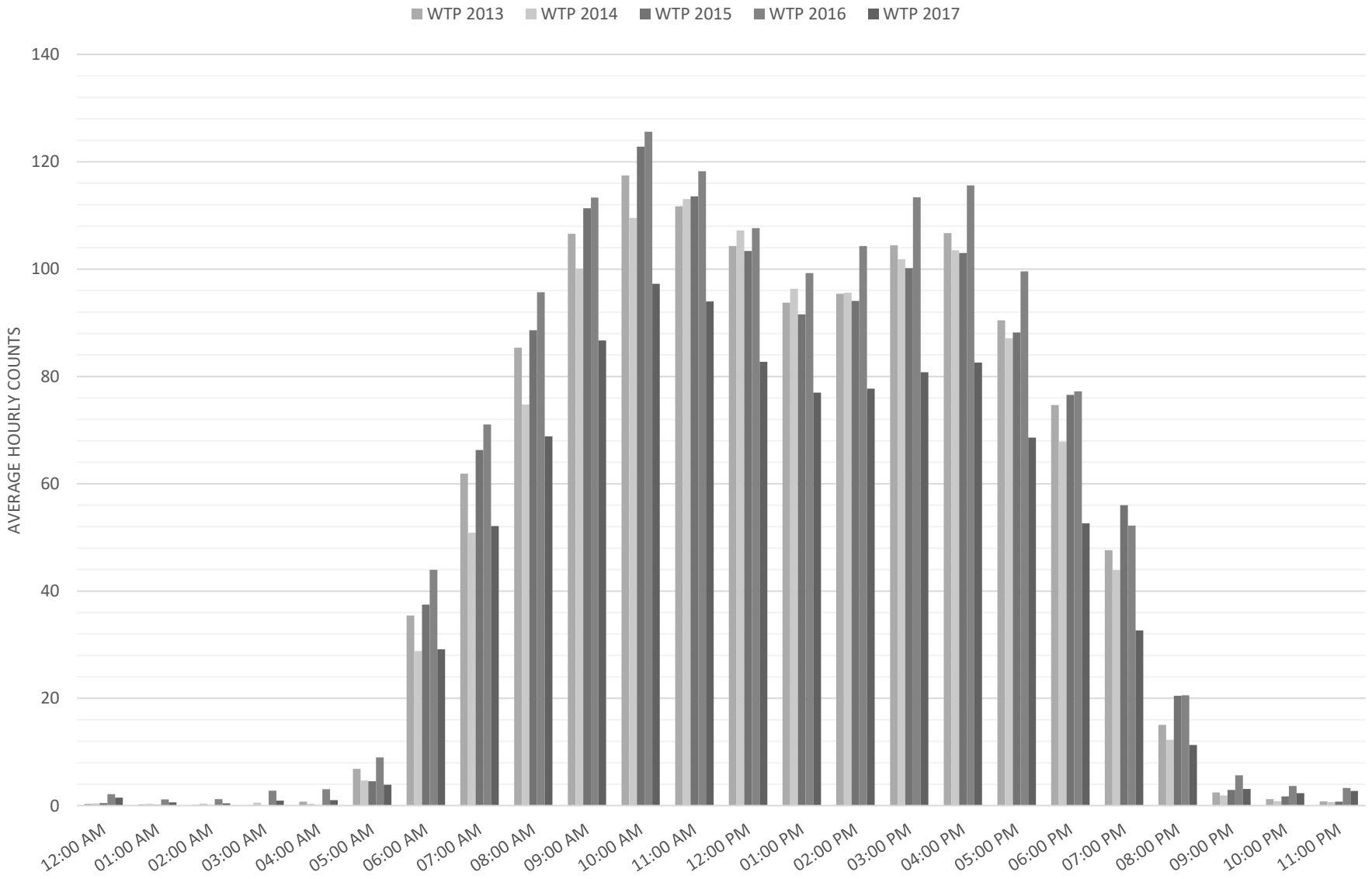
Average Hourly Counts
WTP 2013- 2017



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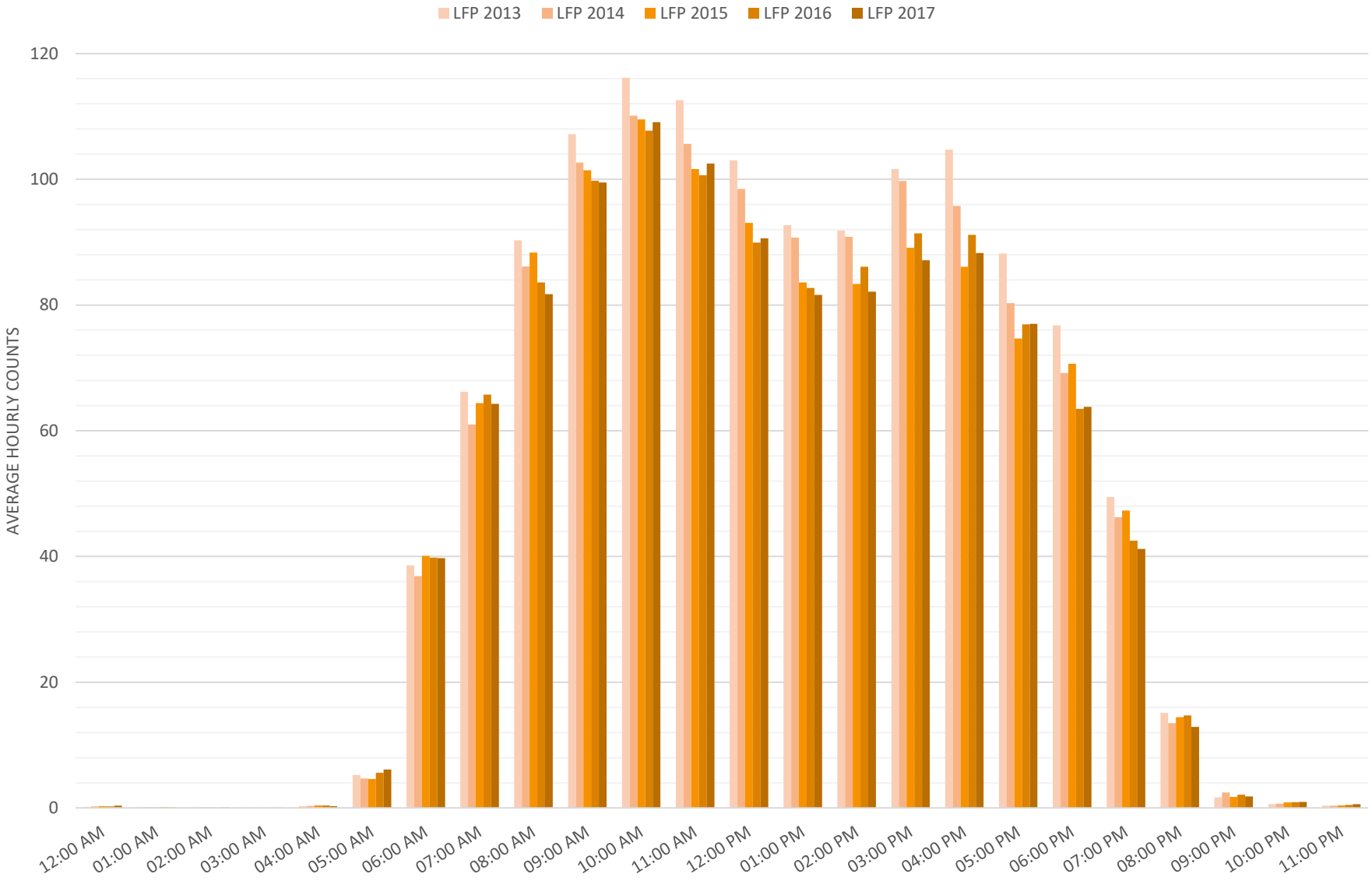
Average Hourly Counts
LFP 2013 - 2017



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Results • *Entrance Sensors*

