

#2

COMPLETE

Collector: Web Link 1 (Web Link)
Started: Tuesday, January 07, 2020 12:25:31 PM
Last Modified: Tuesday, January 07, 2020 12:32:17 PM
Time Spent: 00:06:46
IP Address: 198.238.119.211

Page 1

Q1 Contact Information for Nomination

Name of Contact	Steven Ross
Full Name of State Agency	Washington State Employment Security Department
Email Address	steven.ross@esd.wa.gov
Name of Initiative the state (and/or partnership) is being nominated for:	Washington state Peak Employment Wage and Practices Surveys

Q2 1. Provide a brief description of the nominee's significant contributions in one of the following areas (your primary focus): building the capacity of its workforce and labor market information functions; developing high impact products and services; OR making an impact on efforts in other states and nationally. Response Word Limit: 150

The Washington State Employment Security Department (ESD) (Labor Market and Economic Analysis/Program Evaluation Research & Analysis unit/Joshua Moll) annually, in accordance with federal mandates and broad USDOL guidelines, conducts agricultural establishment and worker surveys to aid regional offices in establishing prevailing wages and prevailing or normal and common employment practices, with the mission to help U.S. employers fill jobs while mitigating adverse impacts to U.S. and foreign agricultural laborers. To achieve this goal ESD/LMEA developed a robust survey instrument, implemented a comprehensive two-stage population estimation system and derived a stable prevailing wage and prevailing or normal and common employment practices determination procedure. The highly impactful characteristics of this system is its capacity to estimate establishment and occupational-activity populations at the crop-variety level, resulting in detailed prevailing wage rates for approximately 26,226 certified foreign agricultural workers during fiscal year 2019 and any U.S domestic agricultural workers in corresponding occupational-activities.

Q3 2. Provide a statement of results, accomplishments, impacts and any other appropriate information that demonstrates why the nominee's efforts described in question #1 were an exceptional contribution. Response Word Limit: 200

Annually, since 2015, ESD/LMEA has conducted the Washington State Peak Employment Wage and Practices survey, surveying occupational-activities for which agricultural employers have requested temporary foreign employment through the agricultural recruitment system (ARS). During 2018, ESD/LMEA tested the use of three survey iterations and developed a systematic methodology to estimate both establishment and occupational-activity populations at the crop-variety level of detail. Through consistent survey administration practices and survey form development, ESD successfully identified a feasible population estimation methodology, utilizing a loglinear approach to an abundance estimator known as capture-recapture. This approach to survey administration and population estimation enabled ESD/LMEA to determine the probability of agricultural establishments experiencing a survey iteration, regarding given agricultural commodities, which was then re-expressed as a log-linear model. This model re-expression allowed the fitting of specific linear regressions that have the capacity to estimate the population of agricultural establishments that did not experience a survey iteration, controlling for survey nonresponse and producing stable population estimates. This accomplishment is impactful as only 8 states/territories of 54 in the nation were able to produce wage structure findings for the ARS. Moreover, ESD/LMEA identified 71 detailed agricultural wage structures while the remaining 7 states/territories cumulatively identified 18 wage structures.

Q4 3. Provide a brief description of the nominee's significant contributions in any one of the other two areas listed under "criteria" that you did not focus on above. Response Word Limit: 200

As ESD's mission and vision is to provide our communities with inclusive workforce solutions to ensure Washington has the nation's best and most future ready workforce, the advancements in survey administration practices and population estimation methodologies, detailed previously, has increased the workforce and labor market information functions of ESD/LMEA by providing individuals and customers, such as public policy administrators, agricultural establishments and agricultural employment seekers, more detailed agricultural wage and employment practices information to include piece rate wage distributions, externalities and factors that affect employment wage structures for Washington State's top agricultural commodities and the role temporary foreign agricultural employment plays in Washington State's economy. Moreover, the structured survey methodology employed by ESD/LMEA aids in providing value to customers by ensuring the safety and fair compensation of agricultural employment and fulfilling the labor needs of agricultural establishments. Additionally, all econometric analysis performed to accomplish these results were carried out and developed using open source R software and can be used by any other state workforce agency, after adapting the analytical code and outlining state specific survey breadth.

Q5 4. Provide samples of work including creative materials, videos, graphics, documents, plans, etc. regarding the efforts and results you outlined in questions #1 and #2. File size limit is 16 MB. Only PDF, DOC, DOCX, PNG, JPG, JPEG, GIF files are supported.

2018 Agricultural Survey Results.pdf (1004.1KB)

Q6 Sample of Work #2 File size limit is 16 MB.

2018 Agricultural Survey Results_supplementary attachment.pdf (872.2KB)

Q7 Sample of Work #3 File size limit is 16 MB.

2018 Agricultural Peak Employment Wage and Practice Employer survey.pdf (786.5KB)

Q8 Sample of Work #4File size limit is 16 MB.

Agricultural Survey Establishment Estimation.pdf (502.8KB)

Q9 Sample of Work #5File size limit is 16 MB.

Agricultural Survey Employment Estimation.pdf (1.1MB)

Q10 Please upload a statement of approval from the Agency Administrator

NASWA Award Nomination Surveys - Data Insight.pdf (71.6KB)

JAY R. INSLEE
Governor

SUZAN G. LEVINE
Commissioner



STATE OF WASHINGTON
EMPLOYMENT SECURITY DEPARTMENT

PO Box 9046 • Olympia WA 98507-9046

January 7, 2020

National Association of State Workforce Agencies
Attn: 2020 Winter Workforce Innovation Awards Committee
444 North Capitol Street, NW
Suite 300
Washington, DC 20001

Re: 2020 Winter Workforce Innovation Awards - Data Insights and Innovations Award

Dear Awards Committee:

I am pleased to submit the Washington State Employment Security Department's (ESD) nomination for the Data Insights and Innovations Award honoring Washington state Peak Employment Wage and Practices Surveys.

By this letter, I confirm my statement of approval as Commissioner and appreciate your consideration.

Sincerely,

Suzan G. LeVine
Commissioner

«FarmName»
Attn: «FirstName» «LastName»
« ADDR1»
« ADDR2»
«CITY» «STATE» «ZIP»



**Employment
Security
Department**
WASHINGTON STATE

Dear <<FirstName >>,

The Washington State Employment Security Department (ESD) has contracted with the University of Washington to collect information about wage rates and employment practices for seasonal and migrant workers hired to work with crops. It's important that we hear from employers like you to ensure that businesses like yours are represented. The information will be used by the U.S. Department of Labor to determine the wage rates and practices for workers hired through the federal Agricultural Clearance System or for any foreign worker hired through the H-2A program.

Your participation is voluntary. **All information collected in this survey is confidential and will not be provided to any other entity with the exception of specific circumstances under RCW 50.13.060; it is used for research purposes only.**

<<FarmName>> at <<Worksite>> has been selected to participate in the **2018 Agricultural Peak Employment Wage and Practice Survey**. Please direct this survey to your Personnel Manager, Human Resources Department or the appropriate person to complete the survey.

We have included with this letter a paper version of the survey and a postage-paid return envelope. Additional information about the survey is on the back of this letter. Please complete this paper survey and mail it back **by [month] [day], [year]**.

If you prefer, you may complete the survey online or by phone:

- 1) **Online:** Please go to the website below and enter your Id/Personal Access Code (PAC).
Website: <<Website>>
Id/PAC: <<PAC>>
- 2) **By Phone:** Please contact us at **agwage@uw.edu** or **866-820-4627**. Leave your name, your Id/PAC, phone number, and best time to reach you. One of our interviewers will call you back within 48 hours.

Thank you for your assistance! If you have any questions please call 866-820-4627 or email us at agwage@uw.edu.

Sincerely,
<<Signature>>

Definitions

Employee Status

Seasonal or migrant worker

Any worker who lives in the U.S. and is temporarily hired to help with growing or harvesting a commodity. This does not include foreign H-2A workers, but does include U.S. workers who are working in corresponding employment in the H-2A program.

Temporary foreign worker

Any worker from a country other than the U.S. who is temporarily hired through the H-2A program to help with growing or harvesting a commodity.

Employment Practices

Family housing

Lodging provided to non-working family members of seasonal or migrant workers.

Free lodging means there is no charge for rent, security deposit or other similar incidentals related to housing, or if the employer secures public housing, the employer pays any charges normally required for use of public housing.

Productivity standard

A minimum amount of work a seasonal or migrant worker must produce as a condition of job retention, where failure to meet the minimum standard results in training, progressive discipline and possible termination, or, not inviting employees back who were hired as day laborers. *An example is picking a minimum quantity of fruits or vegetables in a given day.*

Bonus rates

Payments given to workers as an extra incentive to complete an activity or meet a performance standard. *For example, some workers may receive an additional bonus of 50 cents per bin during harvest, in addition to the regular piece rate of \$20.00 per bin. Others might receive a bonus of 25 cents per bin, but receive the same piece rate of \$20.00 per bin. In this example, the \$20 per bin, plus 50 cents bonus would be a different pay rate than the \$20.00 per bin, plus 25 cents bonus.*

2018 Agricultural Peak Employment Wage and Practice Employer Survey

Instructions:

To begin, please answer questions in section one.

Section 1:

Q1. Does your business hire temporary foreign workers through the H-2A program for activities related to any of these crops? (select all that apply)

- Apples
- Cherries
- Pears
- Berries

- We don't hire through the H-2A program
- We don't grow any of these crops → Please return this survey in the postage-paid envelope provided.

Q2. Does your business hire domestic seasonal or migrant workers for activities related to any of these crops? (select all that apply)

- Apples → Please fill out the apple tables on pages 4 and 5 – Section 2
- Cherries → Please fill out the cherry tables on pages 6 and 7 – Section 3
- Pears → Please fill out the pear tables on pages 8 and 9 – Section 4
- Berries → Please fill out the berry tables on pages 10 and 11 – Section 5
- No, we don't hire domestic seasonal or migrant (non-H-2A) workers
→ Please return this survey in the postage-paid envelope provided.
- We don't grow any of these crops
→ Please return this survey in the postage-paid envelope provided.

Instructions:

If you hire domestic seasonal or migrant workers for activities related to Apples, Cherries, Pears or Berries continue to the indicated tables in sections 2 – 5.

Use one line in the provided tables for each unique wage rate paid for the busiest week to all domestic seasonal or migrant workers (non-H-2A) who are engaged in the production of the listed crop. Each crop table has three examples provided and more examples above the tables for your convenience.

Please write "N/A" when the best answer to a question is not applicable.

Refer to page two for definitions.

Once all the applicable tables in sections 2 – 5 have been completed, answer the questions in section 6 and then please return this survey in the postage-paid envelope enclosed. **Thank you!**

Section 2: APPLE peak employment

Do you grow apples? If yes, please fill out the apple tables below.

Apple response examples					Instructions:	
Varieties:	Orchard densities:	Activities:	Pay units:	Dimensions:	<p>Use one line in the provided tables for each unique wage rate paid for the <u>busiest week</u> to all <u>domestic seasonal or migrant workers</u> (non-H-2A) who are engaged in the production of the listed crop.</p> <p><i>Please write "N/A" when the best answer to a question is not applicable.</i></p> <p><i>Refer to page two for definitions.</i></p>	
Braeburn	low - less than 600 trees per acre	harvesting	bin	47"x47"x24.5"		
Cripps Pink	medium - 600 to 800 trees per acre	pruning	hour	48"x48"x36"		
Fuji	high - more than 800 trees per acre	thinning	tree	44"x48"x24"		
Gala				46"x46"x24"		
Golden Delicious						
Granny Smith						
Honeycrisp						
Red Delicious						

Please answer for domestic seasonal or migrant workers only (non H-2A). Answers should reflect the busiest week of the season.

Row	Variety	Variety acres	Orchard density	Activity	What was the wage rate for this crop variety activity? (dollars per bin, tree, hour)		What was the unit or dimension size for this wage rate? (only for piece rate activities)	What was the hourly guarantee for this wage rate? (only for piece rate activities)	How many workers were hired for this wage rate?	If you paid a bonus, what was the bonus amount per unit? (dollars per bin, tree, hour, End of Season)		How many workers at this wage rate received a bonus?
EX	Gala	50	Low	harvesting	\$27.00	bin	47"x47"x24.5"	\$14.12	100	\$2.00	bin	50
EX	Red Delicious	25	Medium	harvesting	\$20.00	bin	47"x47"x24.5"	\$14.50	25	\$500	EOS	2
EX	Honeycrisp	75	High	pruning	\$15.00	hour	N/A	N/A	46	N/A	N/A	0
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Section 2: APPLE peak employment continued

Please answer for domestic seasonal or migrant workers only (non H-2A). Answers should reflect the <u>busiest week of the season.</u>										
Row	How many months of prior experience are required for employment in this activity? (months)	If this variety activity and wage rate required a productivity standard, what was the minimum productivity standard? (for piece rate activities only) (wage unit per day, week, month)		For this activity on this site, how many pounds were produced and how many labor hours were needed? (for harvesting activities only)		For this variety activity, does your business provide housing to non-working family members for any of these workers? (Y/N)	If non-working family housing was provided, what did you charge for housing per person per week? (if housing was provided but not charged enter \$0) (per person per week)	For this variety activity, what was the start date of the busiest week?		
				Pounds	Labor hrs			MM /	DD /	YYYY
EX	3	3 bins	day	5000	300	Y	\$100	11	05	2018
EX	0	14 bins	week	8500	500	N	N/A	10	15	2018
EX	12	N/A	N/A	N/A	N/A	Y	\$0	02	12	2018
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Section 3: CHERRY peak employment

Do you grow cherries? If yes, please fill out the cherry tables below.

Cherry response examples					Instructions:		
Varieties:	Orchard densities:	Activities:	Pay units:	Dimensions:	<p><i>Use one line in the provided tables for each unique wage rate paid for the busiest week to all domestic seasonal or migrant workers (non-H-2A) who are engaged in the production of the listed crop.</i></p> <p><i>Please write "N/A" when the best answer to a question is not applicable.</i></p> <p><i>Refer to page two for definitions.</i></p>		
Bing	low - less than 200 trees per acre	harvesting	bucket	15 pounds			
Chelan	medium - 200 to 300 trees per acre	pruning	lug	20 pounds			
Lapin	high - more than 300 trees per acre	thinning	pound	30 pounds			
Rainier			hour				
Skeena			tree				

Please answer for domestic seasonal or migrant workers only (non H-2A). Answers should reflect the busiest week of the season.