Reservation Entrance EcoCounter Sensors

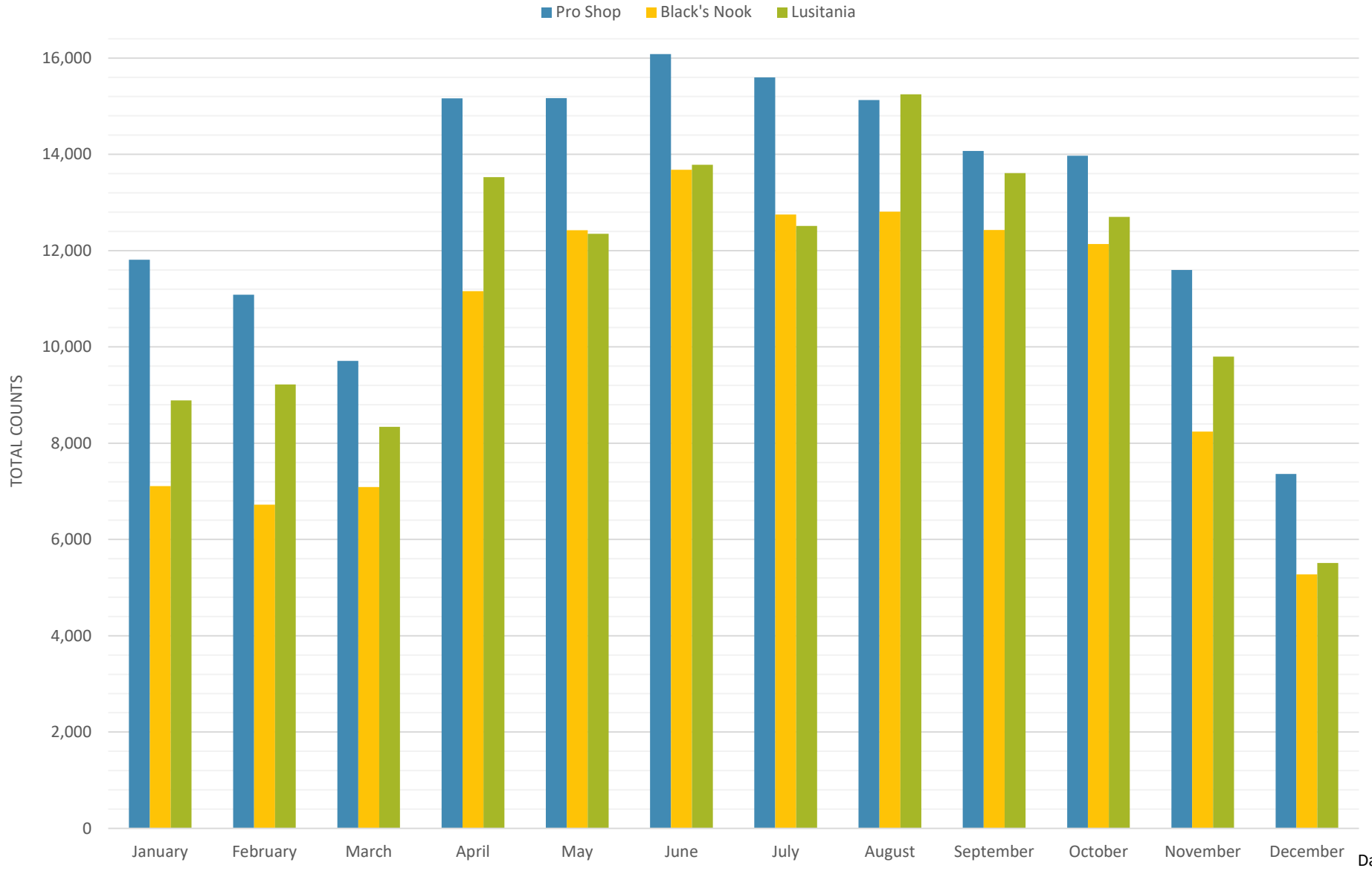
Black's Nook, Lusitania, and Pro Shop

- Directional

2017 Entrance Summary

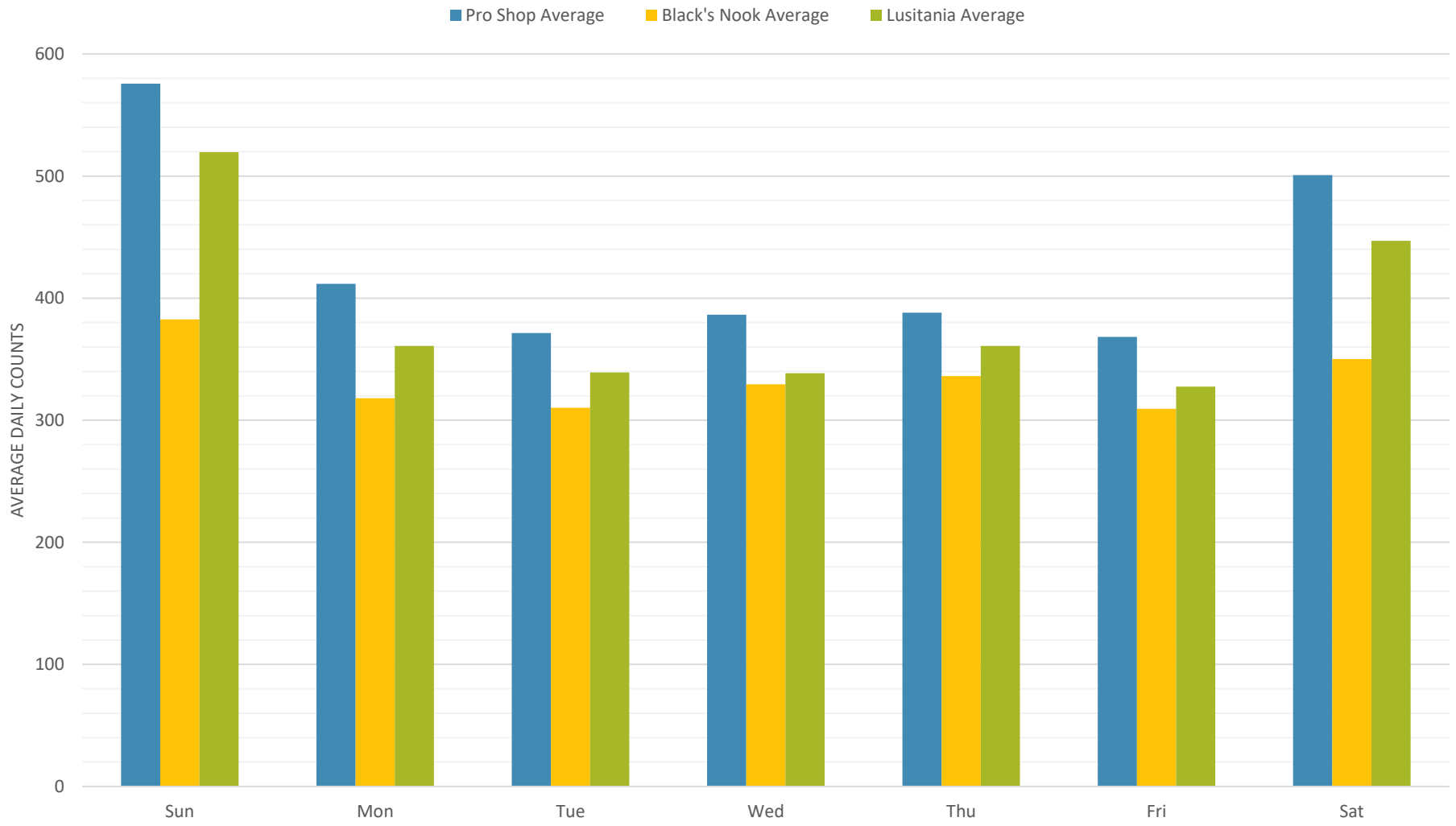
- Winter months had the lowest number of users for all three sensors
- Weekends had more users than weekdays at Pro Shop and Lusitania, while the number of users at Black's Nook was only slightly higher on Weekends than weekdays
- Mid morning (9:00-12:00) and afternoon to early evening (15:00-17:00) were the busiest times of day at Pro Shop
- Black's Nook and Lusitania had peak counts around lunchtime (12:00)
- Pro Shop counts are on average lower than in 2016 because the Glacken Slope detour was no longer in effect
- Black's Nook and Lusitania had similar numbers of users to 2016

Total Monthly Counts
Fresh Pond Reservation Entrances 2017



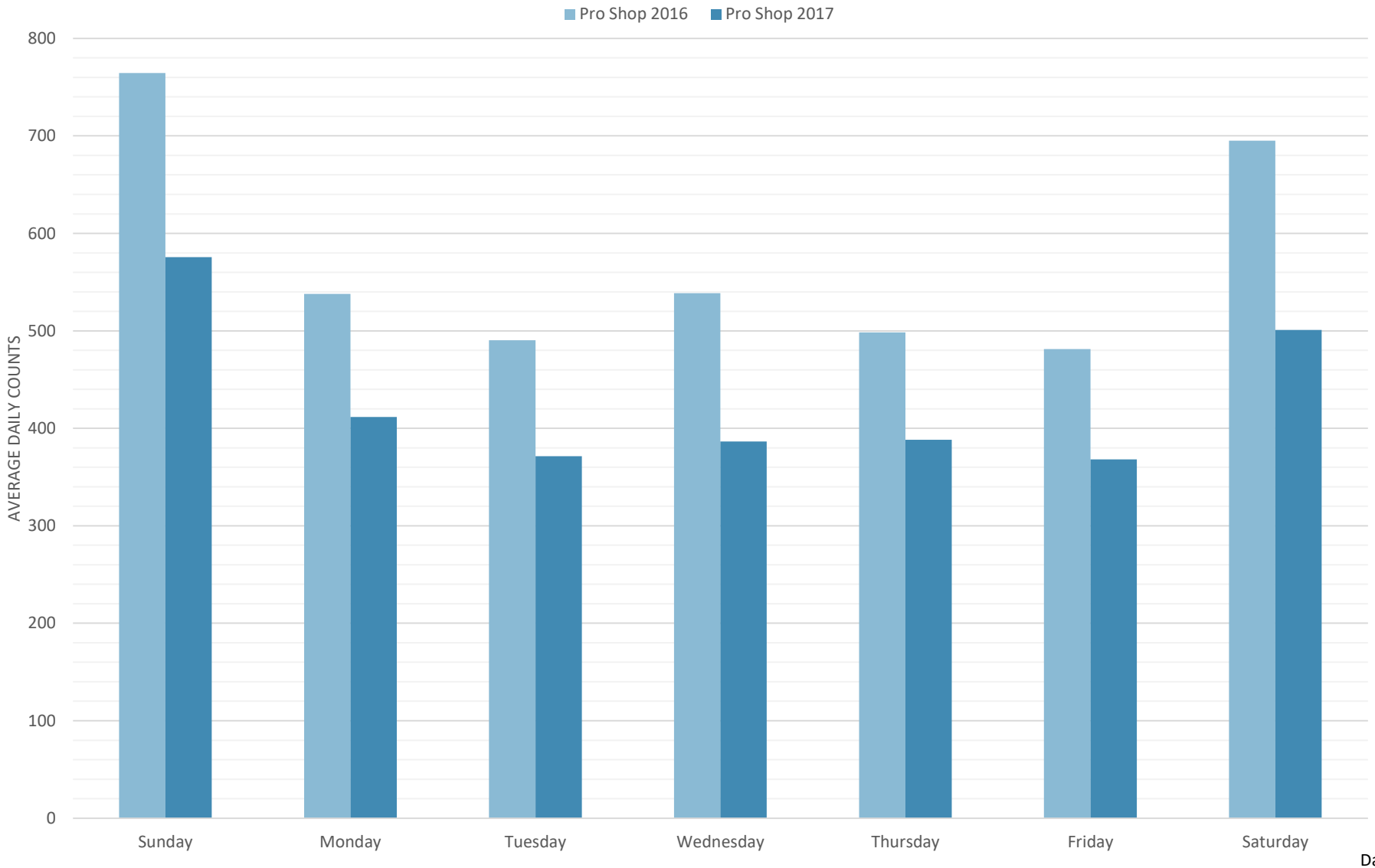
Data errors detailed on slides 10 & 11

Average Daily Counts
Fresh Pond Entrances 2017



Data errors detailed on slides 10 & 11

Average Daily Counts
Pro Shop 2016, 2017



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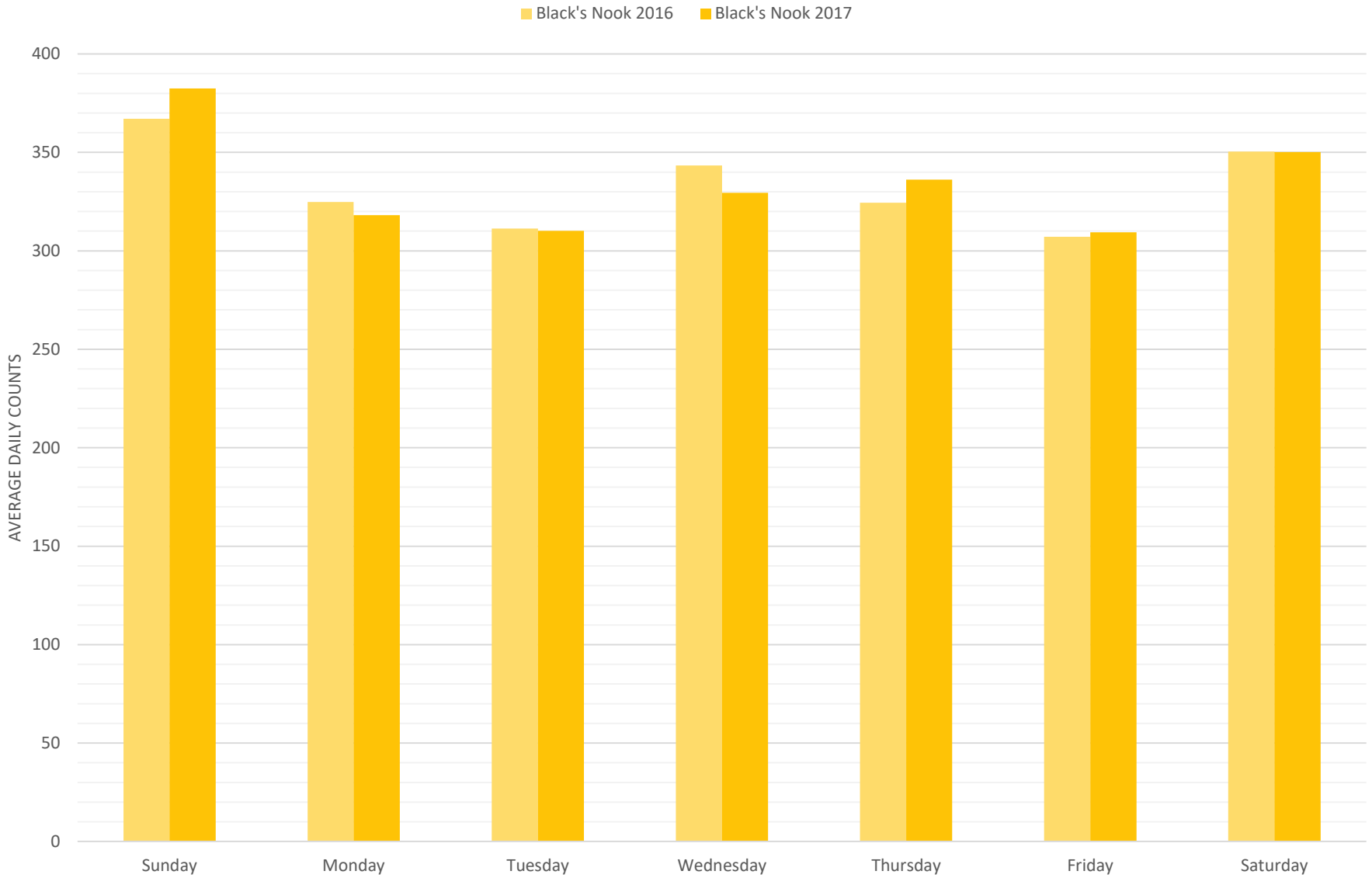
Average Daily Counts
Black's Nook 2016, 2017