Row	Variety	Variety acres	Orchard density	Activity	What was the wage rate for this crop variety activity? (Dollars per lug, bucket, tree, hour)		What was the unit or dimension size for this wage rate? (only for piece rate activities)	What was the hourly guarantee for this wage rate? (only for piece rate activities)	How many workers were hired for this wage rate?	If you paid a bonus, what was the bonus amount per unit? (Dollars per lug, bucket, tree, hour, End of Season)		How many workers at this wage rate received a bonus?
EX	Bing	100	Low	harvesting	\$6.00	bucket	30 pounds	\$14.12	150	\$0.50	bucket	72
EX	Rainier	75	Medium	harvesting	\$6.00	lug	20 pounds	\$14.50	207	\$0.75	lug	23
EX	Skeena	52	High	pruning	\$14.00	hour	N/A	N/A	46	N/A	N/A	0
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Section 3: CHERRY peak employment continued

Please answer for domestic seasonal or migrant workers only (non H-2A).
 Answers should reflect the busiest week of the season.

Row	How many months of prior experience are required for employment in this activity? (Months)	If this variety activity and wage rate required a productivity standard, what was the minimum productivity standard? (for piece rate activities only) (wage unit per day, week, month)		For this activity on this site, how many pounds were produced and how many labor hours were needed? (for harvesting activities only)		For this variety activity, does your business provide housing to non-working family members for any of these workers? (Y/N)	If non-working family housing was provided, what did you charge for housing per person per week? (if housing was provided but not charged enter \$0) (per person per week)	For this variety activity, what was the start date of the busiest week?		
				Pounds	Labor hrs			MM /	DD /	YYYY
EX	6	15 buckets	day	6300	200	Y	\$0	06	03	2018
EX	12	70 lugs	week	7200	400	N	N/A	06	17	2018
EX	0	N/A	N/A	N/A	N/A	Y	\$50	03	12	2018
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Section 4: PEAR peak employment

Do you grow pears? If yes, please fill out the pear tables below.

Pear response examples					Instructions:						
Varieties:	Orchard densities:	Activities:	Pay units:	Dimensions:	<p>Use one line in the provided tables for each unique wage rate paid for the <u>busiest week</u> to all <u>domestic seasonal or migrant workers</u> (non-H-2A) who are engaged in the production of the listed crop.</p> <p>Please write "N/A" when the best answer to a question is not applicable.</p> <p>Refer to page two for definitions.</p>						
Bartlett	low - less than 150 trees per acre	harvesting	bin	47"x47"x24.5"							
Bosc	medium - 150 to 200 trees per acre	pruning	hour	46"x46"x24"							
D'Anjou	high - more than 200 trees per acre	thinning	tree	48"x48"x24"							
Comice Red D'Anjou											

Please answer for domestic seasonal or migrant workers only (non H-2A). Answers should reflect the <u>busiest week</u> of the season.												
Row	Variety	Variety acres	Orchard density	Activity	What was the wage rate for this variety activity? (Dollars per bin, tree, hour)		What was the unit or dimension size for this wage rate? (only for piece rate activities)	What was the hourly guarantee for this wage rate? (only for piece rate activities)	How many workers were hired for this wage rate?	If you paid a bonus, what was the bonus amount per unit? (Dollars per bin, tree, hour, End of Season)		How many workers at this wage rate received a bonus?
EX	Bartlett	32	Low	harvesting	\$22.00	bin	47"x47"x24.5"	\$14.12	46	\$3.00	bin	10
EX	D'Anjou	51	Medium	harvesting	\$26.50	bin	47"x47"x24.5"	\$14.50	75	N/A	N/A	0
EX	Bosc	15	High	pruning	\$14.25	hour	N/A	N/A	10	N/A	N/A	0
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Section 4: PEAR peak employment continued

Please answer for domestic seasonal or migrant workers only (non H-2A).
 Answers should reflect the busiest week of the season.

Row	How many months of prior experience are required for employment in this activity? (Months)	If this variety activity and wage rate required a productivity standard, what was the minimum productivity standard? (for piece rate activities only) (wage unit per day, week, month)		For this activity on this site, how many pounds were produced and how many labor hours were needed? (for harvesting activities only)		For this variety activity, does your business provide housing to non-working family members for any of these workers? (Y/N)	If non-working family housing was provided, what did you charge for housing per person per week? (if housing was provided but not charged enter \$0) (per person per week)	For this variety activity, what was the start date of the busiest week?		
				Pounds	Labor hrs			MM /	DD /	YYYY
EX	12	3 bins	day	7000	450	Y	\$90	08	26	2018
EX	3	14 bins	week	9500	670	N	N/A	09	16	2018
EX	0	N/A	N/A	N/A	N/A	Y	\$0	02	12	2018
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Section 5: BERRY peak employment

Do you grow berries? If yes, please fill out the berry tables below.

Berry response examples				Instructions:
Varieties:	Activities:	Pay units:	Dimensions:	<p><i>Use one line in the provided tables for each unique wage rate paid for the busiest week to all domestic seasonal or migrant workers (non-H-2A) who are engaged in the production of the listed crop.</i></p> <p><i>Please write "N/A" when the best answer to a question is not applicable.</i></p> <p><i>Refer to page two for definitions.</i></p>
Blueberries	harvesting	bucket	5 pounds	
Strawberries	drumming	pound	10 pounds	
Raspberries	packing	hour	15 pounds	

Please answer for domestic seasonal or migrant workers only (non H-2A). Answers should reflect the busiest week of the season.											
Row	Variety	Variety acres	Activity	What was the wage rate for this crop variety activity? (Dollars per bucket, pound, hour)		What was the unit or dimension size for this wage rate? (only for piece rate activities)	What was the hourly guarantee for this wage rate? (only for piece rate activities)	How many workers were hired for this wage rate?	If you paid a bonus, what was the bonus amount per unit? (Dollars per bucket, pound, hour, End of Season)		How many workers at this wage rate received a bonus?
EX	Blueberries	300	harvesting	\$5.00	bucket	5 pounds	\$14.12	175	\$0.20	pound	67
EX	Strawberries	275	harvesting	\$14.75	hour	N/A	N/A	200	N/A	N/A	0
EX	Raspberries	55	packing	\$13.38	hour	N/A	N/A	42	N/A	N/A	0
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Section 5: BERRY peak employment continued

Please answer for domestic seasonal or migrant workers only (non H-2A). Answers should reflect the <u>busiest week of the season.</u>										
Row	How many months of prior experience are required for employment in this activity? (Months)	If this variety activity and wage rate required a productivity standard, what was the minimum productivity standard? (for piece rate activities only) (wage unit per day, week, month)		For this activity on this site, how many pounds were produced and how many labor hours were needed? (for harvesting activities only)		For this variety activity, does your business provide housing to non-working family members for any of these workers? (Y/N)	If non-working family housing was provided, what did you charge for housing per person per week? (if housing was provided but not charged enter \$0) (per person per week)	For this variety activity, what was the start date of the busiest week?		
				Pounds	Labor hrs			MM /	DD /	YYYY
EX	2	20 buckets	day	7900	180	Y	\$60	08	05	2018
EX	0	N/A	N/A	5500	252	N	N/A	06	10	2018
EX	0	N/A	N/A	N/A	N/A	Y	\$0	07	15	2018
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Comments

If you have any additional comments, including any other factors that may affect wages please write them in the space provided below.

Please indicate the topic(s) of the comments you provided above (check all that apply)

- | | |
|---|---|
| <input type="checkbox"/> New Techniques or Technology | <input type="checkbox"/> Laws & Regulations |
| <input type="checkbox"/> Upcoming varieties & cultivars | <input type="checkbox"/> Staffing agencies & Leasing land |
| <input type="checkbox"/> Environment or Nature | <input type="checkbox"/> Post-harvest & Distribution |
| <input type="checkbox"/> Labor or Wages | <input type="checkbox"/> Other |

**Thank you for taking the time to complete the
2018 Agricultural Peak Employment Wage and Employer Practice Survey!**

Please return your completed survey using the enclosed postage-paid envelope or mail to:

University of Washington address

2018 Agricultural Peak Employment Wage and Practices Survey Results

Distributed April 2019

Washington State Employment Security Department

Labor Market and Economic Analysis

Gustavo Aviles, *Program Evaluation, Research & Analysis Manager*

Steven Ross, *Workforce Information Operations Manager*

Daniel Zeitland, *Director of Employment System Policy*

Report prepared by

Joshua Moll, *Research Economist*

Toby Paterson, *Research Economist*

For more information or to get this report in an alternative format, call the Employment Security Department Labor Market Information Center at 800-215-1617.

Employment Security Department is an equal opportunity employer/program. Auxiliary aids and services are available upon request to individuals with disabilities. Language assistance services for limited English proficient individuals are available free of charge. Washington Relay Service: 711.

Contents

Executive summary	1
Background.....	1
Role of State Employment Security Agencies.....	1
Key findings.....	1
2018 results.....	2
Employer estimates.....	2
Employment estimates.....	3
Prevailing wage rates	5
Prevailing or normal and common employment practices	7
Prevailing practices.....	7
Normal and common practices	8
Comparing employer and worker survey responses	10
Apple and cherry wage rate and wage structure comparison.....	11
Apple and cherry employment practices comparison.....	12
Appendices	14
Appendix 1: Prevailing wage rate finding process.....	14
Prevailing wage finding process.....	14
Appendix 2: Estimating prevailing or normal and common practices.....	14
Prevailing practices.....	15
Normal and common practices	16
Minimum productivity standards.....	17
Experience requirements.....	17
Reference checks.....	17
Provision of tools and the positive recruitment of U.S. Nationals	17
Appendix 3: Glossary of terms.....	18

Executive summary

Background

The Washington State Employment Security Department's (ESD) Labor Market and Economic Analysis (LMEA) division has conducted an agricultural wage and practice survey annually since 2015, surveying for occupations and activities for which employers have requested temporary foreign laborers through the agricultural recruitment system (ARS). Prior to 2015, LMEA conducted an agricultural wage and practice survey on a biennial basis for select agricultural commodities.

During spring 2016, LMEA began modifications to the annual Agricultural Peak Employment Wage and Practice Employer survey. In addition, in line with U.S. Department of Labor (USDOL) and Employment Training Administration (ETA) Handbook 385 guidance, LMEA developed an Agricultural Peak Employment Wage and Practice Worker survey, and established a methodology for comparing employer and worker survey responses.

Role of State Employment Security Agencies

USDOL provides funding to State Employment Security Agencies (SESAs) to conduct surveys that help its regional offices establish prevailing wages and prevailing or normal and common practices in agriculture. The guidelines to conduct these surveys are contained in ETA Handbooks 385 and 398. ETA Handbook 385 requires SESAs to conduct a prevailing wage survey for any agricultural activity or occupation to which one or more of the following conditions apply:

1. One hundred or more workers were employed in the previous season, or are expected to be employed in the current season;
2. Foreign workers were employed in the previous season, or employers have requested or may be expected to request foreign workers in the current season, regardless of the number of workers involved;
3. The crop activity has an unusually complex wage structure, or there are other factors affecting the prevailing wage which can best be determined by a wage survey; or
4. The crop or crop activity has been designated by the national office as a major crop or crop activity either because of the importance of the production of this crop to the national economy or because large numbers of workers are employed in the crop activity in a number of different areas in the country (ETA Handbook 385, p. I-115).

Key findings

The 2018 Agricultural Peak Employment Wage and Practice Surveys received 48.44 percent and 42.91 percent response rates for the employer and worker surveys respectively, this equates to 781 eligible employers and 1,833 workers responding to the surveys.

In addition, the 2018 prevailing wage finding process identified 306 different combinations of agricultural commodity-activity wage structures, 71 of these combinations meet or exceed USDOL thresholds for wage determinations. Of the 71 combinations of commodity-activity-wage structures that meet USDOL determination thresholds 33 are for apple activities, 5 are for berry activities, 26 are for cherry activities and 7 are for pear activities. Only two commodity-activity wage structures that meet USDOL determination thresholds increased from the previous 2017 iteration wage finding process. These commodity-activity wage structures are Bartlett-Pear-Harvesting, \$25 per bin (+\$3.00 per bin) and Skeena-Cherry-Harvesting, \$0.20 per pound (+\$0.03 per pound).

Moreover, no employment practices measures, to include experience requirements, the provision of family housing and minimum productivity standards, passed the prevailing practices or normal and common practices thresholds as the majority of employer survey responses indicated that all three employment practices were either not applicable or skipped the questions..

2018 results

Employer estimates

For estimating the total number of employers to have participated in the production of a given agricultural commodity and employed migrant or seasonal laborers LMEA utilized a log-linear approach to an abundance estimator known as a capture-recapture estimator¹.

This type of population estimator has three general requirements:

1. At least two capture occasions are necessary to generate an estimate. An example of this would be having at least two agricultural survey iteration results available and in the same structural format;
2. The capture occasions occur over a relatively short period of time; and
3. All occasions of the search procedure (e.g., survey iterations) remain conceptually equivalent.

Additionally, this type of estimator takes three universal assumptions:

1. The population in question is finite;
2. Immigration into the population area is negligible. An example of this would be the number of new agricultural employers established on a yearly basis is small; and
3. Mortality rates are negligible, meaning the number of agricultural employers going out of business is small.

Procedurally, this approach to population estimation enables the determination of the probability of employers to experience responding to a survey iteration and therefore the expected number of employers, with regard to a given agricultural commodity, can be formulated and re-expressed as a log-linear model. This model re-expression then allows the fitting of specific linear regressions that have the capacity to estimate the number of employers that did not respond to a survey iteration, controlling survey nonresponse and producing a population estimate of the total number of employers participating in the production of a particular agricultural commodity.

Figure 1 details the models chosen to generate employer populations by agricultural commodity, metrics to assess model fit and 95 percent confidence intervals for each commodity. 2015, 2017 and 2018 employer survey iterations were used to generate employer estimates.

Figure 1. 2018 employer estimates

Washington state, 2019

Source: Employment Security Department/LMEA, 2015, 2017, 2018 Agricultural Wage and Practice Employer Surveys

Commodity	Estimation model	Employer estimate	Standard error	Confidence interval (95%)	AIC*	BIC**
Apple	Mth - Chao	1,210	66	1,092 - 1,352	76	99
Apple, ambrosia	Mt	72	64	21 - > 215	21	24
Apple, braeburn	Mt	191	84	93 - 548	30	38
Apple, cripps pink	Mt	171	58	97 - 376	33	41
Apple, fuji	Mth - Chao	731	131	529 - 1,071	48	65
Apple, gala	Mt	911	80	773 - 1091	61	77
Apple, golden delicious	Mt	545	52	457 - 664	52	67
Apple, granny smith	Mt	491	73	374 - 673	41	54
Apple, honeycrisp	Mt	686	90	540 - 904	51	65
Apple, red delicious	Mt	599	67	488 - 756	49	64
Berry	Mt	333	33	279 - 409	54	67
Berry, blueberry	Mt	214	32	164 - 294	41	52

¹ For more detailed information see: Rivest, L.P. & Baillargeon, S. (2007). "Rcapture: Loglinear Models for Capture-Recapture in R". *Journal of Statistical Software*, 19(5).