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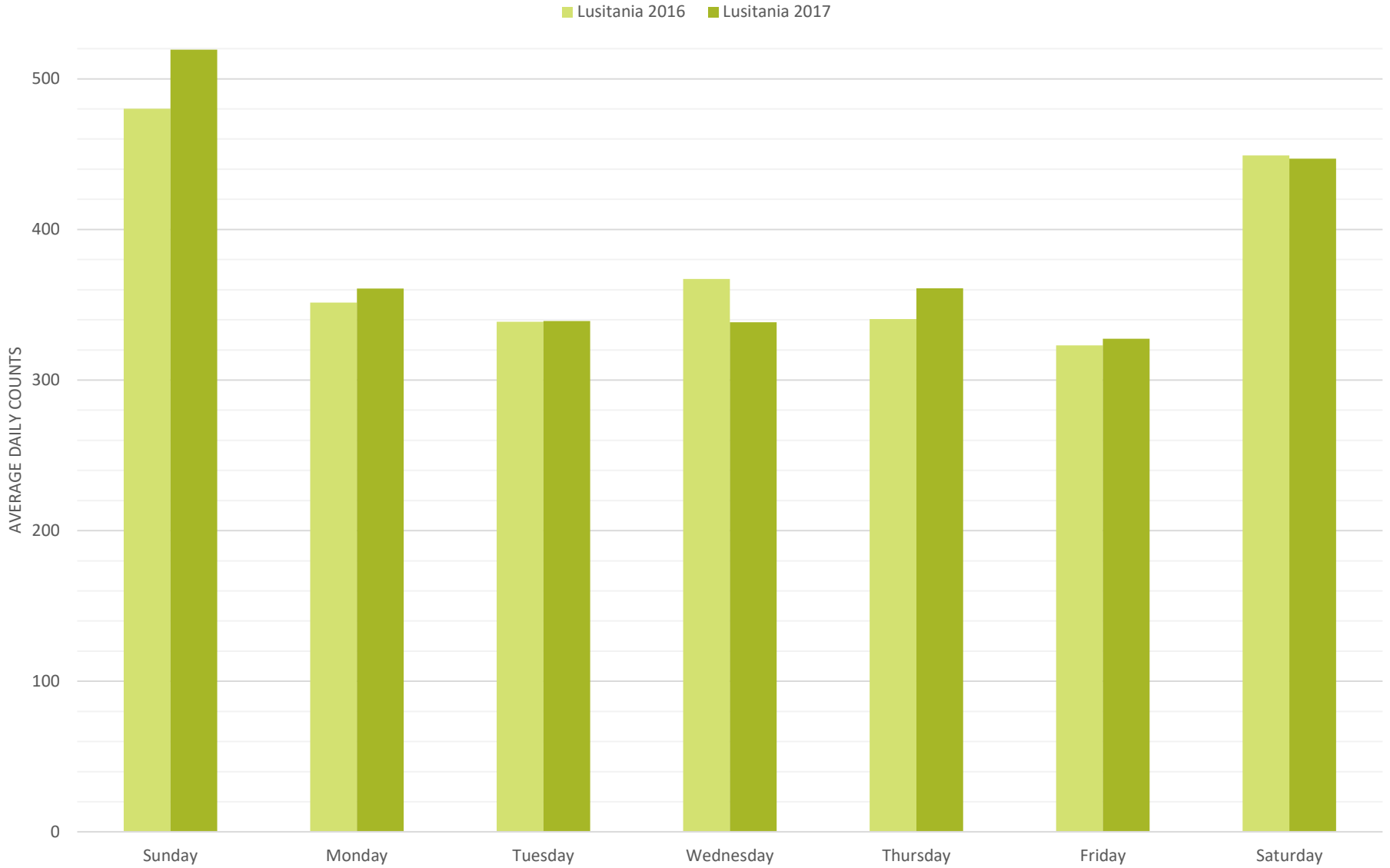
Average Daily Counts
Lusitania 2016, 2017



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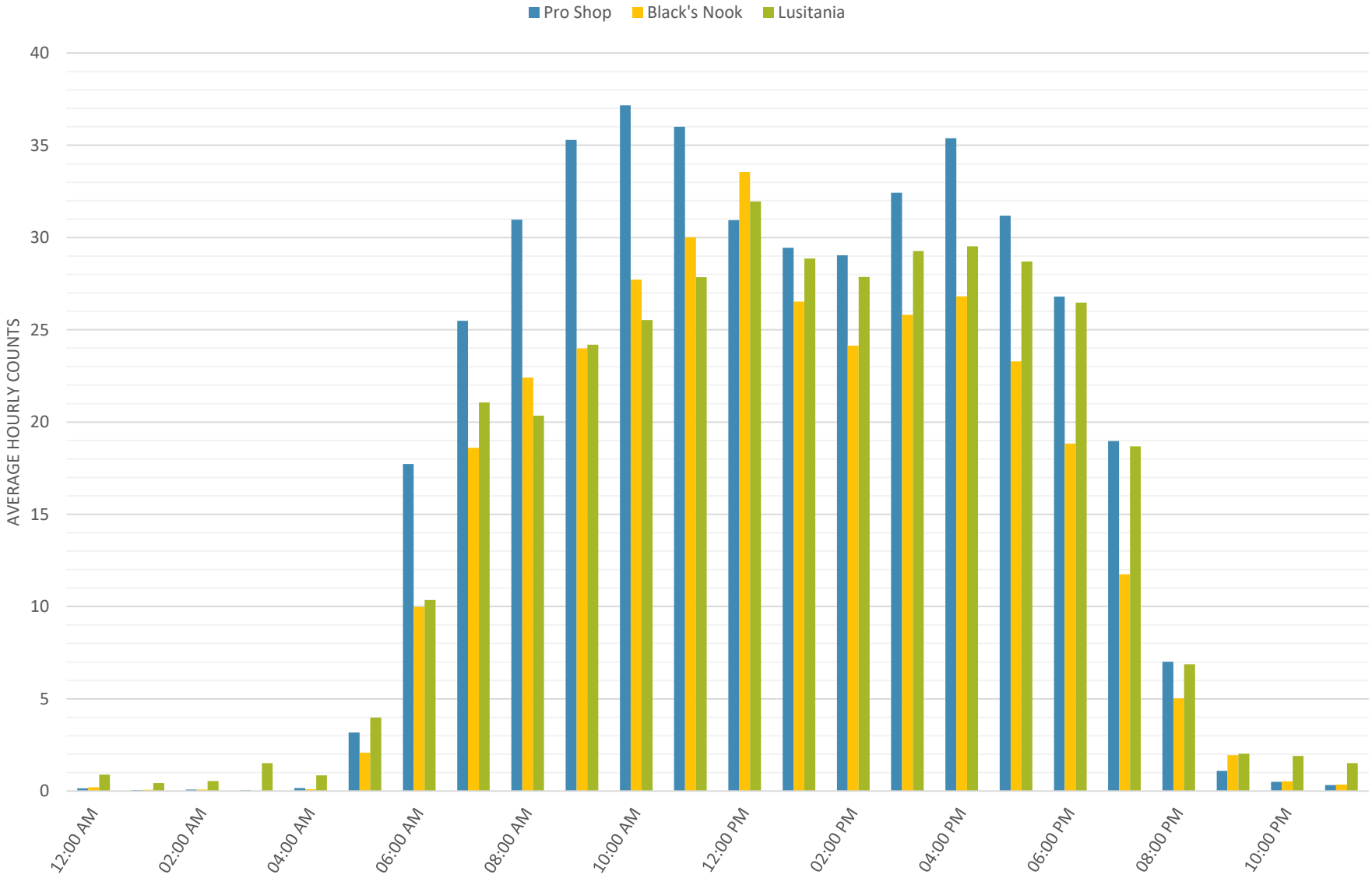
Average Hourly Counts
Entrances 2017



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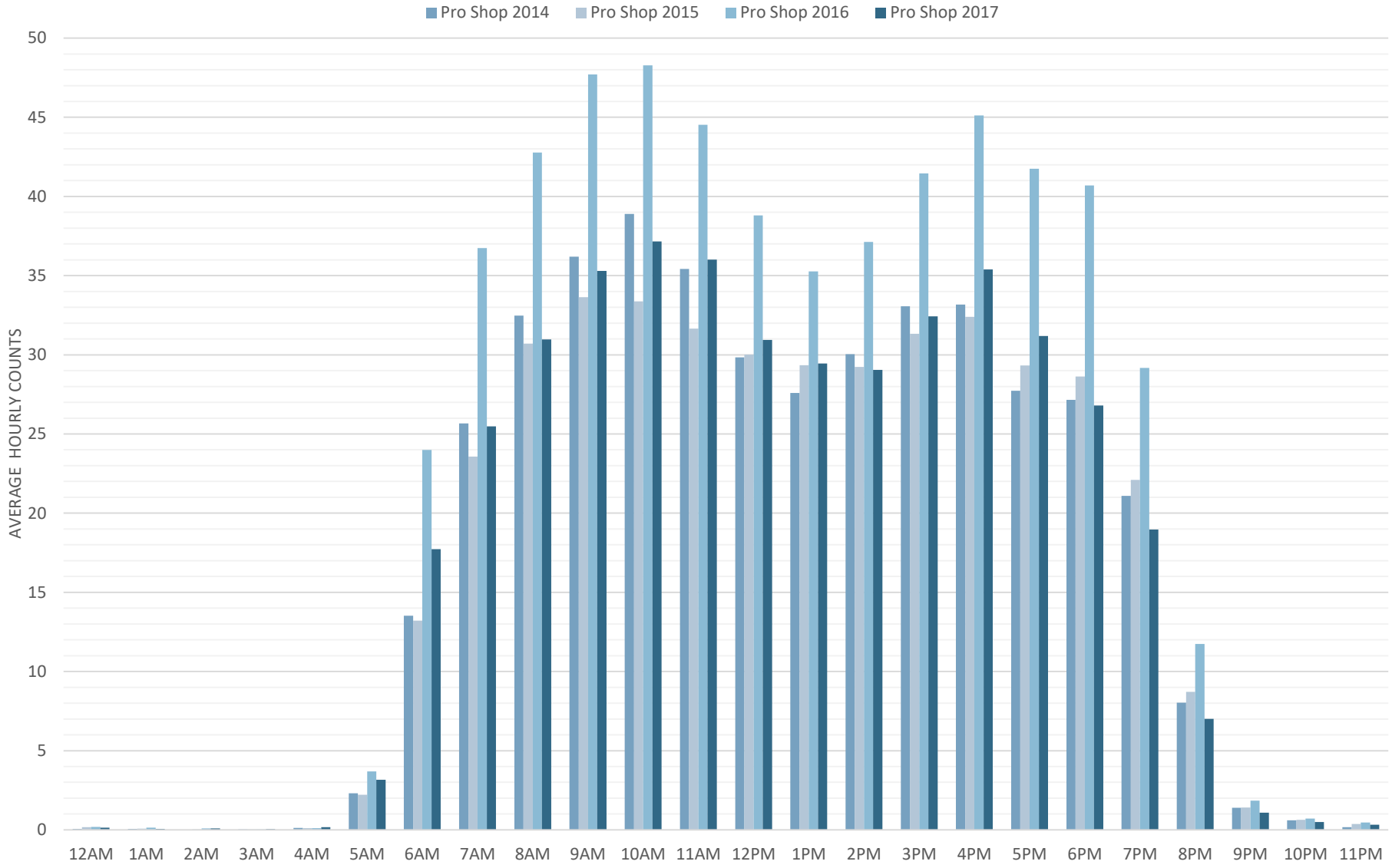
Average Hourly Counts
Pro Shop 2014-2017



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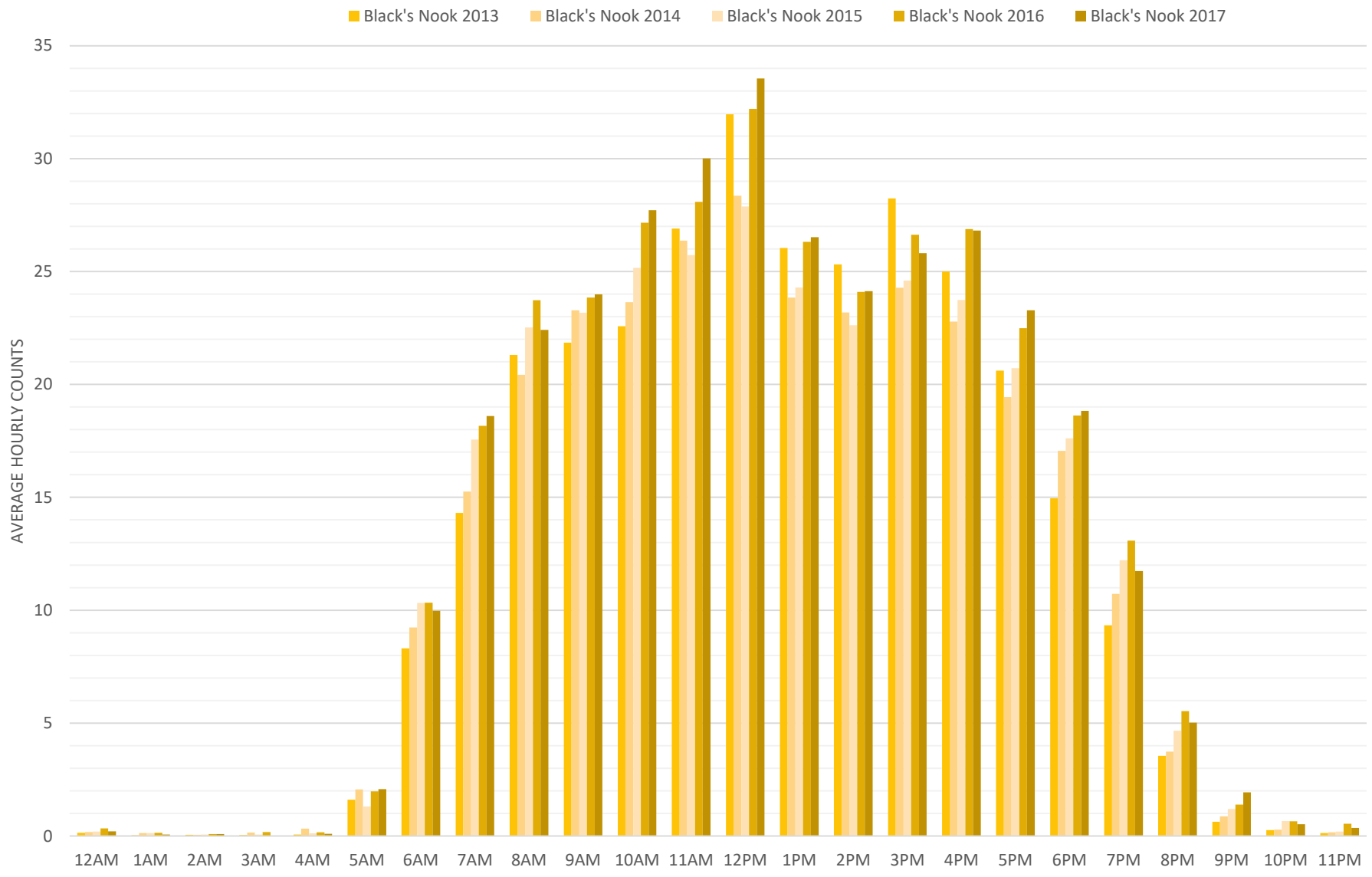
Average Hourly Counts
Black's Nook 2013- 2017