Berry, raspberry	Mt	149	26	110 - 219	56	65
Berry, strawberries	Mh - Poisson	18	17	18 - 29	26	29
Cherry	Mth - Chao	1,047	61	939 - 1179	83	105
Cherry, dark red	Mt	745	57	647 - 871	57	73
Cherry, lapin	Mt	226	38	168 - 326	36	46
Cherry, red	Mt	810	86	665 - 1010	60	75
Cherry, skeena	Mt	250	57	169 - 414	33	44
Cherry, sweetheart	Mt	407	86	280 - 646	37	49
Cherry, yellow	Mt	525	57	430 - 659	49	63
Pear	Mt	717	50	629 - 828	62	78
Pear, bartlett	Mt	678	62	572 - 820	62	77
Pear, bosc	Mt	354	65	255 - 525	36	48
Pear, d'anjou	Mt	500	55	409 - 629	47	61

*Akaike information criterion

**Bayesian information criterion

Employment estimates

The estimation method used for the 2018 survey iteration to estimate total employment by commodity-activity is an iterative proportional fitting procedure, more commonly referred to in survey analysis as a raking algorithm².

The raking algorithm chosen to estimate total employment by commodity-activity incrementally post-stratifies employer survey responses so that the marginal totals from the survey match (equal) specified marginal control totals, where the sample marginal totals would be the number of employers responding for a particular commodity and the control marginal total are defined as the employer population estimates detailed previously. The raking procedure then results in the production of calibration weights to adjust reported employment. These weights are then multiplied by the reported employment for a given commodity-activity to generate total estimated employment levels.

Figure 2 shows the resulting total estimated employment levels by commodity-activity and density for which LMEA could generate an estimate and fulfill USDOL determination requirements³. Additionally Figure 2 shows total reported employment and percent reported employment by commodity-activity and density.

Figure 2. 2018 employment estimates by commodity-activity

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer Survey

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Apple	Harvesting	All	9,932	65,358	15%	15%	Yes
Apple	Harvesting	High	1,745	11,895	15%	15%	Yes
Apple	Harvesting	Low	2,527	9,973	25%	15%	Yes
Apple	Harvesting	Medium	2,021	12,663	16%	15%	Yes
Apple	Harvesting-color-pick	All	4,652	29,924	16%	15%	Yes
Apple	Harvesting-color-pick	High	1,200	7,728	16%	15%	Yes
Apple	Harvesting-color-pick	Low	839	2,614	32%	20%	Yes
Apple	Harvesting-color-pick	Medium	1,181	7,563	16%	15%	Yes
Apple	Harvesting-stem-clip	All	3,129	21,524	15%	15%	Yes
Apple	Harvesting-stem-clip	High	468	3,155	15%	15%	Yes

² For more detailed information see: Lumley, T. (2004). "Analysis of complex survey samples". *Journal of Statistical Software*, 9(1), 1-19.

³ For employment estimates that did not meet USDOL thresholds see Figure 2 in the supplementary attachment

Apple	Harvesting-stem-clip	Low	369	916	40%	40%	Yes
Apple	Harvesting-strip-pick	All	7,628	52,094	15%	15%	Yes
Apple	Harvesting-strip-pick	Low	1,917	7,929	24%	15%	Yes
Apple	Pruning	All	2,139	11,865	18%	15%	Yes
Apple	Thinning	All	1,482	4,266	35%	15%	Yes
Apple, ambrosia	Harvesting	All	543	3,577	15%	15%	Yes
Apple, ambrosia	Harvesting-strip-pick	All	543	3,577	15%	15%	Yes
Apple, cripps pink	Harvesting	All	694	4,134	17%	15%	Yes
Apple, fuji	Harvesting	Medium	487	3,194	15%	15%	Yes
Apple, gala	Harvesting	High	654	4,101	16%	15%	Yes
Apple, gala	Harvesting	Low	782	2,702	29%	20%	Yes
Apple, gala	Harvesting-color-pick	High	498	2,201	23%	20%	Yes
Apple, golden delicious	Harvesting	Low	1,003	4,926	20%	15%	Yes
Apple, golden delicious	Harvesting-strip-pick	All	3,153	20,359	15%	15%	Yes
Apple, golden delicious	Harvesting-strip-pick	Low	920	4,685	20%	15%	Yes
Apple, granny smith	Harvesting	Low	592	3,439	17%	15%	Yes
Apple, granny smith	Harvesting	Medium	501	3,296	15%	15%	Yes
Apple, granny smith	Harvesting-strip-pick	Low	522	3,155	17%	15%	Yes
Apple, honeycrisp	Harvesting	Low	576	2,331	25%	20%	Yes
Apple, honeycrisp	Harvesting	Medium	638	4,099	16%	15%	Yes
Apple, red delicious	Harvesting	Low	1,195	7,592	16%	15%	Yes
Apple, red delicious	Harvesting	Medium	500	3,019	17%	15%	Yes
Apple, red delicious	Harvesting-strip-pick	Low	1,093	7,221	15%	15%	Yes
Berry	Harvesting	All	2,989	12,106	25%	15%	Yes
Berry, blueberry	Harvesting	All	1,786	5,622	32%	15%	Yes
Berry, raspberry	Harvesting	All	1,013	3,356	30%	15%	Yes
Berry, strawberry	Harvesting	All	458	549	83%	50%	Yes
Berry, strawberry	Packing	All	180	180	100%	100%	Yes
Cherry	Harvesting	All	13,449	40,573	33%	15%	Yes
Cherry	Harvesting	High	1,608	4,986	32%	15%	Yes
Cherry	Harvesting	Low	3,457	10,704	32%	15%	Yes
Cherry	Harvesting	Medium	4,149	12,577	33%	15%	Yes
Cherry	Pruning	All	1,945	5,861	33%	15%	Yes
Cherry	Pruning	Medium	503	1,497	34%	30%	Yes
Cherry	Thinning	All	366	1,032	35%	35%	Yes
Cherry, dark red	Harvesting	All	9,716	29,698	33%	15%	Yes
Cherry, dark red	Harvesting	High	867	2,409	36%	20%	Yes
Cherry, dark red	Harvesting	Low	2,928	8,128	36%	15%	Yes
Cherry, dark red	Harvesting	Medium	2,824	8,577	33%	15%	Yes
Cherry, lapin	Harvesting	All	2,310	8,785	26%	15%	Yes
Cherry, lapin	Harvesting	Medium	584	2,056	28%	25%	Yes
Cherry, red	Harvesting	All	5,173	31,850	16%	15%	Yes
Cherry, red	Harvesting	High	833	5,272	16%	15%	Yes
Cherry, red	Harvesting	Medium	1,794	11,089	16%	15%	Yes
Cherry, skeena	Harvesting	All	2,792	9,832	28%	15%	Yes
Cherry, skeena	Harvesting	High	458	1,542	30%	30%	Yes
Cherry, skeena	Harvesting	Medium	722	2,434	30%	20%	Yes
Cherry, sweetheart	Harvesting	All	4,060	17,543	23%	15%	Yes
Cherry, sweetheart	Harvesting	High	606	2,653	23%	20%	Yes
Cherry, sweetheart	Harvesting	Medium	1,598	6,901	23%	15%	Yes

Cherry, yellow	Harvesting	All	4,411	16,246	27%	15%	Yes
Cherry, yellow	Harvesting	High	563	2,225	25%	20%	Yes
Cherry, yellow	Harvesting	Low	981	3,529	28%	15%	Yes
Cherry, yellow	Harvesting	Medium	899	3,341	27%	15%	Yes
Pear	Harvesting	All	3,350	20,090	17%	15%	Yes
Pear	Harvesting	High	760	2,111	36%	20%	Yes
Pear	Harvesting	Low	916	4,409	21%	15%	Yes
Pear	Thinning	All	471	2,246	21%	20%	Yes
Pear, bartlett	Harvesting	All	2,837	17,419	16%	15%	Yes
Pear, bartlett	Harvesting	High	559	1,619	35%	25%	Yes
Pear, bartlett	Harvesting	Low	668	2,803	24%	20%	Yes

Prevailing wage rates

Figure 3 presents prevailing wages for those commodity activities for which LMEA could generate an estimate and a determination from the results of the 2018 Agricultural Peak Employment Wage and Practice Employer Survey. When prevailing wages are hourly rates lower than the AEW, employers must pay hired laborers through the ARS or H-2A program the current AEW. According to federal guidelines, employers who hire laborers through the ARS or the H-2A program can pay the AEW or the prevailing piece rate to those laborers engaged in commodity activities for which the prevailing wage is a piece rate. Regardless of which pay rate they use, employers who use the ARS or H-2A program to hire laborers must ensure their average hourly wage rate in a given week is equal to or greater than the AEW, further details on the prevailing wage finding process can be found in *Appendix 1*.

During the summer of 2018, LMEA held stakeholder focus groups with representatives from the agricultural industry in order to further identify factors that may have potential to affect wage rates being paid to those participating in specific commodity-activities. The outcome of these focus groups led LMEA to include two additional questions to the 2018 employer survey. These questions asked respondents to report more specific activities related to apple harvesting and report specific orchard densities for all apple, cherry and pear activities.⁴ The addition of these two questions substantially increased the number of different combinations of commodity-activity wage structures reported to the employer survey while drastically reducing the number of commodity-activity wage structures that would qualify for a determination. To accommodate this inverse relationship LMEA, with consultation from USDOL, identified aggregated, or high, levels of commodity-activity wage structures resulting in 306 different combinatory wage structures, of which 71 combinations met or exceeded USDOL wage determination thresholds. Figure 3 contains four combination levels of commodity-activity wage structures, ranging from generalized high levels (e.g., apple-harvesting-all densities) to detailed low levels (e.g., apple-red delicious-harvesting strip pick-low densities) that all qualify for wage determinations.

For piece rate wages, LMEA surveyed for hourly earnings guarantee, which is the minimum an employer must pay to an agricultural laborer, regardless of activity or amount of work, and the dimension of the base wage unit. For apple and pear base wage units, reported dimensions and base wages were normalized to meet the industry standard linear bin dimension (47" x 47" x 24.5") recorded and identified in 2018 employer job orders. When a reported linear bin dimension differed from the standard linear bin dimension, the cubic inches for the differing linear bin were calculated and the base wage reported was adjusted proportionally to meet the standard linear bin dimension. When bin dimensions were reported by weight LMEA identified the most common bin weight from the 2018 Agricultural Peak Employment Wage and Practice Employer Survey and equated it to the standard linear bin dimension given the commodity in question. The most common bin weights reported were 900 pounds and 1,000 pounds for apples and pears respectively. This enabled LMEA to proportionally adjust the base wage for bin

⁴ Commodity specific harvesting activities and orchard density definitions can be found in *Appendix 3* of this report

dimensions reported by weight to meet the standard linear bin dimension. The result of normalizing base wages and wage unit dimensions drastically increased the number of employers represented in the prevailing wage finding process on average by 43 percent⁵.

Figure 3. 2018 prevailing wage rates*

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer Survey

Commodity	Activity	Density	Prevailing wage	Base wage	Wage unit	Hourly guarantee	Dimension	Bonus amount	Bonus unit
Apple	Harvesting	All	\$24.50	\$24.50	Bin	\$12.50	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting	High	\$16.00	\$16.00	Hour	N/A	N/A	\$0.00	No Bonus
Apple	Harvesting	Low	\$23.00	\$23.00	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting	Medium	\$25.00	\$25.00	Bin	\$13.00	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting-color-pick	All	\$27.56	\$27.56	Bin	\$12.50	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting-color-pick	High	\$16.00	\$16.00	Hour	N/A	N/A	\$0.00	No Bonus
Apple	Harvesting-color-pick	Low	\$26.00	\$26.00	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting-color-pick	Medium	\$29.36	\$29.36	Bin	\$14.12	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting-stem-clip	All	\$27.00	\$27.00	Bin	\$12.50	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting-stem-clip	High	\$26.00	\$26.00	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting-stem-clip	Low	\$14.00	\$14.00	Hour	N/A	N/A	\$0.00	No Bonus
Apple	Harvesting-strip-pick	All	\$24.50	\$24.50	Bin	\$12.50	47x47x24.5	\$0.00	No Bonus
Apple	Harvesting-strip-pick	Low	\$23.40	\$23.40	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple	Pruning	All	\$12.50	\$12.50	Hour	N/A	N/A	\$0.00	No Bonus
Apple	Thinning	All	\$13.00	\$13.00	Hour	N/A	N/A	\$0.00	No Bonus
Apple, ambrosia	Harvesting	All	\$19.00	\$19.00	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple, ambrosia	Harvesting-strip-pick	All	\$19.00	\$19.00	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple, cripps pink	Harvesting	All	\$27.00	\$27.00	Bin	\$12.50	47x47x24.5	\$0.00	No Bonus
Apple, fuji	Harvesting	Medium	\$25.00	\$25.00	Bin	\$13.00	47x47x24.5	\$0.00	No Bonus
Apple, gala	Harvesting	High	\$26.00	\$26.00	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple, gala	Harvesting	Low	\$27.00	\$27.00	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Apple, gala	Harvesting-color-pick	High	\$39.00	\$36.00	Bin	\$11.50	47x47x24.5	\$3.00	Bin
Apple, golden delicious	Harvesting	Low	\$26.50	\$25.00	Bin	\$0.00	47x47x24.5	\$1.50	Bin
Apple, golden delicious	Harvesting-strip-pick	All	\$24.50	\$24.50	Bin	\$12.50	47x47x24.5	\$0.00	No Bonus
Apple, golden delicious	Harvesting-strip-pick	Low	\$26.50	\$25.00	Bin	\$0.00	47x47x24.5	\$1.50	Bin
Apple, granny smith	Harvesting	Low	\$26.50	\$25.00	Bin	\$0.00	47x47x24.5	\$1.50	Bin
Apple, granny smith	Harvesting	Medium	\$26.50	\$25.00	Bin	\$0.00	47x47x24.5	\$1.50	Bin
Apple, granny smith	Harvesting-strip-pick	Low	\$26.50	\$25.00	Bin	\$0.00	47x47x24.5	\$1.50	Bin
Apple, honeycrisp	Harvesting	Low	\$15.00	\$15.00	Hour	N/A	N/A	\$0.00	No Bonus
Apple, honeycrisp	Harvesting	Medium	\$29.36	\$29.36	Bin	\$14.12	47x47x24.5	\$0.00	No Bonus
Apple, red delicious	Harvesting	Low	\$22.50	\$21.00	Bin	\$0.00	47x47x24.5	\$1.50	Bin
Apple, red delicious	Harvesting	Medium	\$20.00	\$20.00	Bin	\$14.00	47x47x24.5	\$0.00	No Bonus
Apple, red delicious	Harvesting-strip-pick	Low	\$22.50	\$21.00	Bin	\$0.00	47x47x24.5	\$1.50	Bin
Berry	Harvesting	All	\$0.60	\$0.60	Pound	\$12.00	N/A	\$0.00	No Bonus
Berry, blueberry	Harvesting	All	\$0.75	\$0.75	Pound	\$11.50	N/A	\$0.00	No Bonus
Berry, raspberry	Harvesting	All	\$11.50	\$11.50	Hour	N/A	N/A	\$0.00	No Bonus
Berry, strawberry	Harvesting	All	\$0.30	\$0.30	Pound	\$11.50	N/A	\$0.00	No Bonus
Berry, strawberry	Packing	All	\$11.75	\$11.75	Hour	N/A	N/A	\$0.00	No Bonus
Cherry	Harvesting	All	\$0.20	\$0.20	Pound	\$13.00	N/A	\$0.00	No Bonus
Cherry	Harvesting	High	\$0.20	\$0.20	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry	Harvesting	Low	\$0.21	\$0.21	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry	Harvesting	Medium	\$0.22	\$0.22	Pound	\$12.00	N/A	\$0.00	No Bonus

⁵ For more detailed information on the effects of normalizing prevailing wage rates see Figure 1 in the supplementary attachment

Cherry	Pruning	All	\$13.00	\$13.00	Hour	N/A	N/A	\$0.00	No Bonus
Cherry	Pruning	Medium	\$12.00	\$12.00	Hour	N/A	N/A	\$0.00	No Bonus
Cherry	Thinning	All	\$14.12	\$14.12	Hour	N/A	N/A	\$0.00	No Bonus
Cherry, dark red	Harvesting	All	\$0.20	\$0.20	Pound	\$11.50	N/A	\$0.00	No Bonus
Cherry, dark red	Harvesting	High	\$0.20	\$0.20	Pound	\$11.50	N/A	\$0.00	No Bonus
Cherry, dark red	Harvesting	Low	\$0.21	\$0.21	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, dark red	Harvesting	Medium	\$0.20	\$0.20	Pound	\$14.12	N/A	\$0.00	No Bonus
Cherry, lapin	Harvesting	All	\$0.20	\$0.20	Pound	\$11.50	N/A	\$0.00	No Bonus
Cherry, lapin	Harvesting	Medium	\$0.20	\$0.20	Pound	\$11.50	N/A	\$0.00	No Bonus
Cherry, red	Harvesting	All	\$0.20	\$0.20	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, red	Harvesting	High	\$0.20	\$0.20	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, red	Harvesting	Medium	\$0.23	\$0.23	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, skeena	Harvesting	All	\$0.20	\$0.20	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, skeena	Harvesting	High	\$0.20	\$0.20	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, skeena	Harvesting	Medium	\$0.21	\$0.21	Pound	\$11.50	N/A	\$0.00	No Bonus
Cherry, sweetheart	Harvesting	All	\$0.20	\$0.20	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, sweetheart	Harvesting	High	\$0.20	\$0.20	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, sweetheart	Harvesting	Medium	\$0.23	\$0.23	Pound	\$12.00	N/A	\$0.00	No Bonus
Cherry, yellow	Harvesting	All	\$0.30	\$0.30	Pound	\$11.50	N/A	\$0.00	No Bonus
Cherry, yellow	Harvesting	High	\$0.30	\$0.30	Pound	\$13.00	N/A	\$0.00	No Bonus
Cherry, yellow	Harvesting	Low	\$0.25	\$0.25	Pound	\$13.00	N/A	\$0.00	No Bonus
Cherry, yellow	Harvesting	Medium	\$0.30	\$0.30	Pound	\$11.50	N/A	\$0.00	No Bonus
Pear	Harvesting	All	\$25.04	\$25.04	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Pear	Harvesting	High	\$25.00	\$25.00	Bin	\$12.00	47x47x24.5	\$0.00	No Bonus
Pear	Harvesting	Low	\$25.04	\$25.04	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Pear	Thinning	All	\$12.00	\$12.00	Hour	N/A	N/A	\$0.00	No Bonus
Pear, bartlett	Harvesting	All	\$25.00	\$25.00	Bin	\$12.00	47x47x24.5	\$0.00	No Bonus
Pear, bartlett	Harvesting	High	\$23.49	\$23.49	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus
Pear, bartlett	Harvesting	Low	\$25.04	\$25.04	Bin	\$11.50	47x47x24.5	\$0.00	No Bonus

*N/A means not applicable

Prevailing or normal and common employment practices

Regulations contained at 20 CFR Part 655, subpart B, and 20 CFR Part 653, subpart F, define the “prevailing” and “normal and common” practices for seasonal U.S. agricultural workers that USDOL may allow in job orders filed through the ARS.⁶

Prevailing practices

Family Housing

LMEA analyzed the provision of family housing first by crop-variety-activity to identify if there was notable distinction. As those specific crop-variety-activities received similar responses with regard to the provision of family housing, LMEA grouped crop varieties when arraying the data for family housing analysis. For those commodity-activity combinations which had a sufficient sample size LMEA found no variation in the results. It follows that the provision of family housing is not a prevailing practice. *Figure 4* illustrates the percent of estimated employment and employers reported in order to dictate a prevailing practice.

⁶ For more information see *Appendix 2* of this report

Figure 4. 2018 provision of family housing*

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer Survey

Commodity	Activity	Density	Housing	Housing amount (per week)	Percent of estimated employment reported	Percent estimated employers reported
Apple	Harvesting	All	No	N/A	11.46%	21.78%
Apple	Harvesting	All	Missing	Missing	2.27%	5.15%
Apple	Harvesting	All	Yes	\$0.00	1.32%	3.52%
Apple	Pruning	All	No	N/A	11.98%	21.69%
Apple	Pruning	All	Missing	Missing	2.69%	5.77%
Apple	Pruning	All	Yes	\$0.00	2.64%	3.28%
Apple	Thinning	All	No	N/A	24.14%	24.40%
Apple	Thinning	All	Missing	Missing	5.06%	5.75%
Apple	Thinning	All	Yes	\$0.00	3.77%	3.35%
Berry	Harvesting	All	No	N/A	21.39%	25.16%
Berry	Harvesting	All	Yes	\$0.00	1.21%	2.38%
Berry	Harvesting	All	Missing	Missing	0.41%	4.42%
Berry	Pruning	All	No	N/A	21.46%	26.19%
Berry	Pruning	All	Yes	\$0.00	1.91%	3.17%
Cherry	Harvesting	All	No	N/A	26.44%	24.40%
Cherry	Harvesting	All	Missing	Missing	3.35%	4.11%
Cherry	Harvesting	All	Yes	\$0.00	1.96%	2.21%
Cherry	Harvesting	All	Yes	Missing	0.32%	0.40%
Cherry	Pruning	All	No	N/A	22.76%	23.71%
Cherry	Pruning	All	Yes	\$0.00	4.35%	1.34%
Cherry	Pruning	All	Missing	Missing	3.62%	6.12%
Cherry	Thinning	All	No	N/A	31.69%	16.67%
Cherry	Thinning	All	Missing	Missing	1.74%	11.12%
Pear	Harvesting	All	No	N/A	10.97%	20.57%
Pear	Harvesting	All	Yes	\$0.00	2.88%	3.43%
Pear	Harvesting	All	Missing	Missing	2.31%	4.57%
Pear	Pruning	All	No	N/A	6.90%	21.03%
Pear	Pruning	All	Yes	\$0.00	4.11%	4.36%
Pear	Pruning	All	Missing	Missing	2.06%	5.14%
Pear	Thinning	All	No	N/A	11.66%	20.65%
Pear	Thinning	All	Yes	\$0.00	5.39%	4.89%
Pear	Thinning	All	Missing	Missing	1.92%	3.80%

*N/A means not applicable

Normal and common practices

Experience requirements

LMEA first calculated experience requirements by commodity-activity to determine if there were differences across specific crop-variety-activities. As all specific crop-variety-activity combinations indicated “no experience requirements,” LMEA grouped crop varieties when arraying the data for experience requirement analysis. It was found that there was no variation in experience requirements, and that the majority of employers included in the analysis indicated “no months required,” or skipped the question. *Figure 5* details the percent of estimated employment and employers reported in order to determine a finding by months of experience required to be employed.

Figure 5. 2018 experience requirements

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer Survey

Commodity	Activity	Density	Experience (months)	Total reported employment	Total estimated employment	Employers reported	Estimated employers	Percent estimated employment reported	Percent estimated employers reported
Apple	Harvesting	All	0	6,279	39,361	251	801	15.02%	26.50%
Apple	Harvesting	All	1	396	1,511	29	84	0.95%	3.06%
Apple	Harvesting	All	12	140	349	8	20	0.33%	0.84%
Apple	Harvesting	All	2	109	271	7	17	0.26%	0.74%
Apple	Harvesting	All	3	97	240	6	15	0.23%	0.63%
Apple	Pruning	All	0	1,256	6,078	131	427	16.18%	23.07%
Apple	Pruning	All	1	290	1,418	34	96	3.74%	5.99%
Apple	Pruning	All	2	39	96	5	12	0.50%	0.88%
Apple	Pruning	All	12	20	49	4	10	0.26%	0.70%
Apple	Thinning	All	0	1,043	2,943	106	311	28.90%	27.75%
Apple	Thinning	All	1	143	353	17	42	3.96%	4.45%
Apple	Thinning	All	2	65	162	4	10	1.80%	1.05%
Berry	Harvesting	All	0	2,101	6,899	77	227	28.79%	29.39%
Berry	Harvesting	All	1	122	343	7	20	1.67%	2.67%
Berry	Pruning	All	0	193	563	33	97	20.75%	28.21%
Berry	Pruning	All	1	113	317	6	17	12.15%	5.13%
Cherry	Harvesting	All	0	8,742	26,678	236	748	27.43%	26.48%
Cherry	Harvesting	All	1	978	2,993	27	86	3.07%	3.03%
Cherry	Harvesting	All	12	207	650	8	26	0.65%	0.90%
Cherry	Harvesting	All	2	139	421	4	13	0.44%	0.45%
Cherry	Pruning	All	0	1,061	3,234	113	358	23.89%	23.69%
Cherry	Pruning	All	1	328	987	19	60	7.39%	3.98%
Cherry	Pruning	All	2	27	86	6	19	0.61%	1.26%
Cherry	Pruning	All	12	19	58	5	15	0.43%	1.05%
Cherry	Thinning	All	0	58	181	9	28	28.02%	26.47%
Pear	Harvesting	All	0	2,177	7,487	151	446	25.22%	28.33%
Pear	Harvesting	All	1	291	808	19	53	3.37%	3.56%
Pear	Harvesting	All	3	43	119	4	11	0.50%	0.75%
Pear	Pruning	All	0	468	1,308	82	228	26.52%	27.06%
Pear	Pruning	All	1	100	280	12	33	5.67%	3.96%
Pear	Pruning	All	24	17	47	4	11	0.96%	1.32%
Pear	Thinning	All	0	230	641	34	95	27.03%	26.36%
Pear	Thinning	All	1	51	143	7	19	5.99%	5.43%

Minimum productivity standards

For all commodity-activities with a sufficient sample size to report findings, LMEA did not have any occurrences where minimum productivity standards were normal and common, as the majority of employers either skipped the question or responded as a minimum productivity standard was not applicable. *Figure 6* shows the percent of estimated employment and employers reported for given minimum productivity standards.

Figure 6. 2018 minimum productivity standards*

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer Survey

Commodity	Activity	Density	Productivity standard	Productivity unit	Productivity frequency	Percent estimated employment reported	Percent estimated employers reported
Apple	Harvesting	All	N/A	N/A	N/A	14.45%	28.61%
Apple	Harvesting	All	3	Bin	Hour	0.10%	0.36%
Apple	Pruning	All	N/A	N/A	N/A	17.52%	30.84%
Apple	Thinning	All	N/A	N/A	N/A	34.15%	34.54%
Berry	Harvesting	All	N/A	N/A	N/A	21.01%	31.97%
Berry	Pruning	All	N/A	N/A	N/A	34.80%	34.12%
Cherry	Harvesting	All	N/A	N/A	N/A	30.26%	29.63%
Cherry	Pruning	All	N/A	N/A	N/A	33.18%	31.73%
Cherry	Thinning	All	N/A	N/A	N/A	35.46%	32.44%
Pear	Harvesting	All	N/A	N/A	N/A	15.12%	27.11%
Pear	Pruning	All	N/A	N/A	N/A	13.32%	30.52%
Pear	Thinning	All	N/A	N/A	N/A	20.97%	30.77%

*N/A means not applicable

Comparing employer and worker survey responses

Little guidance has been given on how to use worker survey responses to compare with employer responses. As a result, LMEA followed advice received from an email communication, dated July 8, 2016, with USDOL to determine how best to use responses. USDOL indicated that, “USDOL does not ‘use’ worker survey results. Worker surveys are a mechanism by which SESAs can ‘validate’ or ‘verify’ the wage survey responses that come in from the growers.” LMEA’s interpretation of this is that worker responses serve as a mechanism to compare employer responses and submitted ETA 232 forms are based solely on employer responses.

LMEA originally anticipated having a matched employer – employee dataset; however, changes to the worker survey questionnaire to incorporate best practices suggestions necessitated a simpler comparison involving primarily the inspection of employer and worker wage structure.

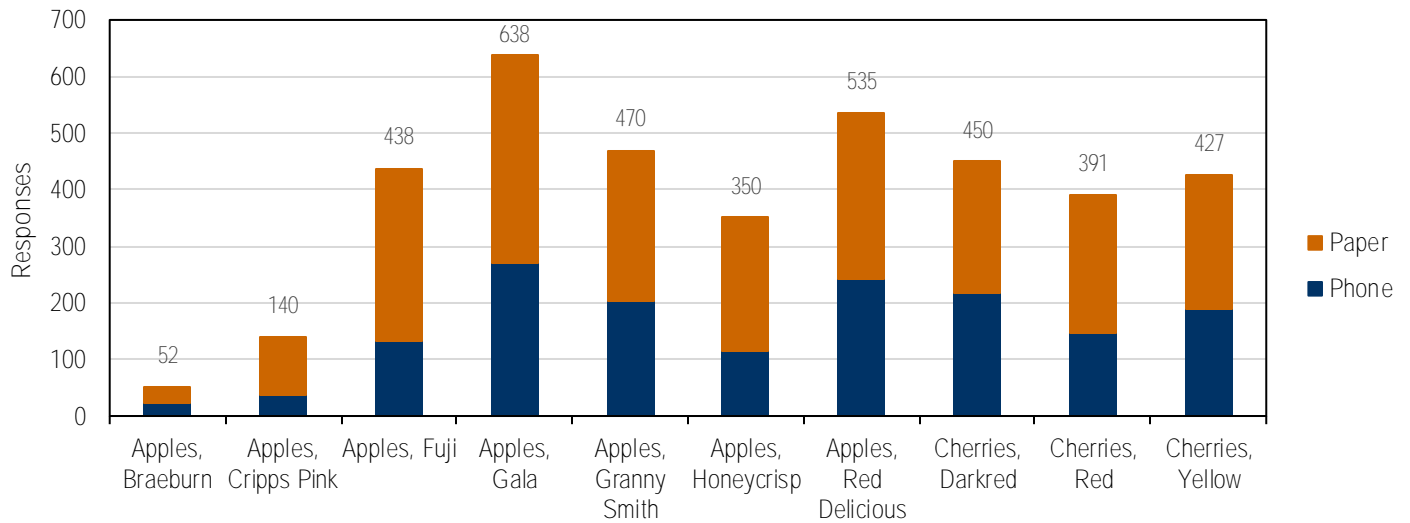
The worker sample was selected based using a simple random sampling method, where unemployment insurance (UI) claimants were identified as having worked during 2017 primarily in either North American Industry Classification System (NAICS) codes 111331 (apple orchards) and 111339 (other non citrus fruit farming).