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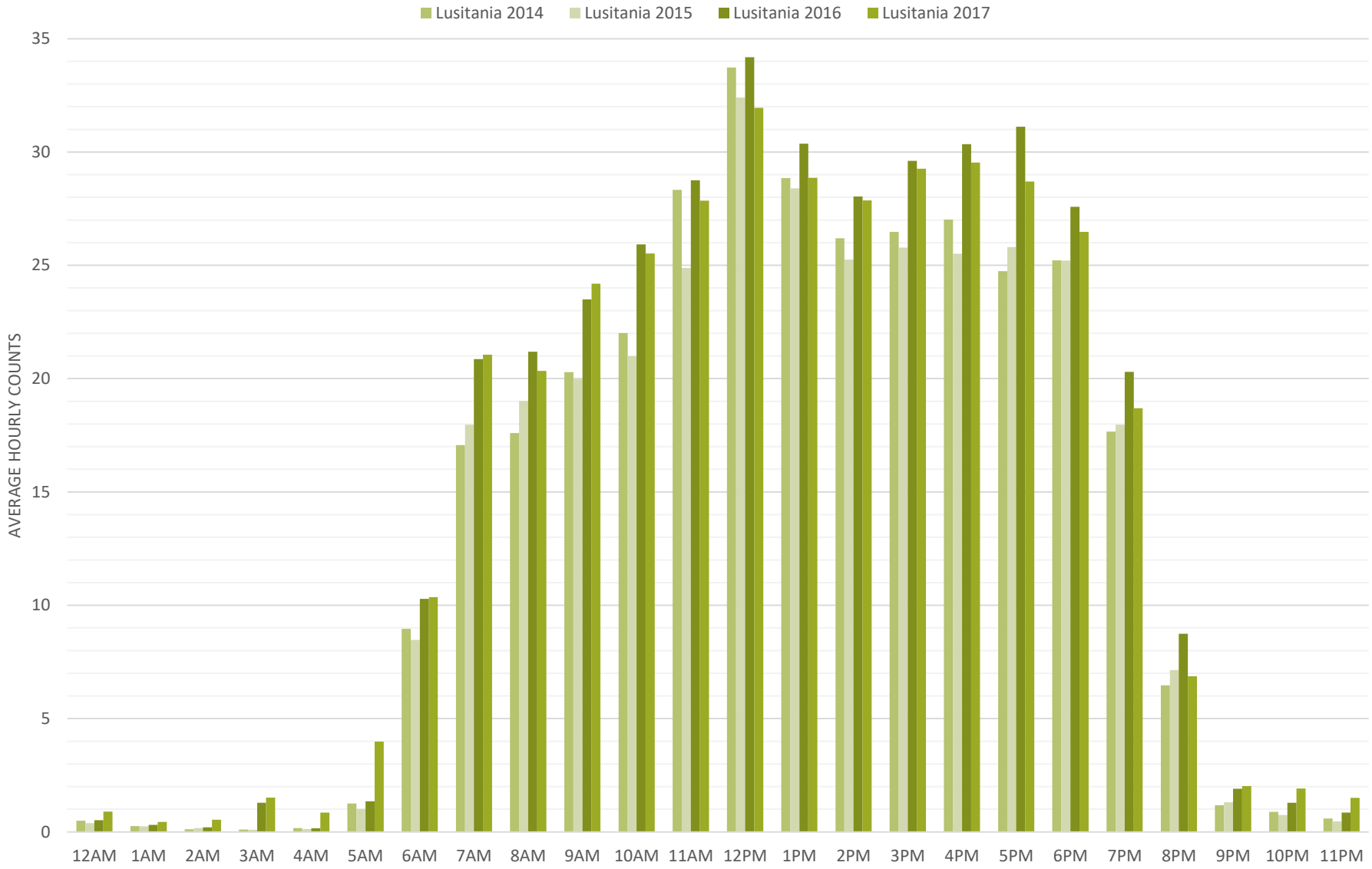
Average Hourly Counts
Lusitania 2014- 2017



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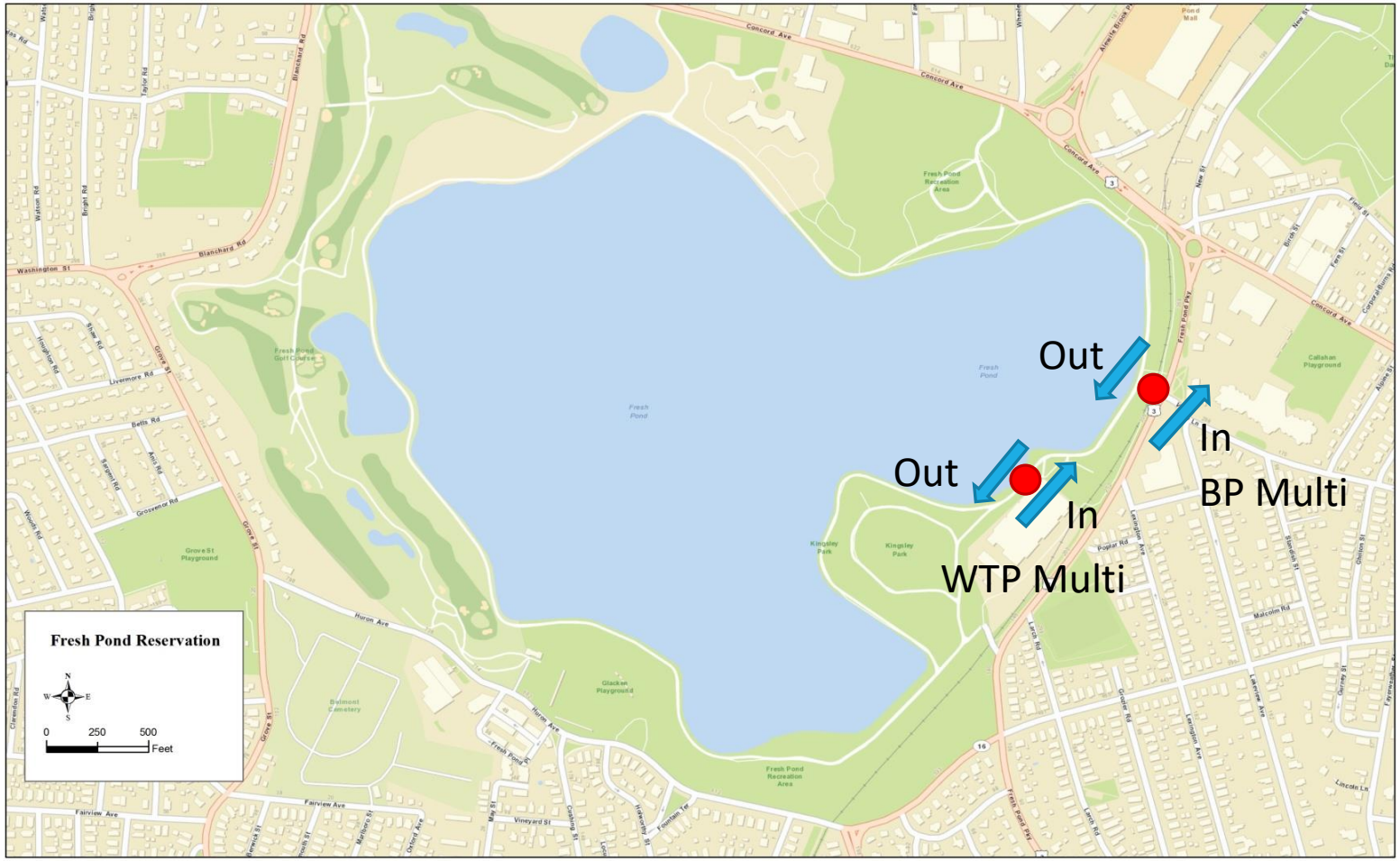
Results • *Multi Sensors*

Multi Sensor EcoCounter Sensors

Water Treatment Plant Multi (WTP Multi) and Bike Path Multi (BP Multi)

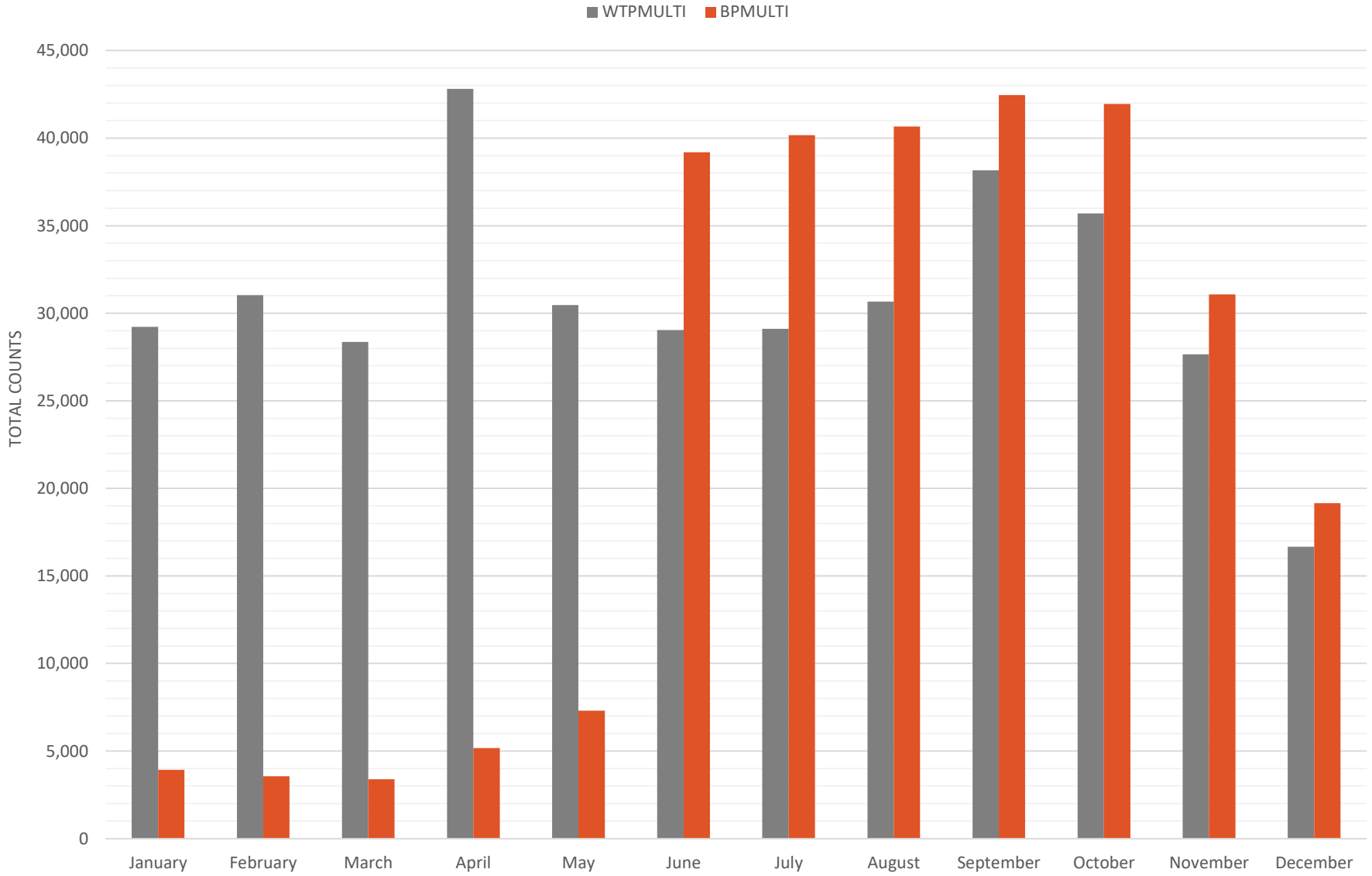
- Directional
- Differentiates between pedestrians and cyclists