The 2018 worker survey was created to be administered via phone and as a field survey (paper). Unlike the 2017 worker survey the 2018 survey was not distributed via a web application as this mode yielded few responses. *Figure 7* outlines the number of workers responding by commodity and survey mode.

Figure 7. 2018 worker survey responses by commodity and survey mode

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer and Worker Survey



Apple and cherry wage rate and wage structure comparison

In order to draw a comparison between worker and employer wage structure responses, LMEA employed the Kruskal-Wallis rank sum test (a non-parametric ANOVA)⁷. This test does not require the assumption that the distributions follow a normal curve, nor does it assume equal variance among groups (e.g., employer and worker survey responses). Under the assumption that distribution shapes are similar between groups, the Kruskal-Wallis test serves as a sum of ranks test, where the null hypothesis is the “type” of distribution of the given groups (commodity-activity-wage structure) is the same with only a difference in their central location and therefore originate from the same population. If the samples share the same type of distribution, then the Kruskal-Wallis test can informally be considered to compare the medians; however, if the samples come from different types of distributions (e.g., one is left skewed, one is right skewed or one has a much larger variance than the other) then the Kruskal-Wallis test may imply the type of distributions are dissimilar.

For apple and cherry harvest, a standard significance level of 0.01 was chosen to assess the results of the Kruskal-Wallis test. As Figure 8 indicates, the majority of commodity-activity-wage structures fail to reject the null hypothesis, meaning the majority of commodity-activity-wage structures between the employer and worker surveys are not significantly different with regard to the type of wage structure distribution. However, seven of the wage structures must be rejected in favor of the alternative, implying the type of distribution for these seven wage structures are dissimilar.

Figure 8. Comparison of 2018 employer and worker harvesting wage rates and wage structures

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer and Worker Surveys

Commodity-Activity-Wage Structure	P Value	Chi Square	Results	Employer Median	Worker Median
Cherries, Darkred, Piece Rate	0.000102	15.096770	Reject Null	\$4.00	\$4.00
Cherries, Yellow, Piece Rate	0.074105	3.189680	Fail To Reject Null	\$6.00	\$6.00
Cherries, Red, Piece Rate	0.035540	4.419041	Fail To Reject Null	\$4.00	\$4.00
Apples, Gala, Piece Rate	0.000000	84.817814	Reject Null	\$25.00	\$26.00
Apples, Granny Smith, Piece Rate	0.000000	44.086015	Reject Null	\$24.50	\$26.00

⁷ For more information see: Hollander, M. & Wolfe, D. (1973), "Nonparametric Statistical Methods". New York: John Wiley & Sons. Pages 115-120

Apples, Braeburn, Hour	0.724707	0.124027	Fail To Reject Null	\$14.12	\$14.12
Apples, Cripps Pink, Hour	0.000324	12.925868	Reject Null	\$16.00	\$14.12
Apples, Fuji, Hour	0.056889	3.625826	Fail To Reject Null	\$14.12	\$14.10
Apples, Gala, Hour	0.106521	2.605092	Fail To Reject Null	\$14.12	\$14.12
Apples, Honeycrisp, Hour	0.000000	39.067481	Reject Null	\$15.00	\$15.00
Apples, Honeycrisp, Piece Rate	0.000002	23.006481	Reject Null	\$30.00	\$36.00
Apples, Braeburn, Piece Rate	0.302424	1.063475	Fail To Reject Null	\$23.00	\$22.00
Apples, Fuji, Piece Rate	0.582077	0.302888	Fail To Reject Null	\$28.00	\$28.00
Apples, Red Delicious, Piece Rate	0.239556	1.383202	Fail To Reject Null	\$20.00	\$20.00
Cherries, Red, Hour	0.114997	2.484163	Fail To Reject Null	\$14.00	\$12.13
Cherries, Darkred, Hour	0.023475	5.132979	Fail To Reject Null	\$14.12	\$14.00
Apples, Cripps Pink, Piece Rate	0.145541	2.118376	Fail To Reject Null	\$27.00	\$30.00
Apples, Red Delicious, Hour	0.030444	4.684060	Fail To Reject Null	\$14.12	\$14.12
Apples, Granny Smith, Hour	0.518994	0.415892	Fail To Reject Null	\$14.12	\$14.00
Cherries, Yellow, Hour	0.000001	24.920479	Reject Null	\$14.00	\$12.88

Apple and cherry employment practices comparison

For employment practices, LMEA calculated the percent of worker reported employers where workers reported provision of family housing, experience requirements and minimum productivity standards. LMEA held this percent to the same standards as the employer responses, and determined if it fit either the double-majority rule or the 33 percent indicative of a normal and common practice.⁸ The worker survey was structured for workers to report on the number of employers they worked for and the number of employers who met the conditions of each employment practice question. *Figure 9*, *Figure 10* and *Figure 11* detail the percent of employers reporting and worker reported employers to have indicated employment practices. Additionally, none of the worker or employer responses for employment practices were high enough to claim a prevailing practice or a practice normal and common.

Figure 9. Comparison of 2018 employer and worker family housing responses*

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer and Worker Surveys

Commodity	Housing	Housing (per week)	Percent employers reporting	Percent employers indicated by workers
Apples	Missing	Missing	16.76%	38.22%
Apples	No	N/A	70.88%	60.98%
Apples	Yes	\$0.00	11.47%	N/A
Apples	Don't - know	Missing	N/A	0.19%
Apples	Yes	\$10.00	N/A	0.15%
Apples	Yes	\$30.00	N/A	0.19%
Cherries	Missing	Missing	13.10%	42.92%
Cherries	No	N/A	77.00%	56.53%
Cherries	Yes	\$0.00	7.03%	N/A
Cherries	Yes	Missing	1.28%	N/A

*N/A means not applicable

⁸ For more information on the double majority rule or the 33 percent rule see *Appendix 2* of this report

Figure 10. Comparison of 2018 employer and worker experience requirements responses
Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer and Worker Survey

Commodity	Experience (months)	Percent employers reporting	Percent employers indicated by workers
Apples	0	82.29%	88.76%
Apples	1	9.51%	7.32%
Apples	2	2.30%	0.19%
Apples	3	1.97%	0.95%
Apples	12	2.62%	0.65%
Cherries	0	84.23%	87.74%
Cherries	1	9.32%	6.92%
Cherries	2	1.43%	0.24%
Cherries	12	2.87%	0.47%

Figure 11. Comparison of 2018 employer and worker productivity standards responses *
Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer and Worker Surveys

Commodity	Productivity	Standard	Productivity unit	Productivity frequency	Percent employers reporting	Percent employers indicated by workers
Apples	Yes	\$3.00	Bin	Hour	1.18%	N/A
Apples	N/A	N/A	N/A	N/A	92.94%	85.48%
Cherries	N/A	N/A	N/A	N/A	93.29%	89.62%

*N/A means not applicable

Appendices

Appendix 1: Prevailing wage rate finding process

Prevailing wage finding process

ETA Handbook 385 provides guidelines for determining the prevailing wage in each agricultural activity or occupation. According to federal guidelines and found in *Figure 12*, the suggested sample size in terms of the percentage of total domestic employment decreases as the level of total domestic employment in each activity increases.

Figure 12. U.S. Department of Labor prevailing wage rate threshold requirements
Washington state, 2019

Source: U.S. Department of Labor, Employment and Training Administration, Handbook No. 385: p. I-114

Level of estimated employment in commodity activity area	Percent needed to make a determination
100 – 349	100%
350 – 499	60%
500 – 799	50%
800 – 999	40%
1,000 – 1,249	35%
1,250 – 1,599	30%
1,600 – 2,099	25%
2,100 – 2,999	20%
3,000 or more	15%

After collecting wage information for agricultural commodities and activities, LMEA calculates the prevailing wage rate according to one of two rules. The first is the 40 percent rule, which states that if there is one pay rate paid to 40 percent or more of domestic seasonal employment for a given commodity activity, then that rate becomes the prevailing wage. If two separate wage rates are paid to 40 percent of domestic seasonal employment for a given commodity activity, then both are considered prevailing.

The second is the 51 percent rule. This rule requires arraying wage rates in descending order and counting the cumulative level of domestic seasonal employment, until 51 percent of domestic seasonal employment is covered. If there is not a single unit of payment (e.g., hour, bin) SESAs are to determine which payment unit is applicable to the largest level of employment and then determine the prevailing wage rate according to either the 40 percent rule or the 51 percent rule.

As required by USDOL, LMEA identified the prevailing wage rates based on responses to the 2018 employer survey according to federal guidelines contained in ETA Handbook 385. Because a raking algorithm was used to estimate the level of total domestic seasonal employment, the total estimated level of domestic seasonal employment was used to identify and establish the prevailing wage rates.

Appendix 2: Estimating prevailing or normal and common practices

Per ETA Handbook 398, SESAs are required to determine the conditions of employment for U.S. seasonal workers in each agricultural activity surveyed. This portion of the survey is to ensure employers who hire foreign workers, “conform the job offer to conditions and standards which are ‘prevailing,’ ‘normal,’ or ‘common’ practices or standards of other employers who hire U.S. workers in the same area and in the same occupation” (ETA Handbook 398, p. II-5).

The concept of a “prevailing practice” has a specific quantitative threshold. If at least 50 percent of all employers who also employ at least 50 percent of all U.S. workers in a given activity engage in a practice, then it is prevailing.⁹ This is referred to as the “double-majority” rule. The following practices are subject to the prevailing threshold:

1. The provision of family housing
2. Transportation and subsistence costs
3. Frequency of payment

However, the quantitative threshold for normal and common standards is not specified in ETA Handbook 398. Instead, normal and common are defined as:

...situations which may be less than prevailing, but which clearly are not unusual or rare. The degree to which a practice is engaged in (or a benefit is provided) should be determined to be close to what is viewed (and measured) as “prevailing,” but the degree by which the practice or benefit is measured and degree of proof needed to establish its acceptability for H-2A purposes is not as formal or stringent as “prevailing” calls for (ETA Handbook 398, p. II-7).

When setting the quantitative threshold for normal and common practices or benefits, USDOL’s Regional Administrators (RA) use their discretion. The following practices are subject to the “normal and common” threshold:

1. Minimum productivity standards
2. Provision of tools and equipment
3. Occupational qualifications (e.g., experience requirements)
4. Positive recruitment of U.S. Nationals.

SESAs do not use the same sampling universe for every practice surveyed to make a prevailing or normal and common determination. Of the practices listed previously, SESAs are required to survey both H-2A and non-H-2A employers about the following:

1. Provision of tools and equipment
2. Provision of family housing
3. Frequency of payment

SESAs are required to survey only non-H-2A employers concerning the following practices:¹⁰

1. Transportation and subsistence costs
2. Positive recruitment of U.S. Nationals
3. Occupational qualifications

The employers to be surveyed and the threshold to be used are less clear for productivity standards. Additional guidance from USDOL led us to survey both H-2A and non-H-2A employers, and to apply the “normal and common” threshold, for productivity standards.

Prevailing practices

According to USDOL guidance, a practice or standard must apply to half of all employers who also hire half of all workers in our sample in order to be considered prevailing (the double-majority rule). The only practice or benefit

⁹ Regulatory definitions, see: 20 CFR 655.103(b) and 20 CFR 655.1300(c)

¹⁰ For more information, see: 20 CFR 655.122, § 655.150-158, and § 655.1305

included in the 2018 survey that is subject to the prevailing threshold is the provision of family housing. For our prevailing practice recommendations, we used the same sample size rules used to estimate prevailing wages.

Family housing

LMEA, following guidance from USDOL, surveyed for all family housing offered and the cost associated on a weekly basis. ETA Handbook 398 states:

In arriving at a determination as to whether the provision of family housing is a prevailing practice, RAs and SESAs must look beyond the threshold question on the basic availability of housing which is suitable for families. They must also determine whether it is the active practice of employers to offer this housing as a benefit to migrant workers who need and request it.

Transportation and subsistence costs and frequency of payments

ESD did not include questions about transportation and subsistence costs on the 2018 survey. ETA Handbook 398 states the following about transportation and subsistence costs:

H-2A employers must offer to advance transportation and subsistence costs (or otherwise provide them) to U.S. workers when it is the prevailing practice of non-H-2A employers in the area and occupation to do so (or when transportation is advanced for H-2A workers) (ETA Handbook 398 p. II-10).

In addition, 20 CFR 655.1305(e)5 states:

During the period of employment that is the subject of the labor certification application, the employer will... Provide transportation in compliance with all applicable Federal, State or local laws and regulations between the worker's living quarters (i.e., housing provided by the employer under 20 CFR 655.104(d)) and the employer's worksite without cost to the worker.

It is our understanding that the language in ETA Handbook 398 and 20 CFR 655.1305 require employers to provide advance transportation and subsistence costs.¹¹ Therefore, we did not survey employers about the advancement of transportation or subsistence costs in the 2018 survey.

LMEA also did not include questions related to the frequency of payment on the 2018 survey. According to 20 CFR 655.122(m):

The employer must state in the job offer the frequency with which the worker will be paid, which may be at least twice monthly or according to the prevailing practice in the area of intended employment, whichever is more frequent.

Due to the language included in the regulation, making reference to a minimum requirement of twice a month, LMEA decided to not include questions on the 2018 survey related to the frequency of payment.

Normal and common practices

There is no quantitative threshold for normal or common practices specified in ETA Handbook 398. As a result, we followed advice received in an email communication, dated January 5, 2016, with the CNPC to arrive at our normal and common practices recommendations for minimum productivity standards and experience requirements.

According to this guidance, at least 33 percent of employers in a sample must report engaging in a practice before the practice is considered "normal and common." However, LMEA received no instruction regarding the percentage of employers who must use a specific standard (e.g., 4 bins/day, or 3 months of experience) in order to

¹¹ In addition, see: 20 CFR 655.122

determine maximum allowable standards in H-2A job orders. As a result, LMEA decided that the next step should be to determine the most common quantifiable standard reported.

Minimum productivity standards

For all commodity-activities with a sufficient sample size to report findings, LMEA did not have any occurrences by commodity-activity where minimum productivity standards were normal and common, as the majority of the employers either skipped the question or answered “no.”

Experience requirements

ETA Handbook 398 states that experience requirements (occupational qualifications) are subject to the normal and common threshold.