2017 Multi Sensor Summary

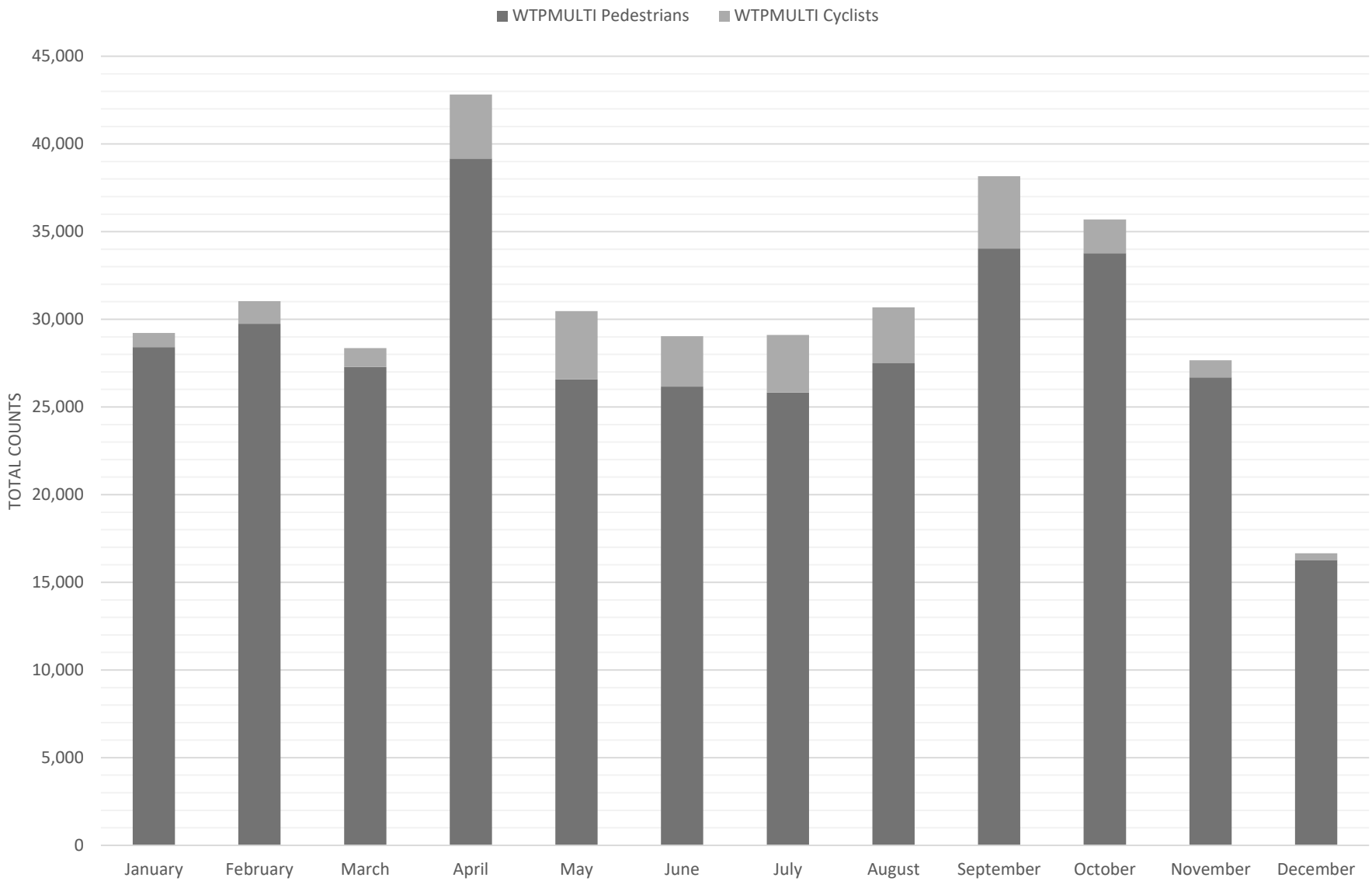
- Both sensors had the lowest number of users in winter months
- Both WTP Multi and BP Multi had more users on the weekends than on weekdays
  - BP Multi has had a more even distribution of users across days in the past, but the construction detour likely caused this shift
- BP Multi had peaks in the number of users during commuting hours (7:00-9:00, 16:00-19:00), while WTP Multi had peaks in the mid morning and afternoon (10:00-12:00, 15:00-17:00)
- WTP Multi had an overall decrease in hourly users from last year, while BP Multi had a large increase in users.
  - Both changes are most likely due to the Perimeter Road and Community Garden construction and detour.
- Both BP Multi and WTP Multi had more pedestrian users than bike users

Total Monthly Counts
Multi Sensors 2017



Data errors detailed on slides 10 & 11

Total Monthly Counts
WTP Multi 2017



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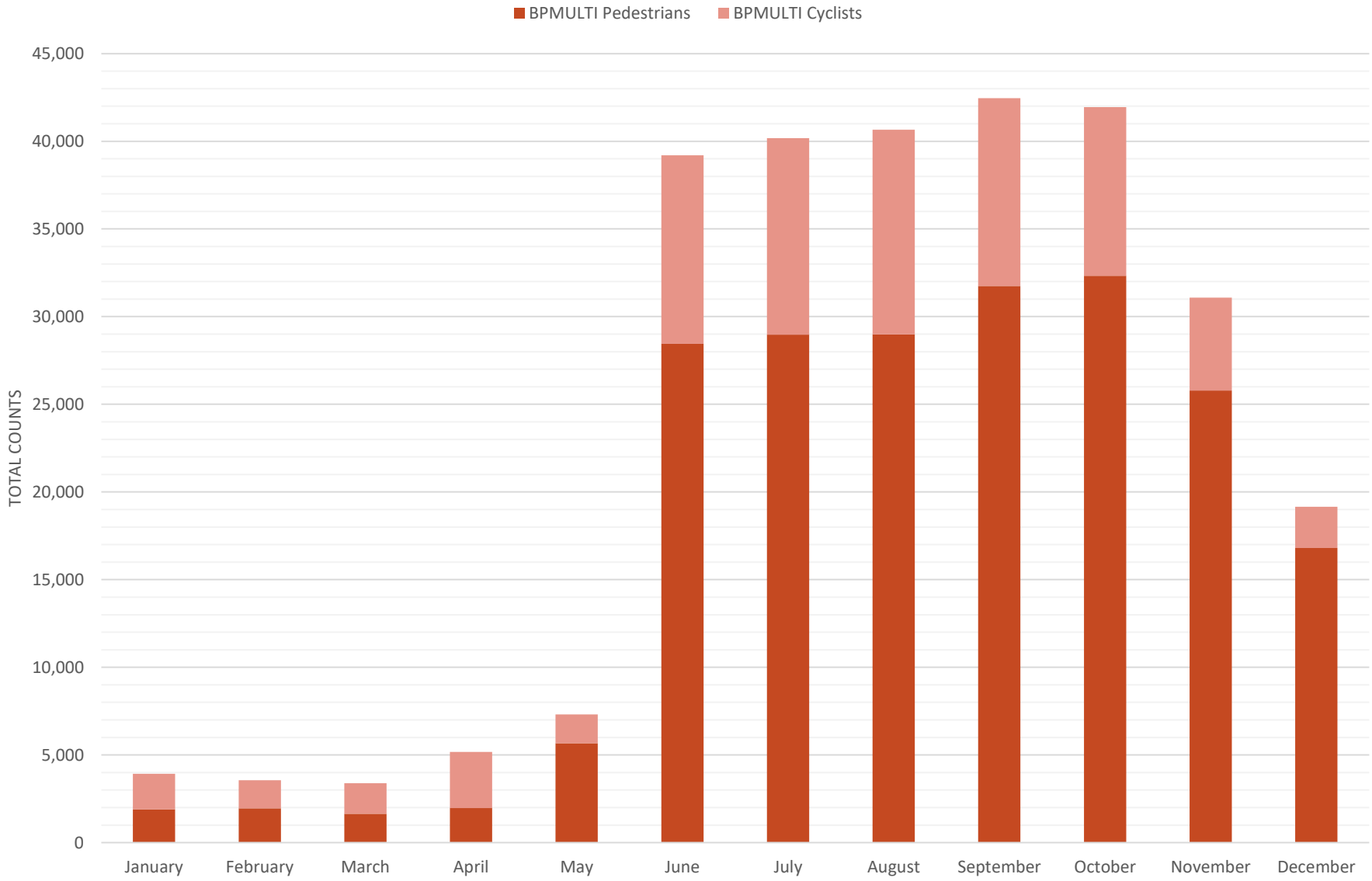
Total Monthly Counts
BP Multi 2017



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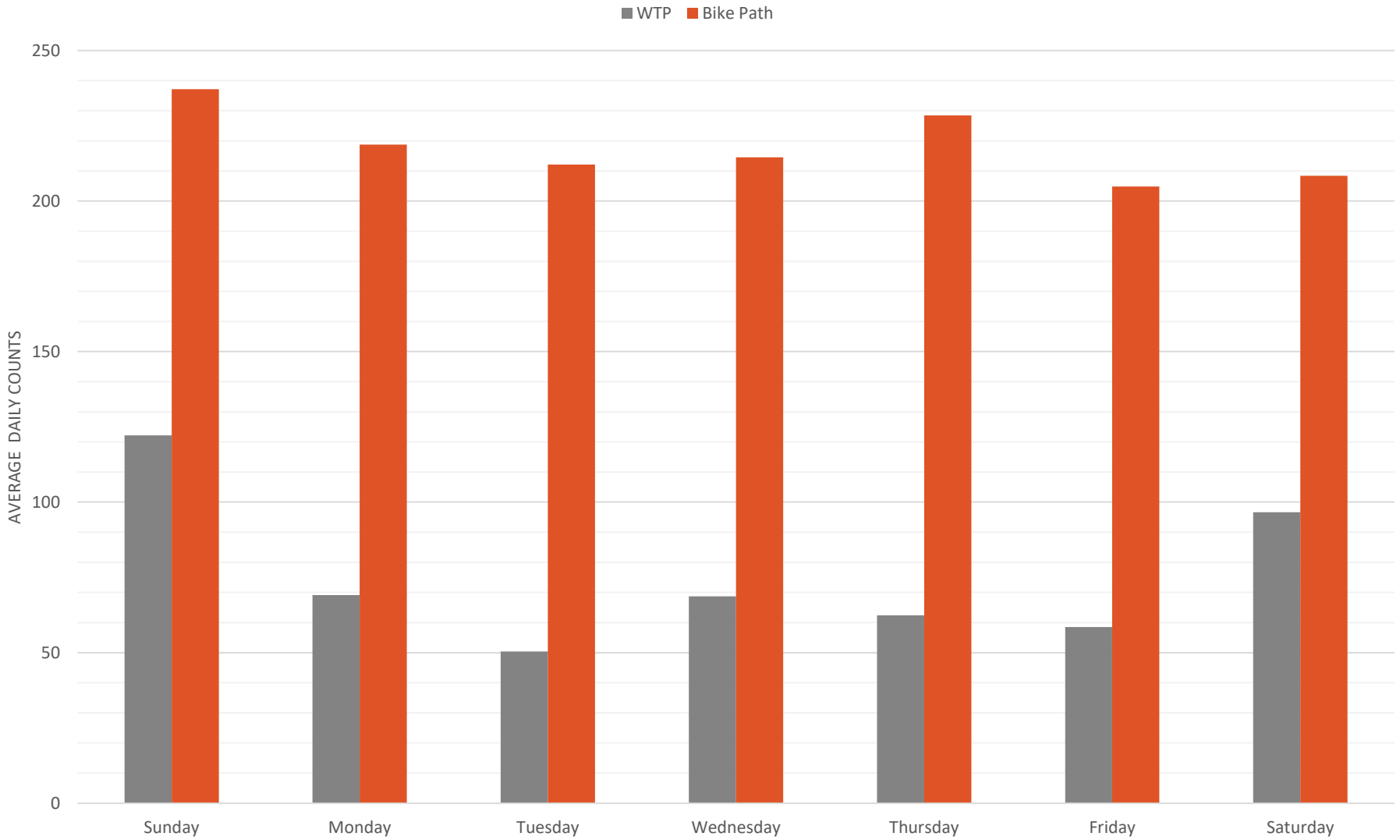
Average Daily Counts
Cyclists 2017



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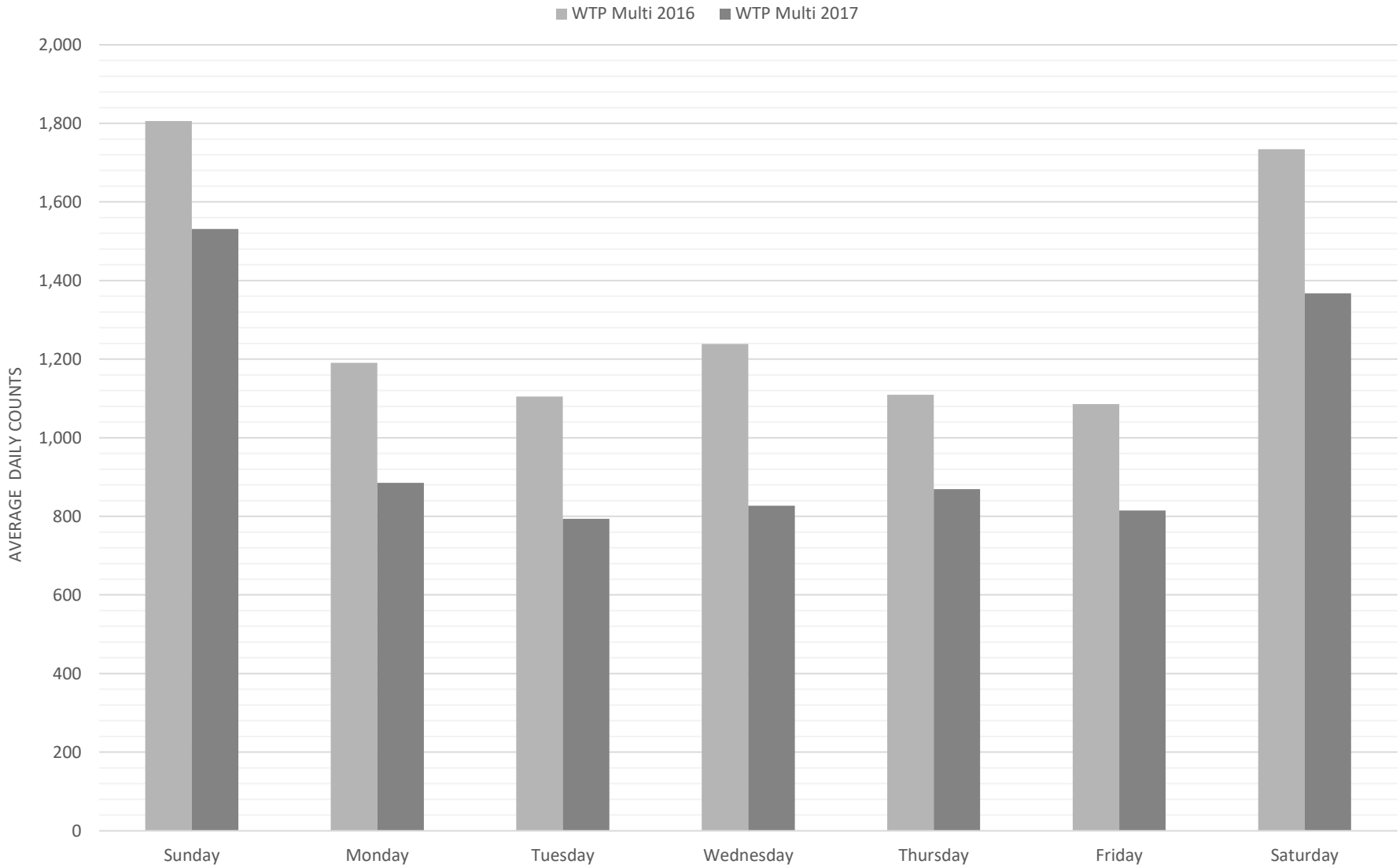
Average Daily Counts
WTP Multi 2016, 2017



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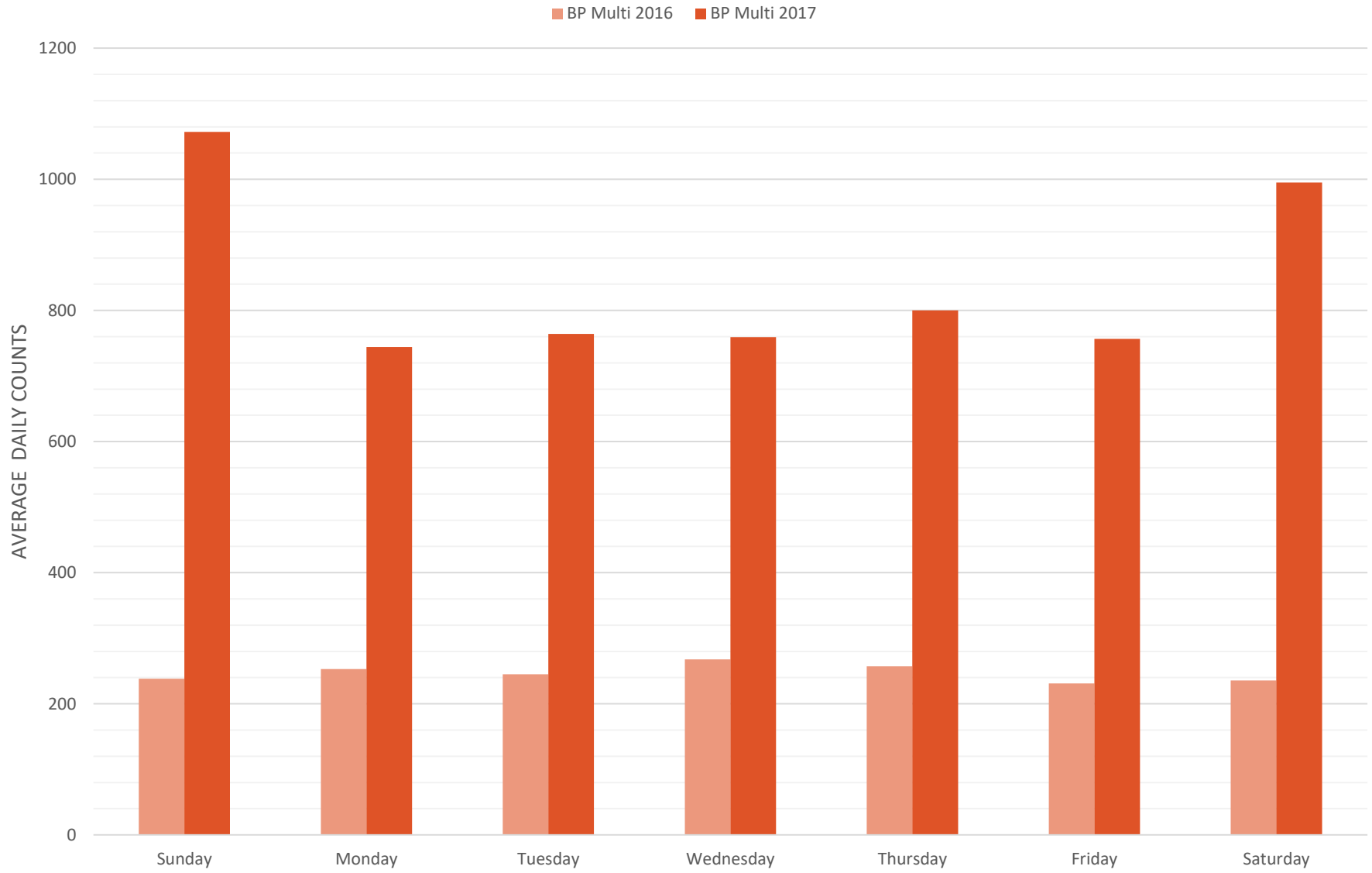
Average Daily Counts
BP Multi 2016, 2017



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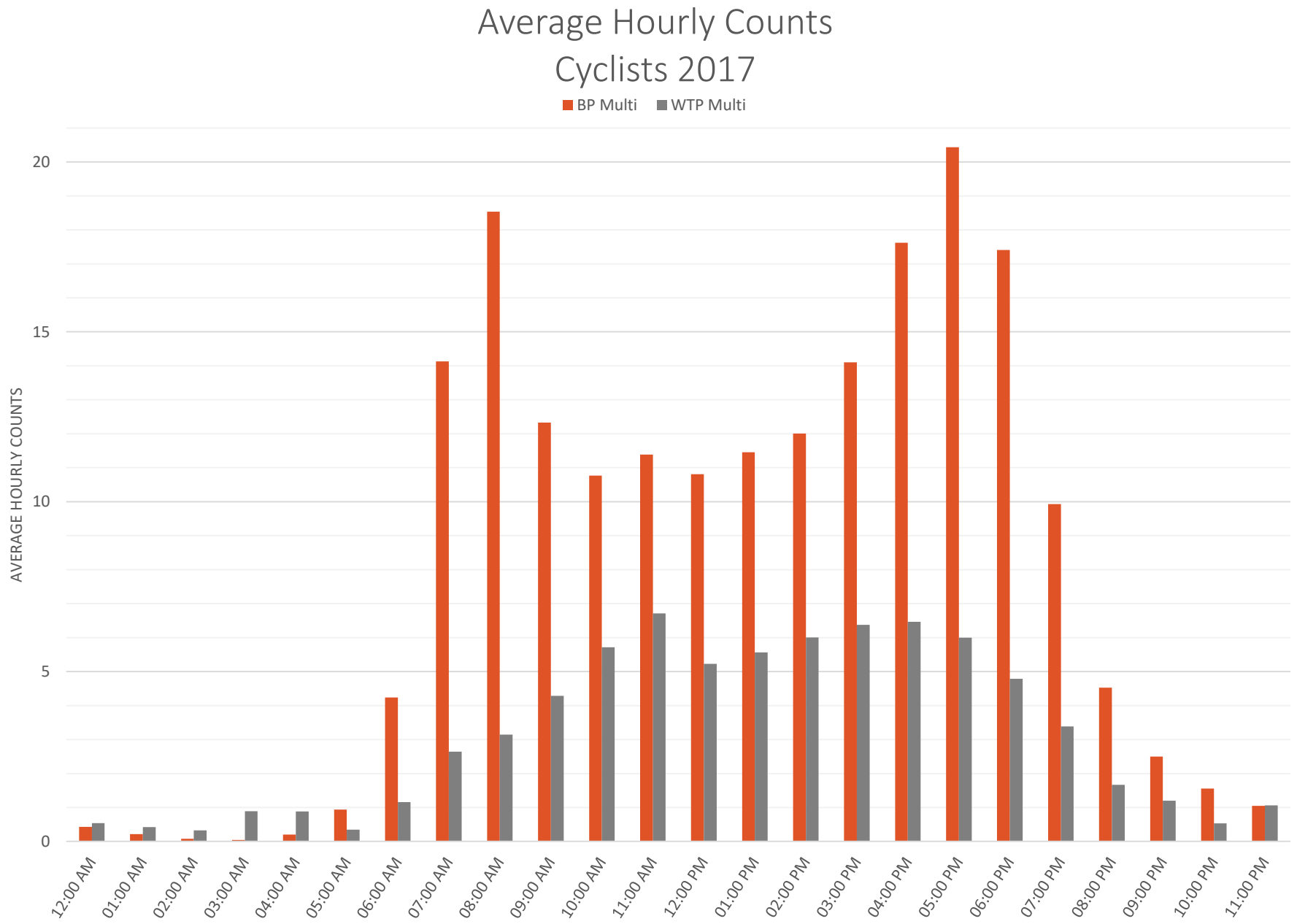