In determining the appropriateness of occupational qualification, the Regional office should consider normal, accepted practice of non-H-2A employers in the same or comparable occupations and crops as a first step (ETA Handbook 398, pp. II-13 – II 14).

Reference checks

As of April 2019, there have been no requirements or guidelines that require a normal and common practice determination for employee references. LMEA was notified that USDOL previously challenged employers on the reference requirement issue and lost the case before an administrative law judge. The decision indicated that, if experience requirements are deemed “normal and common,” the USDOL must allow employers to require a reference in their job orders when they choose to do so. Although LMEA collected information on reference checks for the 2015 survey iteration, given the administrative law judge decision that employers must be allowed to require references when they chose to, LMEA did not include the question for the 2018 surveys.

Provision of tools and the positive recruitment of U.S. Nationals

LMEA did not include questions about the provision of tools on the 2018 survey. ETA Handbook 398 states the following about the provision of tool:

Normally, employers must provide, without charge, all tools, supplies, and equipment to the workers, if they are required to perform the tasks described in the job offer ... Absent a specific, justifiable, approved request from an employer, the RA must require that employers provide necessary tools, supplies and equipment without charge to the worker (ETA Handbook 398 pp. II-9).

In addition, 20 CFR 655.122(f) states that, “The employer must provide to the worker, without charge or deposit charge, all tools, supplies, and equipment required to perform the duties assigned.”

LMEA also did not include questions on the 2018 surveys related to the positive recruitment of U.S. Nationals. Since the majority of employers report bypassing the ARS for the recruitment of domestic workers, almost all job orders received in the state of Washington go through the H-2A system. We know that the recruitment of U.S. Nationals is a requirement of the H-2A system. Therefore, we did not survey employers about the positive recruitment of U.S. Nationals.

Appendix 3: Glossary of terms

Harvesting – strip – picking

Harvesting all fruit on every tree in the orchard.

Harvesting – color –picking

Selectively harvesting fruit based on color or maturity.

Harvesting – stem – clipping

Selectively harvesting fruit then clipping the stem of the fruit down to avoid punctures or damage.

Apple orchard densities

Low density: less than 600 trees per acre.

Medium density: 600 to 800 trees per acre.

High density: more than 800 trees per acre.

Cherry orchard densities

Low density: less than 200 trees per acre.

Medium density: 200 to 300 trees per acre.

High density: more than 300 trees per acre.

Pear orchard densities

Low density: less than 150 trees per acre.

Medium density: 150 to 200 trees per acre.

High density: more than 200 trees per acre.

2018 Agricultural Peak Employment Wage and Practices Survey Results: supplemental attachment

Effects of prevailing wage normalization

Figure 1. Results of normalized prevailing wage finding process

Washington state, 2019

Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer Survey

Commodity	Activity	Density	Prevailing wage normalized	Prevailing wage not normalized	Base wage normalized	Base wage not normalized	Wage unit normalized	Wage unit not normalized	Hourly Guarantee	Dimension normalized	Dimension not normalized
Apples	Harvesting	All	\$24.50	\$24.50	\$24.50	\$24.50	Bin	Bin	\$12.50	47x47x24.5	900 pounds
Apples	Harvesting	High	\$16.00	\$16.00	\$16.00	\$16.00	Hour	Hour	N/A	N/A	N/A
Apples	Harvesting	Low	\$23.00	\$25.00	\$23.00	\$25.00	Bin	Bin	\$11.50	47x47x24.5	900 pounds
Apples	Harvesting	Medium	\$25.00	\$25.00	\$25.00	\$25.00	Bin	Bin	\$13.00	47x47x24.5	900 pounds
Apples	Harvesting-Color-Pick	All	\$27.56	\$24.50	\$27.56	\$24.50	Bin	Bin	\$12.50	47x47x24.5	800 pounds
Apples	Harvesting-Color-Pick	High	\$16.00	\$16.00	\$16.00	\$16.00	Hour	Hour	N/A	N/A	N/A
Apples	Harvesting-Color-Pick	Low	\$26.00	\$24.00	\$26.00	\$24.00	Bin	Bin	\$11.50	47x47x24.5	1000 pounds
Apples	Harvesting-Color-Pick	Medium	\$29.36	\$45.00	\$29.36	\$45.00	Bin	Bin	\$14.12	47x47x24.5	48x48x36
Apples	Harvesting-Stem-Clip	All	\$27.00	\$27.00	\$27.00	\$27.00	Bin	Bin	\$12.50	47x47x24.5	900 pounds
Apples	Harvesting-Stem-Clip	High	\$26.00	\$26.00	\$26.00	\$26.00	Bin	Bin	\$11.50	47x47x24.5	900 pounds
Apples	Harvesting-Stem-Clip	Low	\$14.00	\$14.00	\$14.00	\$14.00	Hour	Hour	N/A	N/A	N/A
Apples	Harvesting-Strip-Pick	All	\$24.50	\$24.50	\$24.50	\$24.50	Bin	Bin	\$12.50	47x47x24.5	900 pounds
Apples	Harvesting-Strip-Pick	Low	\$23.40	\$25.00	\$23.40	\$25.00	Bin	Bin	\$11.50	47x47x24.5	900 pounds
Apples	Pruning	All	\$12.50	\$12.50	\$12.50	\$12.50	Hour	Hour	N/A	N/A	N/A
Apples	Thinning	All	\$13.00	\$13.00	\$13.00	\$13.00	Hour	Hour	N/A	N/A	N/A
Apples, Ambrosia	Harvesting	All	\$19.00	\$19.00	\$19.00	\$19.00	Bin	Bin	\$11.50	47x47x24.5	Missing
Apples, Ambrosia	Harvesting-Strip-Pick	All	\$19.00	\$19.00	\$19.00	\$19.00	Bin	Bin	\$11.50	47x47x24.5	Missing
Apples, Cripps Pink	Harvesting	All	\$27.00	\$27.00	\$27.00	\$27.00	Bin	Bin	\$12.50	47x47x24.5	900 pounds

Figure 1. Results of normalized prevailing wage finding process, continued

Commodity	Activity	Density	Prevailing wage normalized	Prevailing wage not normalized	Base wage normalized	Base wage not normalized	Wage unit normalized	Wage unit not normalized	Hourly Guarantee	Dimension normalized	Dimension not normalized
Apples, Fuji	Harvesting	Medium	\$25.00	\$25.00	\$25.00	\$25.00	Bin	Bin	\$13.00	47x47x24.5	900 pounds
Apples, Gala	Harvesting	High	\$26.00	\$26.00	\$26.00	\$26.00	Bin	Bin	\$11.50	47x47x24.5	900 pounds
Apples, Gala	Harvesting	Low	\$27.00	\$30.00	\$27.00	\$30.00	Bin	Bin	\$11.50	47x47x24.5	900 pounds
Apples, Gala	Harvesting-Color-Pick	High	\$39.00	\$35.00	\$36.00	\$32.00	Bin	Bin	\$11.50	47x47x24.5	800 pounds
Apples, Golden Delicious	Harvesting	Low	\$26.50	\$26.50	\$25.00	\$25.00	Bin	Bin	\$0.00	47x47x24.5	Don't - know
Apples, Golden Delicious	Harvesting-Strip-Pick	All	\$24.50	\$24.50	\$24.50	\$24.50	Bin	Bin	\$12.50	47x47x24.5	900 pounds
Apples, Golden Delicious	Harvesting-Strip-Pick	Low	\$26.50	\$26.50	\$25.00	\$25.00	Bin	Bin	\$0.00	47x47x24.5	Don't - know
Apples, Granny Smith	Harvesting	Low	\$26.50	\$26.50	\$25.00	\$25.00	Bin	Bin	\$0.00	47x47x24.5	Don't - know
Apples, Granny Smith	Harvesting	Medium	\$26.50	\$26.50	\$25.00	\$25.00	Bin	Bin	\$0.00	47x47x24.5	Don't - know
Apples, Granny Smith	Harvesting-Strip-Pick	Low	\$26.50	\$26.50	\$25.00	\$25.00	Bin	Bin	\$0.00	47x47x24.5	Don't - know
Apples, Honeycrisp	Harvesting	Low	\$15.00	\$15.00	\$15.00	\$15.00	Hour	Hour	N/A	N/A	N/A
Apples, Honeycrisp	Harvesting	Medium	\$29.36	\$45.00	\$29.36	\$45.00	Bin	Bin	\$14.12	47x47x24.5	48x48x36
Apples, Red Delicious	Harvesting	Low	\$22.50	\$22.50	\$21.00	\$21.00	Bin	Bin	\$0.00	47x47x24.5	Don't - know
Apples, Red Delicious	Harvesting	Medium	\$20.00	\$20.00	\$20.00	\$20.00	Bin	Bin	\$14.00	47x47x24.5	900 pounds
Apples, Red Delicious	Harvesting-Strip-Pick	Low	\$22.50	\$22.50	\$21.00	\$21.00	Bin	Bin	\$0.00	47x47x24.5	Don't - know
Berries	Harvesting	All	\$0.60	\$0.60	\$0.60	\$0.60	Pound	Pound	\$12.00	N/A	N/A
Berries, Blueberries	Harvesting	All	\$0.75	\$0.75	\$0.75	\$0.75	Pound	Pound	\$11.50	N/A	N/A
Berries, Raspberries	Harvesting	All	\$11.50	\$11.50	\$11.50	\$11.50	Hour	Hour	N/A	N/A	N/A
Berries, Strawberries	Harvesting	All	\$0.30	\$0.30	\$0.30	\$0.30	Pound	Pound	\$11.50	N/A	N/A
Berries, Strawberries	Packing	All	\$11.75	\$11.75	\$11.75	\$11.75	Hour	Hour	N/A	N/A	N/A
Cherries	Harvesting	All	\$0.20	\$4.00	\$0.20	\$4.00	Pound	Pound	\$13.00	N/A	20 pounds
Cherries	Harvesting	High	\$0.20	\$4.00	\$0.20	\$4.00	Pound	Pound	\$12.00	N/A	20 pounds

Figure 1. Results of normalized prevailing wage finding process, continued

Commodity	Activity	Density	Prevailing wage normalized	Prevailing wage not normalized	Base wage normalized	Base wage not normalized	Wage unit normalized	Wage unit not normalized	Hourly Guarantee	Dimension normalized	Dimension not normalized
Cherries	Harvesting	Low	\$0.21	\$4.00	\$0.21	\$4.00	Pound	Pound	\$12.00	N/A	20 pounds
Cherries	Harvesting	Medium	\$0.22	\$4.00	\$0.22	\$4.00	Pound	Pound	\$12.00	N/A	20 pounds
Cherries	Pruning	All	\$13.00	\$13.00	\$13.00	\$13.00	Hour	Hour	N/A	N/A	N/A
Cherries	Pruning	Medium	\$12.00	\$12.00	\$12.00	\$12.00	Hour	Hour	N/A	N/A	N/A
Cherries	Thinning	All	\$14.12	\$14.12	\$14.12	\$14.12	Hour	Hour	N/A	N/A	N/A
Cherries, Darkred	Harvesting	All	\$0.20	\$3.75	\$0.20	\$3.75	Pound	Pound	\$11.50	N/A	20 pounds
Cherries, Darkred	Harvesting	High	\$0.20	\$3.50	\$0.20	\$3.50	Pound	Pound	\$11.50	N/A	20 pounds
Cherries, Darkred	Harvesting	Low	\$0.21	\$4.00	\$0.21	\$4.00	Pound	Pound	\$12.00	N/A	20 pounds
Cherries, Darkred	Harvesting	Medium	\$0.20	\$4.00	\$0.20	\$4.00	Pound	Pound	\$14.12	N/A	Missing
Cherries, Lapin	Harvesting	All	\$0.20	\$3.75	\$0.20	\$3.75	Pound	Pound	\$11.50	N/A	20 pounds
Cherries, Lapin	Harvesting	Medium	\$0.20	\$4.00	\$0.20	\$4.00	Pound	Pound	\$11.50	N/A	20 pounds
Cherries, Red	Harvesting	All	\$0.20	\$4.00	\$0.20	\$4.00	Pound	Pound	\$12.00	N/A	20 pounds
Cherries, Red	Harvesting	High	\$0.20	\$6.00	\$0.20	\$6.00	Pound	Pound	\$12.00	N/A	30 pounds
Cherries, Red	Harvesting	Medium	\$0.23	\$0.23	\$0.23	\$0.23	Pound	Pound	\$12.00	N/A	Missing
Cherries, Skeena	Harvesting	All	\$0.20	\$6.00	\$0.20	\$6.00	Pound	Pound	\$12.00	N/A	30 pounds
Cherries, Skeena	Harvesting	High	\$0.20	\$4.00	\$0.20	\$4.00	Pound	Pound	\$12.00	N/A	20 pounds
Cherries, Skeena	Harvesting	Medium	\$0.21	\$4.00	\$0.21	\$4.00	Pound	Pound	\$11.50	N/A	20 pounds
Cherries, Sweetheart	Harvesting	All	\$0.20	\$3.75	\$0.20	\$3.75	Pound	Pound	\$12.00	N/A	20 pounds
Cherries, Sweetheart	Harvesting	High	\$0.20	\$4.25	\$0.20	\$4.25	Pound	Pound	\$12.00	N/A	20 pounds
Cherries, Sweetheart	Harvesting	Medium	\$0.23	\$0.23	\$0.23	\$0.23	Pound	Pound	\$12.00	N/A	Missing
Cherries, Yellow	Harvesting	All	\$0.30	\$6.00	\$0.30	\$6.00	Pound	Pound	\$11.50	N/A	20 pounds
Cherries, Yellow	Harvesting	High	\$0.30	\$6.00	\$0.30	\$6.00	Pound	Pound	\$13.00	N/A	20 pounds
Cherries, Yellow	Harvesting	Low	\$0.25	\$5.50	\$0.25	\$5.50	Pound	Pound	\$13.00	N/A	20 pounds

Figure 1. Results of normalized prevailing wage finding process, continued

Commodity	Activity	Density	Prevailing wage normalized	Prevailing wage not normalized	Base wage normalized	Base wage not normalized	Wage unit normalized	Wage unit not normalized	Hourly Guarantee	Dimension normalized	Dimension not normalized
Cherries, Yellow	Harvesting	Medium	\$0.30	\$6.00	\$0.30	\$6.00	Pound	Pound	\$11.50	N/A	20 pounds
Pears	Harvesting	All	\$25.04	\$29.00	\$25.04	\$29.00	Bin	Bin	\$11.50	47x47x24.5	Missing
Pears	Harvesting	High	\$25.00	\$25.00	\$25.00	\$25.00	Bin	Bin	\$12.00	47x47x24.5	Don't - know
Pears	Harvesting	Low	\$25.04	\$23.50	\$25.04	\$23.50	Bin	Bin	\$11.50	47x47x24.5	46x46x24
Pears	Thinning	All	\$12.00	\$12.00	\$12.00	\$12.00	Hour	Hour	N/A	N/A	N/A
Pears, Bartlett	Harvesting	High	\$23.49	\$25.00	\$23.49	\$25.00	Bin	Bin	\$11.50	47x47x24.5	Don't - know
Pears, Bartlett	Harvesting	Low	\$25.04	\$23.50	\$25.04	\$23.50	Bin	Bin	\$11.50	47x47x24.5	46x46x24