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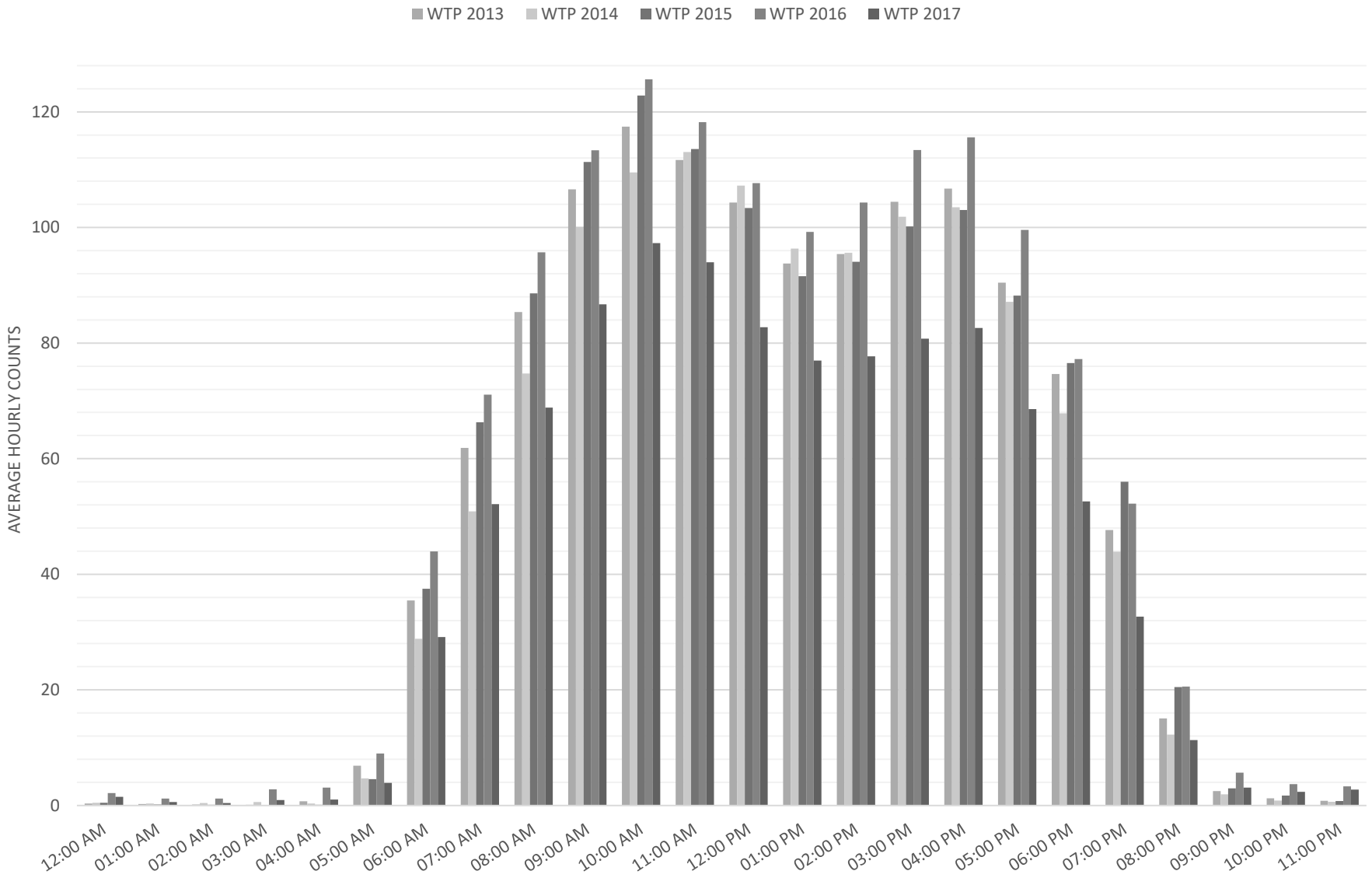
Average Hourly Counts
WTP 2013- 2017



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Average Hourly Counts
BP Multi 2014- 2017

Data errors detailed on slides 10 & 11

Methods • *Visual Survey Data*

2017 Visual Survey Methods

- The goal of visual surveys was to quantify different types of users at Fresh Pond (for example, runners, walkers, dogs, children, bikes)

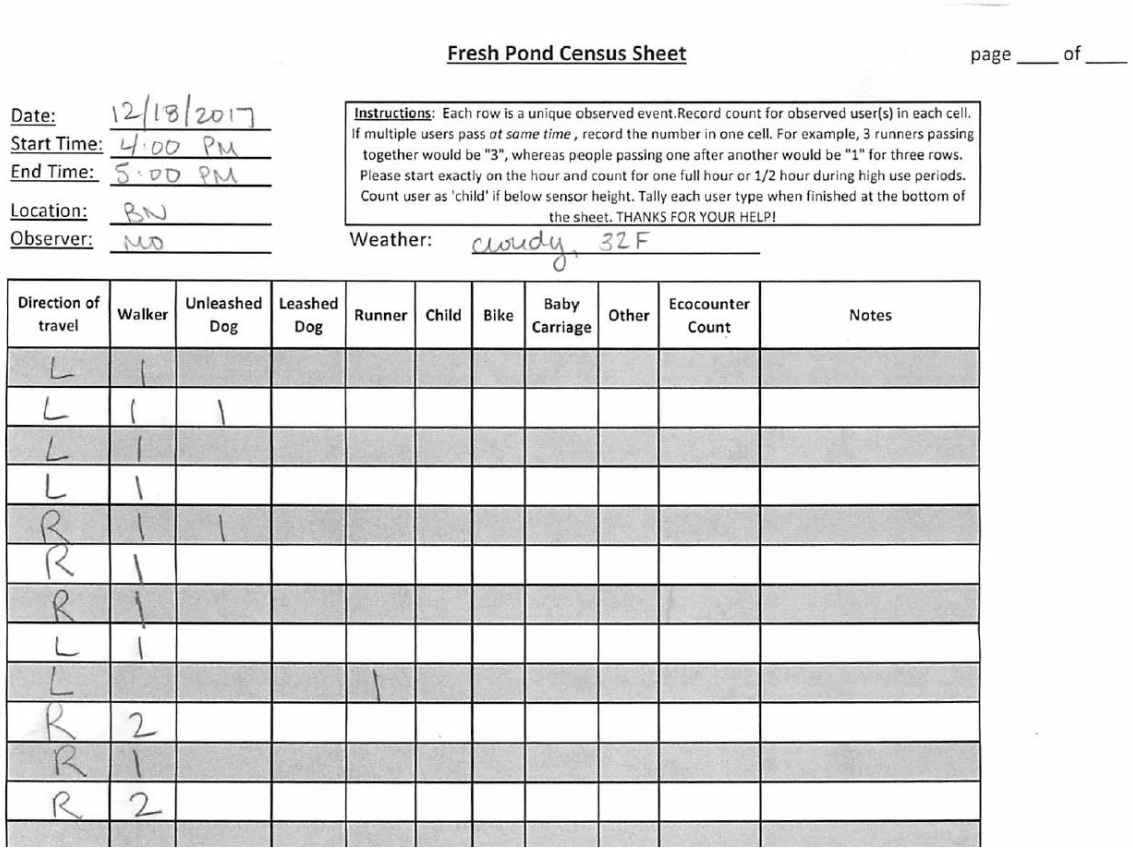
- Surveys were conducted for 1-hr increments at WTP Multi and Blacks Nook according to a stratified simple random sampling design. For each sensor, 6 – 8 hours were randomly selected from four strata (S1-S4) to survey:
  - S1 - Weekends- Saturday and Sunday 7:00 AM – 5:00 PM, 6:00 PM, or 7:00 PM (end time varied by seasonal changes in daylight)
  - S2 - Weekday mornings- 7:00 AM – 10:00 AM
  - S3 - Weekday mid-days- 11:00 AM – 2:00 PM
  - S4 - Weekday afternoons- 3:00 PM – 6:00 PM or 7:00 PM (end time varied by seasonal changes in daylight)

- Surveys at other sensors were only conducted to assess errors in EcoCounter sensor output. These survey results are not reported here.

- 2017 was the first year a formalized sampling design was used to estimate total usership and the proportion of user types

2017 Visual Survey Methods

- Surveyors stood at sensors and counted the number and type of users that crossed the sensors in both directions
- The number of survey hours was doubled from 2016 to provide a more robust estimate of usership at Fresh Pond



Fresh Pond Census Sheet page ____ of ____

Date: 12/18/2017
Start Time: 4:00 PM
End Time: 5:00 PM
Location: BN
Observer: MD

Instructions: Each row is a unique observed event.Record count for observed user(s) in each cell. If multiple users pass *at same time*, record the number in one cell. For example, 3 runners passing together would be "3", whereas people passing one after another would be "1" for three rows. Please start exactly on the hour and count for one full hour or 1/2 hour during high use periods. Count user as 'child' if below sensor height. Tally each user type when finished at the bottom of the sheet. THANKS FOR YOUR HELP!

Weather: cloudy, 32 F

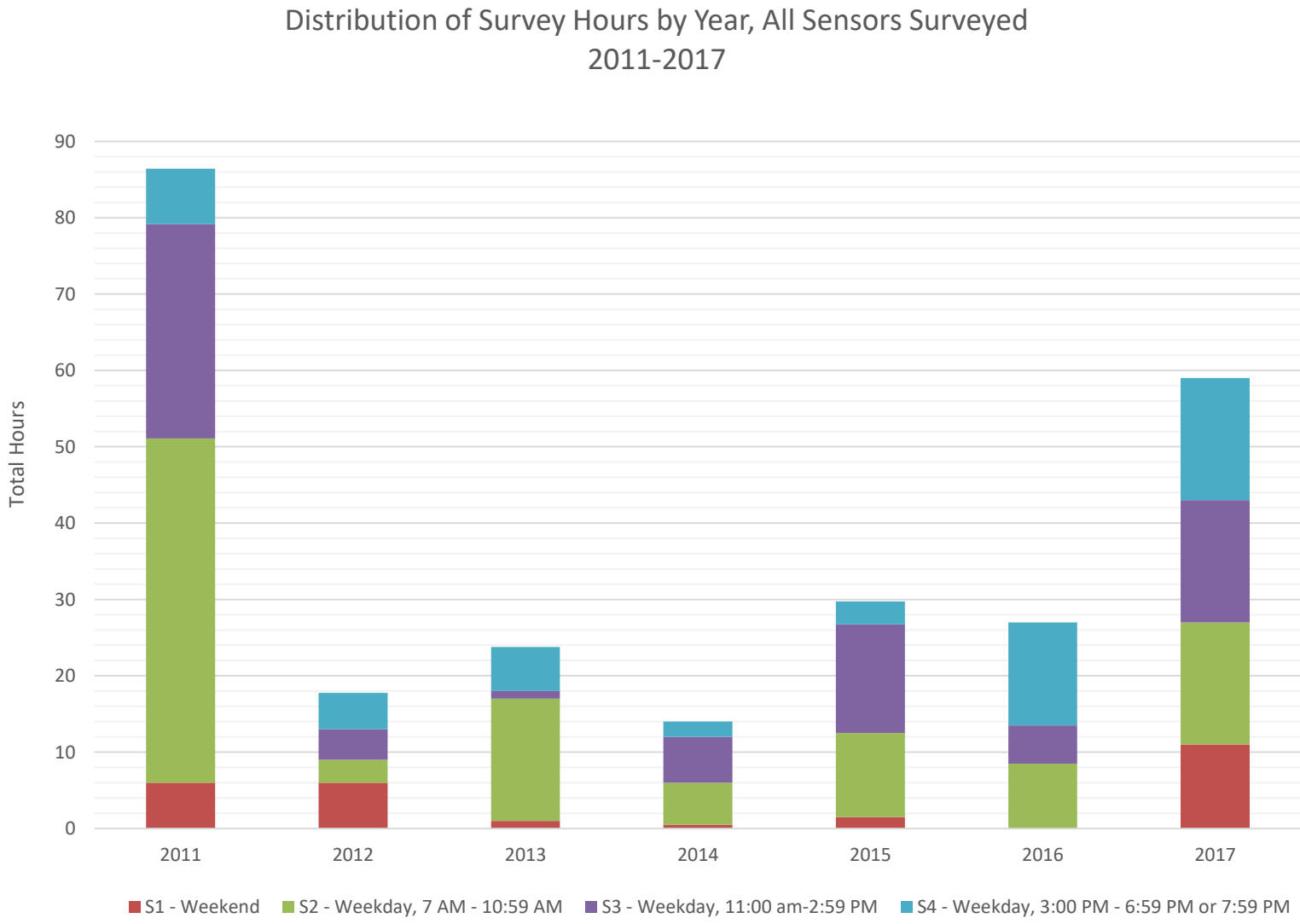
Direction of travel	Walker	Unleashed Dog	Leashed Dog	Runner	Child	Bike	Baby Carriage	Other	Ecocounter Count	Notes
L	1									
L	1	1								
L	1									
L	1									
R	1	1								
R	1									
R	1									
L	1									
L				1						
R	2									
R	1									
R	2									

Example survey data collection form

Methods

Survey Hours by Time Period

- In 2017, surveys were randomly selected from four strata to obtain representative samples of users.
- Note: 2011-2016 are calendar years. 2017 represents 2/1/2017-1/31/2018.