Figure 1. Results of normalized prevailing wage finding process, continued

Commodity	Activity	Density	Employer count normalized wage finding process	Employer count not normalized wage finding process	Employer count wage finding difference	Employer count wage finding percent difference	Total employers reporting
Apples	Harvesting	All	191	53	138	41%	340
Apples	Harvesting	High	N/A	N/A	N/A	N/A	72
Apples	Harvesting	Low	98	27	71	43%	165
Apples	Harvesting	Medium	59	15	44	51%	87
Apples	Harvesting-Color-Pick	All	94	16	78	45%	175
Apples	Harvesting-Color-Pick	High	N/A	N/A	N/A	N/A	48
Apples	Harvesting-Color-Pick	Low	34	2	32	53%	60
Apples	Harvesting-Color-Pick	Medium	33	4	29	62%	47
Apples	Harvesting-Stem-Clip	All	N/A	N/A	N/A	N/A	103
Apples	Harvesting-Stem-Clip	High	N/A	N/A	N/A	N/A	21
Apples	Harvesting-Stem-Clip	Low	14	14	0	0%	33
Apples	Harvesting-Strip-Pick	All	146	45	101	42%	238
Apples	Harvesting-Strip-Pick	Low	83	25	58	47%	123
Apples	Pruning	All	163	163	0	0%	201
Apples	Thinning	All	125	125	0	0%	145
Apples, Ambrosia	Harvesting	All	N/A	N/A	N/A	N/A	5
Apples, Ambrosia	Harvesting-Strip-Pick	All	N/A	N/A	N/A	N/A	5
Apples, Cripps Pink	Harvesting	All	N/A	N/A	N/A	N/A	28
Apples, Fuji	Harvesting	Medium	16	7	9	38%	24
Apples, Gala	Harvesting	High	N/A	N/A	N/A	N/A	33
Apples, Gala	Harvesting	Low	41	11	30	48%	62
Apples, Gala	Harvesting-Color-Pick	High	6	1	5	18%	28
Apples, Golden Delicious	Harvesting	Low	N/A	N/A	N/A	N/A	79
Apples, Golden Delicious	Harvesting-Strip-Pick	All	N/A	N/A	N/A	N/A	123
Apples, Golden Delicious	Harvesting-Strip-Pick	Low	N/A	N/A	N/A	N/A	70
Apples, Granny Smith	Harvesting	Low	N/A	N/A	N/A	N/A	34
Apples, Granny Smith	Harvesting	Medium	N/A	N/A	N/A	N/A	21
Apples, Granny Smith	Harvesting-Strip-Pick	Low	N/A	N/A	N/A	N/A	29
Apples, Honeycrisp	Harvesting	Low	18	18	0	0%	41
Apples, Honeycrisp	Harvesting	Medium	N/A	N/A	N/A	N/A	23
Apples, Red Delicious	Harvesting	Low	N/A	N/A	N/A	N/A	65

Figure 1. Results of normalized prevailing wage finding process, continued

Commodity	Activity	Density	Employer count normalized wage finding process	Employer count not normalized wage finding process	Employer count wage finding difference	Employer count wage finding percent difference	Total employers reporting
Apples, Red Delicious	Harvesting	Medium	N/A	N/A	N/A	N/A	22
Apples, Red Delicious	Harvesting-Strip-Pick	Low	N/A	N/A	N/A	N/A	57
Berries	Harvesting	All	22	11	11	11%	97
Berries, Blueberries	Harvesting	All	19	9	10	19%	54
Berries, Raspberries	Harvesting	All	N/A	N/A	N/A	N/A	36
Berries, Strawberries	Harvesting	All	N/A	N/A	N/A	N/A	8
Berries, Strawberries	Packing	All	N/A	N/A	N/A	N/A	1
Cherries	Harvesting	All	169	47	122	39%	315
Cherries	Harvesting	High	29	10	19	40%	48
Cherries	Harvesting	Low	70	17	53	45%	117
Cherries	Harvesting	Medium	56	14	42	42%	99
Cherries	Pruning	All	130	130	0	0%	166
Cherries	Pruning	Medium	21	21	0	0%	29
Cherries	Thinning	All	N/A	N/A	N/A	N/A	12
Cherries, Darkred	Harvesting	All	131	37	94	37%	251
Cherries, Darkred	Harvesting	High	18	6	12	41%	29
Cherries, Darkred	Harvesting	Low	61	16	45	44%	103
Cherries, Darkred	Harvesting	Medium	35	3	32	47%	68
Cherries, Lapin	Harvesting	All	32	9	23	36%	64
Cherries, Lapin	Harvesting	Medium	8	2	6	38%	16
Cherries, Red	Harvesting	All	66	21	45	40%	113
Cherries, Red	Harvesting	High	15	5	10	45%	22
Cherries, Red	Harvesting	Medium	24	3	21	53%	40
Cherries, Skeena	Harvesting	All	36	6	30	48%	62
Cherries, Skeena	Harvesting	High	8	1	7	50%	14
Cherries, Skeena	Harvesting	Medium	13	2	11	69%	16
Cherries, Sweetheart	Harvesting	All	50	15	35	42%	84
Cherries, Sweetheart	Harvesting	High	11	2	9	56%	16
Cherries, Sweetheart	Harvesting	Medium	18	2	16	50%	32
Cherries, Yellow	Harvesting	All	67	20	47	36%	129
Cherries, Yellow	Harvesting	High	8	4	4	19%	21

Figure 1. Results of normalized prevailing wage finding process, continued

Commodity	Activity	Density	Employer count normalized wage finding process	Employer count not normalized wage finding process	Employer count wage finding difference	Employer count wage finding percent difference	Total employers reporting
Cherries, Yellow	Harvesting	Low	16	7	9	24%	37
Cherries, Yellow	Harvesting	Medium	20	7	13	43%	30
Pears	Harvesting	All	128	17	111	54%	204
Pears	Harvesting	High	26	11	15	37%	41
Pears	Harvesting	Low	N/A	N/A	N/A	N/A	64
Pears	Thinning	All	N/A	N/A	N/A	N/A	56
Pears, Bartlett	Harvesting	High	16	5	11	38%	29
Pears, Bartlett	Harvesting	Low	36	3	33	59%	56

Employment estimates

Figure 2. 2018 employment estimates by commodity-activity that did not meet USDOL thresholds
 Washington state, 2019
 Source: Employment Security Department/LMEA, 2018 Agricultural Wage and Practice Employer Survey

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Apples	Harvesting-Stem-Clip	Medium	468	3,297	14%	15%	No
Apples	Harvesting-Strip-Pick	High	533	3,902	14%	15%	No
Apples	Harvesting-Strip-Pick	Medium	1,247	9,040	14%	15%	No
Apples	Pruning	High	146	712	21%	50%	No
Apples	Pruning	Low	347	1,555	22%	30%	No
Apples	Pruning	Medium	317	2,309	14%	20%	No
Apples	Thinning	High	137	340	40%	100%	No
Apples	Thinning	Low	281	696	40%	50%	No
Apples	Thinning	Medium	143	355	40%	60%	No
Apples, Ambrosia	Harvesting	High	4	69	6%	100%	No
Apples, Ambrosia	Harvesting	Low	15	260	6%	100%	No
Apples, Ambrosia	Harvesting-Strip-Pick	High	4	69	6%	100%	No
Apples, Ambrosia	Harvesting-Strip-Pick	Low	15	260	6%	100%	No
Apples, Braeburn	Harvesting	All	496	5,477	9%	15%	No
Apples, Braeburn	Harvesting	High	18	135	13%	100%	No
Apples, Braeburn	Harvesting	Low	156	2,051	8%	25%	No
Apples, Braeburn	Harvesting	Medium	53	395	13%	60%	No
Apples, Braeburn	Harvesting-Color-Pick	All	72	537	13%	50%	No
Apples, Braeburn	Harvesting-Color-Pick	Low	31	232	13%	100%	No
Apples, Braeburn	Harvesting-Color-Pick	Medium	21	156	13%	100%	No
Apples, Braeburn	Harvesting-Stem-Clip	All	21	157	13%	100%	No
Apples, Braeburn	Harvesting-Stem-Clip	High	18	135	13%	100%	No
Apples, Braeburn	Harvesting-Stem-Clip	Low	3	22	14%	100%	No
Apples, Braeburn	Harvesting-Strip-Pick	All	403	4,783	8%	15%	No
Apples, Braeburn	Harvesting-Strip-Pick	Low	122	1,797	7%	25%	No
Apples, Braeburn	Harvesting-Strip-Pick	Medium	32	239	13%	100%	No
Apples, Braeburn	Pruning	All	30	224	13%	100%	No
Apples, Cripps Pink	Harvesting	High	97	427	23%	60%	No
Apples, Cripps Pink	Harvesting	Low	124	545	23%	50%	No
Apples, Cripps Pink	Harvesting	Medium	95	418	23%	60%	No
Apples, Cripps Pink	Harvesting-Color-Pick	All	188	827	23%	40%	No
Apples, Cripps Pink	Harvesting-Color-Pick	High	31	136	23%	100%	No
Apples, Cripps Pink	Harvesting-Color-Pick	Low	85	374	23%	60%	No
Apples, Cripps Pink	Harvesting-Color-Pick	Medium	40	176	23%	100%	No

Figure 2. 2018 employment estimates by commodity-activity that did not meet USDOL thresholds, continued

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Apples, Cripps Pink	Harvesting-Stem-Clip	All	399	2,835	14%	20%	No
Apples, Cripps Pink	Harvesting-Stem-Clip	High	53	233	23%	100%	No
Apples, Cripps Pink	Harvesting-Stem-Clip	Low	6	26	23%	100%	No
Apples, Cripps Pink	Harvesting-Stem-Clip	Medium	20	88	23%	100%	No
Apples, Cripps Pink	Harvesting-Strip-Pick	All	160	705	23%	50%	No
Apples, Cripps Pink	Harvesting-Strip-Pick	High	44	194	23%	100%	No
Apples, Cripps Pink	Harvesting-Strip-Pick	Low	35	154	23%	100%	No
Apples, Cripps Pink	Harvesting-Strip-Pick	Medium	35	154	23%	100%	No
Apples, Cripps Pink	Pruning	All	34	149	23%	100%	No
Apples, Cripps Pink	Pruning	Low	23	101	23%	100%	No
Apples, Cripps Pink	Thinning	All	5	22	23%	100%	No
Apples, Fuji	Harvesting	All	2,976	29,739	10%	15%	No
Apples, Fuji	Harvesting	High	461	5,497	8%	15%	No
Apples, Fuji	Harvesting	Low	310	1,419	22%	30%	No
Apples, Fuji	Harvesting-Color-Pick	All	970	9,088	11%	15%	No
Apples, Fuji	Harvesting-Color-Pick	High	106	486	22%	60%	No
Apples, Fuji	Harvesting-Color-Pick	Low	120	550	22%	50%	No
Apples, Fuji	Harvesting-Color-Pick	Medium	175	801	22%	40%	No
Apples, Fuji	Harvesting-Stem-Clip	All	968	8,357	12%	15%	No
Apples, Fuji	Harvesting-Stem-Clip	High	233	2,760	8%	20%	No
Apples, Fuji	Harvesting-Stem-Clip	Low	102	467	22%	60%	No
Apples, Fuji	Harvesting-Stem-Clip	Medium	162	1,282	13%	30%	No
Apples, Fuji	Harvesting-Strip-Pick	All	1,196	14,709	8%	15%	No
Apples, Fuji	Harvesting-Strip-Pick	High	122	2,251	5%	20%	No
Apples, Fuji	Harvesting-Strip-Pick	Low	88	402	22%	60%	No
Apples, Fuji	Harvesting-Strip-Pick	Medium	150	1,111	14%	35%	No
Apples, Fuji	Pruning	All	47	215	22%	100%	No
Apples, Fuji	Pruning	High	6	27	22%	100%	No
Apples, Fuji	Pruning	Low	11	51	22%	100%	No
Apples, Fuji	Thinning	All	51	234	22%	100%	No
Apples, Fuji	Thinning	High	12	55	22%	100%	No
Apples, Fuji	Thinning	Low	14	64	22%	100%	No
Apples, Fuji	Thinning	Medium	25	115	22%	100%	No
Apples, Gala	Harvesting	All	5,874	53,995	11%	15%	No
Apples, Gala	Harvesting	Medium	1,223	12,337	10%	15%	No
Apples, Gala	Harvesting-Color-Pick	All	3,152	27,087	12%	15%	No

Figure 2. 2018 employment estimates by commodity-activity that did not meet USDOL thresholds, continued

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Apples, Gala	Harvesting-Color-Pick	Low	427	1,475	29%	30%	No
Apples, Gala	Harvesting-Color-Pick	Medium	842	8,510	10%	15%	No
Apples, Gala	Harvesting-Stem-Clip	All	156	537	29%	50%	No
Apples, Gala	Harvesting-Stem-Clip	Low	17	58	29%	100%	No
Apples, Gala	Harvesting-Stem-Clip	Medium	18	62	29%	100%	No
Apples, Gala	Harvesting-Strip-Pick	All	2,628	26,585	10%	15%	No
Apples, Gala	Harvesting-Strip-Pick	High	156	1,900	8%	25%	No
Apples, Gala	Harvesting-Strip-Pick	Low	368	1,273	29%	30%	No
Apples, Gala	Harvesting-Strip-Pick	Medium	363	3,765	10%	15%	No
Apples, Gala	Pruning	All	123	456	27%	60%	No
Apples, Gala	Pruning	High	24	83	29%	100%	No
Apples, Gala	Pruning	Low	41	140	29%	100%	No
Apples, Gala	Pruning	Medium	18	62	29%	100%	No
Apples, Gala	Thinning	All	163	596	27%	50%	No
Apples, Gala	Thinning	High	22	76	29%	100%	No
Apples, Gala	Thinning	Low	72	248	29%	100%	No
Apples, Gala	Thinning	Medium	55	191	29%	100%	No
Apples, Golden Delicious	Harvesting	All	4,266	29,878	14%	15%	No
Apples, Golden Delicious	Harvesting	High	147	2,638	6%	20%	No
Apples, Golden Delicious	Harvesting	Medium	327	1,554	21%	30%	No
Apples, Golden Delicious	Harvesting-Color-Pick	All	954	6,846	14%	15%	No
Apples, Golden Delicious	Harvesting-Color-Pick	Low	72	209	34%	100%	No
Apples, Golden Delicious	Harvesting-Color-Pick	Medium	32	93	34%	100%	No
Apples, Golden Delicious	Harvesting-Stem-Clip	All	159	2,673	6%	20%	No
Apples, Golden Delicious	Harvesting-Stem-Clip	High	130	2,589	5%	20%	No
Apples, Golden Delicious	Harvesting-Stem-Clip	Low	11	32	34%	100%	No
Apples, Golden Delicious	Harvesting-Strip-Pick	High	17	49	35%	100%	No
Apples, Golden Delicious	Harvesting-Strip-Pick	Medium	295	1,461	20%	30%	No
Apples, Golden Delicious	Pruning	All	60	175	34%	100%	No
Apples, Golden Delicious	Pruning	Low	20	59	34%	100%	No
Apples, Golden Delicious	Pruning	Medium	4	12	33%	100%	No
Apples, Golden Delicious	Thinning	All	67	194	35%	100%	No
Apples, Golden Delicious	Thinning	Low	55	159	35%	100%	No
Apples, Golden Delicious	Thinning	Medium	8	23	35%	100%	No
Apples, Granny Smith	Harvesting	All	4,174	29,744	14%	15%	No
Apples, Granny Smith	Harvesting	High	236	2,196	11%	20%	No