Results • *Visual Survey Data*

Results

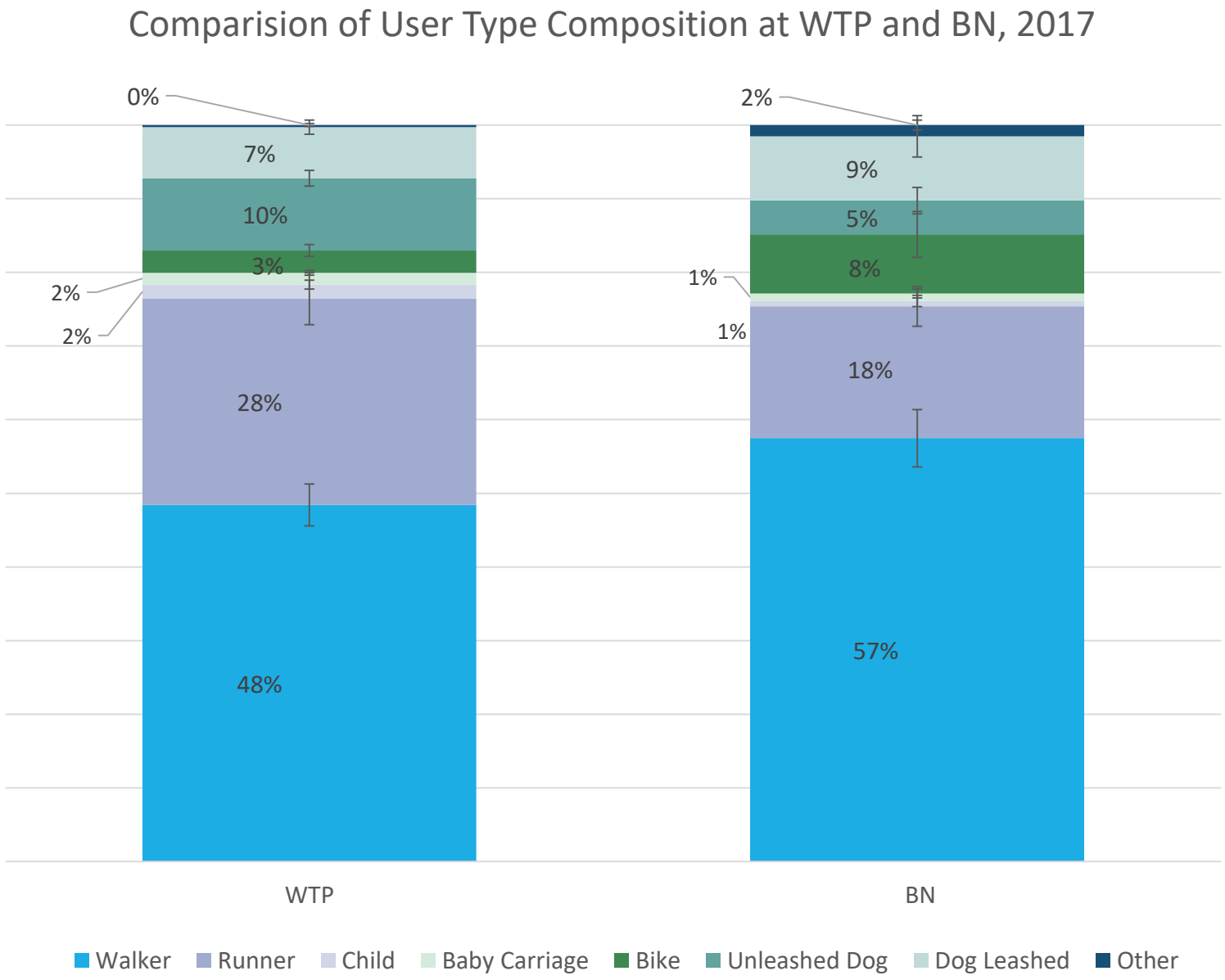
- At a 90 % confidence interval, the proportion of users and corresponding margins of error for 2017*:

	WTP		BN	
User Type	Percentage of users	Margin of Error (+/-)	Percentage of users	Margin of Error (+/-)
Walker	48%	3%	57%	4%
Runner	28%	4%	18%	3%
Baby Carriage	2%	0%	1%	1%
Child	2%	1%	1%	1%
Unleashed Dog	10%	1%	5%	2%
Dog Leashed	7%	1%	9%	3%
Bike	3%	1%	8%	3%
Other	0%	0%	2%	1%
Total Users	100%	--	100%	--

*2017 survey year spanned from 2/1/2017 – 1/31/2018

Results
User Type Composition

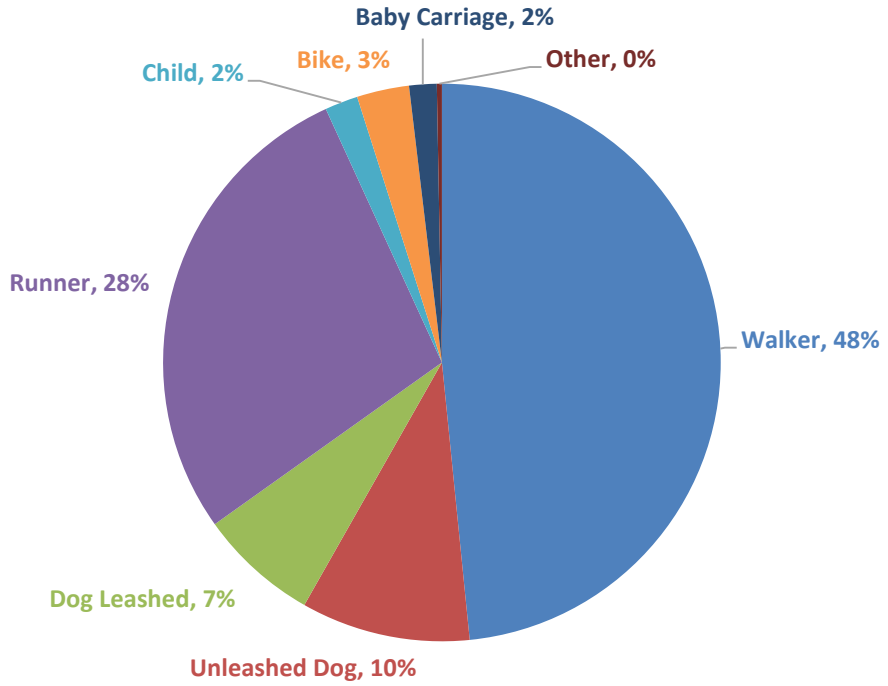
- Overall, proportions are similar
- ~75 % of users were pedestrians (runners + walkers)
  - Slightly higher % of walkers at BN than WTP, vice versa for runners
- Bikers < 10 % of users
  - Slightly higher % of bikers at BN than WTP
- Dog usage between ~10-20% of users
  - WTP may have a higher % of dogs, but margins of error overlap
- Small children (<3ft tall) and baby carriages comprised =<5 % of users at both sensors



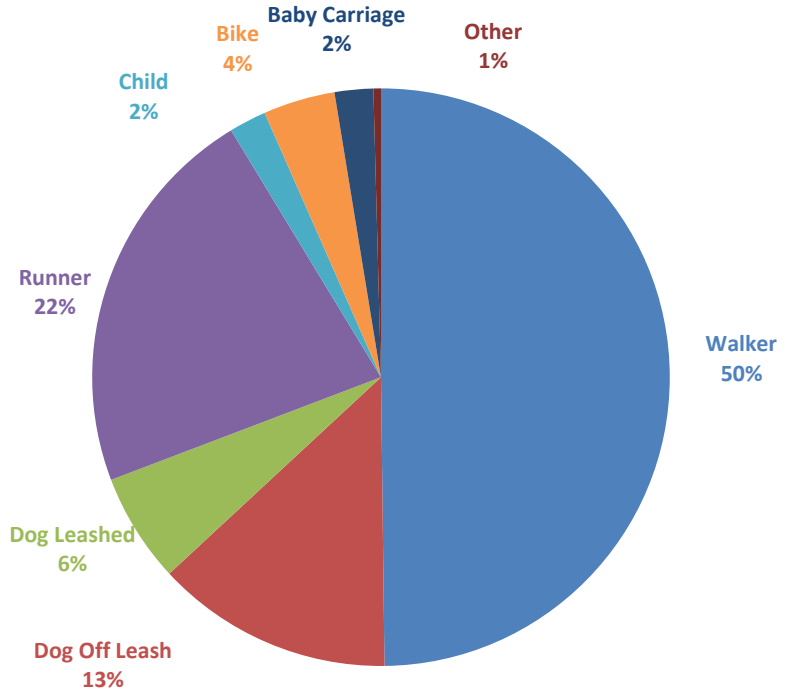
Results
WTP comparison to previous years

- Results are similar, despite informal survey methods previously used
- 97.75 survey hours were performed at WTP from 2011 - 2016

2017 WTP SURVEY ESTIMATED USERS BY TYPE



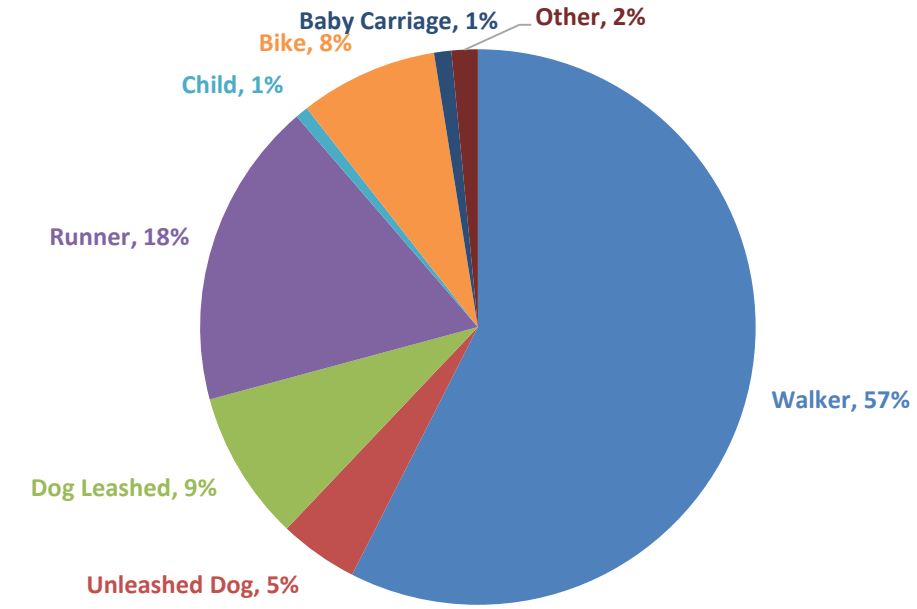
2011-2016 WTP Survey Estimated Users by Type



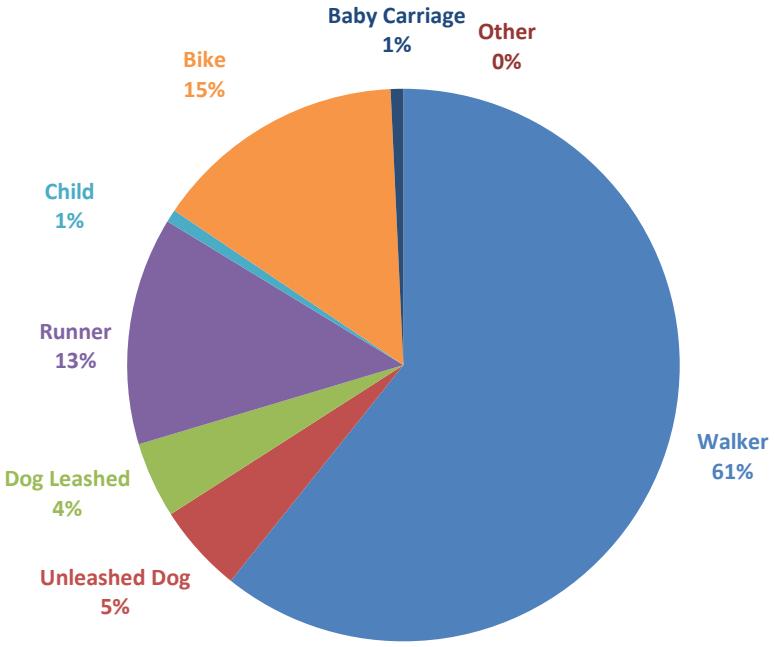
Results
BN comparison to previous years

- 2017 Results are similar, despite small number of survey hours and informal survey methods previously used
- Only 5 survey hours were performed at BN from 2015 - 2016

2017 BN SURVEY
ESTIMATED USERS BY TYPE



2015-2016 BN SURVEY
ESTIMATED USERS BY TYPE



Results • *Survey - Sensor Comparison*

- In 2017, the WTP sensor (compared to visual surveys):
  - Under counted 80% of the time
  - Over counted 20% of the time
  - Counted the same number of users 0% of the time
- In 2017, the BN sensor (compared to visual surveys):
  - Under counted 56.7% of the time
  - Over counted 26.7% of the time
  - Counted the same number of users 16.7% of the time
- From 2011-2016, all sensors combined (compared to visual surveys):
  - Under counted users 78% of the time
  - Over counted users 14% of the time
  - Counted the same number of users 8% of the time

- Under counting is likely due to grouped events (when multiple users pass a sensor but are directly next to each other and do not trigger separate counts). WTP likely has more under counts because there tend to be larger groups that pass the sensor.

Future Goals

Future Goals

- Continue to track long term trends
- Inform Shared Use plan
- Use senor and survey data to better understand impacts on Fresh Pond Reservation from neighborhood development projects

If you would like to volunteer to collect surveys at Fresh Pond, contact Tim Puopolo tpuopolo@cambridgma.gov!