Figure 2. 2018 employment estimates by commodity-activity that did not meet USDOL thresholds, continued

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Apples, Granny Smith	Harvesting-Color-Pick	All	1,062	8,200	13%	15%	No
Apples, Granny Smith	Harvesting-Color-Pick	Low	45	183	25%	100%	No
Apples, Granny Smith	Harvesting-Color-Pick	Medium	69	280	25%	100%	No
Apples, Granny Smith	Harvesting-Stem-Clip	All	40	162	25%	100%	No
Apples, Granny Smith	Harvesting-Stem-Clip	High	15	61	25%	100%	No
Apples, Granny Smith	Harvesting-Stem-Clip	Low	25	101	25%	100%	No
Apples, Granny Smith	Harvesting-Strip-Pick	All	3,072	21,382	14%	15%	No
Apples, Granny Smith	Harvesting-Strip-Pick	High	221	2,135	10%	20%	No
Apples, Granny Smith	Harvesting-Strip-Pick	Medium	432	3,016	14%	15%	No
Apples, Granny Smith	Pruning	All	75	305	25%	100%	No
Apples, Granny Smith	Pruning	High	8	33	24%	100%	No
Apples, Granny Smith	Pruning	Low	11	45	24%	100%	No
Apples, Granny Smith	Pruning	Medium	14	57	25%	100%	No
Apples, Granny Smith	Thinning	All	38	154	25%	100%	No
Apples, Granny Smith	Thinning	Low	23	93	25%	100%	No
Apples, Granny Smith	Thinning	Medium	15	61	25%	100%	No
Apples, Honeycrisp	Harvesting	All	3,636	29,788	12%	15%	No
Apples, Honeycrisp	Harvesting	High	904	8,115	11%	15%	No
Apples, Honeycrisp	Harvesting-Color-Pick	All	1,374	9,602	14%	15%	No
Apples, Honeycrisp	Harvesting-Color-Pick	High	577	5,460	11%	15%	No
Apples, Honeycrisp	Harvesting-Color-Pick	Low	293	1,186	25%	35%	No
Apples, Honeycrisp	Harvesting-Color-Pick	Medium	181	732	25%	50%	No
Apples, Honeycrisp	Harvesting-Stem-Clip	All	1,264	9,351	14%	15%	No
Apples, Honeycrisp	Harvesting-Stem-Clip	High	317	2,615	12%	20%	No
Apples, Honeycrisp	Harvesting-Stem-Clip	Low	204	825	25%	40%	No
Apples, Honeycrisp	Harvesting-Stem-Clip	Medium	326	2,571	13%	20%	No
Apples, Honeycrisp	Harvesting-Strip-Pick	All	1,165	12,512	9%	15%	No
Apples, Honeycrisp	Harvesting-Strip-Pick	High	10	40	25%	100%	No
Apples, Honeycrisp	Harvesting-Strip-Pick	Low	79	320	25%	100%	No
Apples, Honeycrisp	Harvesting-Strip-Pick	Medium	146	857	17%	40%	No
Apples, Honeycrisp	Pruning	All	146	755	19%	50%	No
Apples, Honeycrisp	Pruning	High	18	72	25%	100%	No
Apples, Honeycrisp	Pruning	Low	58	234	25%	100%	No
Apples, Honeycrisp	Pruning	Medium	2	8	25%	100%	No
Apples, Honeycrisp	Thinning	All	127	679	19%	50%	No
Apples, Honeycrisp	Thinning	High	27	109	25%	100%	No

Figure 2. 2018 employment estimates by commodity-activity that did not meet USDOL thresholds, continued

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Apples, Honeycrisp	Thinning	Low	52	210	25%	100%	No
Apples, Honeycrisp	Thinning	Medium	14	56	25%	100%	No
Apples, Red Delicious	Harvesting	All	4,655	34,804	13%	15%	No
Apples, Red Delicious	Harvesting	High	37	135	27%	100%	No
Apples, Red Delicious	Harvesting-Color-Pick	All	223	1,412	16%	30%	No
Apples, Red Delicious	Harvesting-Color-Pick	Low	102	371	27%	60%	No
Apples, Red Delicious	Harvesting-Color-Pick	Medium	53	193	27%	100%	No
Apples, Red Delicious	Harvesting-Stem-Clip	All	16	58	28%	100%	No
Apples, Red Delicious	Harvesting-Strip-Pick	All	4,448	33,450	13%	15%	No
Apples, Red Delicious	Harvesting-Strip-Pick	High	37	135	27%	100%	No
Apples, Red Delicious	Harvesting-Strip-Pick	Medium	447	2,826	16%	20%	No
Apples, Red Delicious	Pruning	All	85	335	25%	100%	No
Apples, Red Delicious	Pruning	Low	41	151	27%	100%	No
Apples, Red Delicious	Thinning	All	89	348	26%	100%	No
Apples, Red Delicious	Thinning	Low	49	178	28%	100%	No
Apples, Red Delicious	Thinning	Medium	8	29	28%	100%	No
Berries	Packing	All	280	782	36%	50%	No
Berries	Pruning	All	347	997	35%	40%	No
Berries, Blueberries	Packing	All	249	597	42%	50%	No
Berries, Blueberries	Pruning	All	114	365	31%	60%	No
Berries, Raspberries	Packing	All	195	532	37%	50%	No
Berries, Raspberries	Pruning	All	99	343	29%	100%	No
Berries, Strawberries	Pruning	All	1	2	50%	100%	No
Cherries	Pruning	High	226	690	33%	50%	No
Cherries	Pruning	Low	201	641	31%	50%	No
Cherries	Thinning	High	10	32	31%	100%	No
Cherries	Thinning	Medium	7	22	32%	100%	No
Cherries, Dark red	Pruning	All	154	447	34%	60%	No
Cherries, Dark red	Pruning	High	32	92	35%	100%	No
Cherries, Dark red	Pruning	Low	81	238	34%	100%	No
Cherries, Dark red	Pruning	Medium	12	36	33%	100%	No
Cherries, Lapin	Harvesting	High	236	816	29%	40%	No
Cherries, Lapin	Harvesting	Low	199	676	29%	50%	No
Cherries, Lapin	Pruning	All	21	71	30%	100%	No
Cherries, Lapin	Pruning	High	3	10	30%	100%	No
Cherries, Red	Harvesting	Low	452	2,562	18%	20%	No

Figure 2. 2018 employment estimates by commodity-activity that did not meet USDOL thresholds, continued

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Cherries, Red	Pruning	All	183	1,070	17%	35%	No
Cherries, Red	Pruning	High	145	791	18%	50%	No
Cherries, Red	Pruning	Low	1	8	12%	100%	No
Cherries, Red	Pruning	Medium	25	175	14%	100%	No
Cherries, Red	Thinning	All	3	23	13%	100%	No
Cherries, Red	Thinning	Medium	3	23	13%	100%	No
Cherries, Skeena	Harvesting	Low	369	1,114	33%	35%	No
Cherries, Skeena	Pruning	All	22	89	25%	100%	No
Cherries, Skeena	Pruning	High	9	33	27%	100%	No
Cherries, Skeena	Pruning	Low	1	4	25%	100%	No
Cherries, Skeena	Pruning	Medium	8	35	23%	100%	No
Cherries, Sweetheart	Harvesting	Low	190	893	21%	40%	No
Cherries, Sweetheart	Pruning	All	162	624	26%	50%	No
Cherries, Sweetheart	Pruning	High	136	498	27%	60%	No
Cherries, Sweetheart	Pruning	Medium	17	78	22%	100%	No
Cherries, Sweetheart	Thinning	All	3	16	19%	100%	No
Cherries, Sweetheart	Thinning	Medium	3	16	19%	100%	No
Cherries, Yellow	Pruning	All	52	216	24%	100%	No
Cherries, Yellow	Pruning	High	31	130	24%	100%	No
Cherries, Yellow	Pruning	Medium	9	34	26%	100%	No
Cherries, Yellow	Thinning	All	300	1,100	27%	35%	No
Pears	Harvesting	Medium	1,119	12,027	9%	15%	No
Pears	Pruning	All	938	7,010	13%	15%	No
Pears	Pruning	High	61	170	36%	100%	No
Pears	Pruning	Low	132	1,302	10%	30%	No
Pears	Pruning	Medium	259	4,182	6%	15%	No
Pears	Thinning	High	21	59	36%	100%	No
Pears	Thinning	Low	92	1,190	8%	35%	No
Pears	Thinning	Medium	15	42	36%	100%	No
Pears, Bartlett	Harvesting	Medium	942	11,066	9%	15%	No
Pears, Bartlett	Pruning	All	60	174	34%	100%	No
Pears, Bartlett	Pruning	High	13	38	34%	100%	No
Pears, Bartlett	Pruning	Low	17	49	35%	100%	No
Pears, Bartlett	Pruning	Medium	15	44	34%	100%	No
Pears, Bartlett	Thinning	All	99	1,158	9%	35%	No
Pears, Bartlett	Thinning	High	21	61	34%	100%	No

Figure 2. 2018 employment estimates by commodity-activity that did not meet USDOL thresholds, continued

Commodity	Activity	Density	Total reported employment	Total estimated employment	Percent reported employment	USDOL threshold	Determination
Pears, Bartlett	Thinning	Low	58	1,039	6%	35%	No
Pears, Bartlett	Thinning	Medium	10	29	34%	100%	No
Pears, Bosc	Harvesting	All	1,312	14,850	9%	15%	No
Pears, Bosc	Harvesting	High	277	965	29%	40%	No
Pears, Bosc	Harvesting	Low	274	956	29%	40%	No
Pears, Bosc	Harvesting	Medium	393	11,646	3%	15%	No
Pears, Bosc	Pruning	All	4	14	29%	100%	No
Pears, Bosc	Pruning	Medium	4	14	29%	100%	No
Pears, Bosc	Thinning	All	8	28	29%	100%	No
Pears, Bosc	Thinning	Low	4	14	29%	100%	No
Pears, Bosc	Thinning	Medium	4	14	29%	100%	No
Pears, D'anjou	Harvesting	All	2,151	16,753	13%	15%	No
Pears, D'anjou	Harvesting	High	290	832	35%	40%	No
Pears, D'anjou	Harvesting	Low	638	5,198	12%	15%	No
Pears, D'anjou	Harvesting	Medium	686	9,185	7%	15%	No
Pears, D'anjou	Pruning	All	50	142	35%	100%	No
Pears, D'anjou	Pruning	High	15	42	36%	100%	No
Pears, D'anjou	Pruning	Low	14	40	35%	100%	No
Pears, D'anjou	Pruning	Medium	21	60	35%	100%	No
Pears, D'anjou	Thinning	All	4	11	36%	100%	No
Pears, D'anjou	Thinning	Medium	4	11	36%	100%	No

Agricultural peak employment estimation



**Employment
Security
Department**
WASHINGTON STATE

Agenda



- Review
 - ESD requirements
 - Job order identification
 - USDOL determination thresholds
 - Employer estimation
- Employment estimation
 - Method overview
 - Example results
- Moving forward

Review: ESD requirements



- USDOL/ETA for 232 requires:
 - Total number of employers contacted during the survey
 - Total number of respondents
 - Total number of U.S. workers (employment) reported by employers
 - Estimated number of employers (business locations)
 - Estimated number of U.S. workers (employment)
 - Estimated number of crop variety activity workers (employment)

Review: job order identification



- Federal guidelines encourage surveys for any commodity activity to which one or more of the following conditions apply
 1. One hundred or more workers were employed in the previous season, or are expected to be employed in the current season
 2. The crop activity has an unusually complex wage structure
 3. The crop or crop activity has been designated by the national office as a major crop or crop activity
 4. Foreign workers were employed in the previous season, or employers have requested or may be expected to request foreign worker in the current season

Review: USDOL determination threshold



USDOL threshold requirements

Number of estimated workers in crop activity area	Percent needed to make a determination
100 – 349	100%
350 – 499	60%
500 – 799	50%
800 – 999	40%
1,000 – 1,249	35%
1,250 – 1,599	30%
1,600 – 2,099	25%
2,100 – 2,999	20%
3,000 or more	15%

Examples:

Crop-variety	Activity	Reported workers	Estimated workers	Proportion (reported/estimated)	Threshold	Wage determination
Apple, Gala	Harvest	3,500	20,000	18%	15%	Yes
Cherry, Red	Harvest	2,000	15,000	13%	15%	No
Pear, Bosc	Harvest	800	2,000	40%	25%	Yes
Berry, Strawberry	Harvest	240	500	48%	50%	No

Review: employer estimation method



- Log-linear models for capture recapture:
 - 1) Determine the probability of a unit to experience a capture history
 - Example: Determine the likelihood of a crop-variety firm responding to the surveys
 - 2) From understanding the probability of capture, the expected number of units having a capture history can be determined
 - 3) The expected number of units having a capture history then is re-expressed as a log-linear model
 - Expression as a log-linear model aids in reducing inherent bias from the data and allows the fitting of a regression model to estimate abundance
 - 4) Fit a log-linear model
 - Poisson regression, deals with count data
 - Helps us identify bias, correct any bias found and produce a stable estimate
 - Enables the estimation of firms missed during the search occasions
 - 5) Abundance estimation
 - Produces final abundance estimate
 - Uses the number found at least once and the estimated number missed

Review: employer estimation analytical steps



Descriptive statistics

- Transform data to a usable format (matrix of capture histories)
- Assign binary indicators for each capture occasion
- Produce descriptive statistics for capture-recapture data

Model fitting

- Fit various log-linear models for a closed population
- M_0 , M_{1^*} , M_b

Model selection

- Produce fit statistics for the number of captures on each capture occasion and model performance.
 - AIC, BIC, standard error, etc.
- Using model fit statistics, select the model to be used for estimation

Abundance estimate

- Apply the selected model to compute the closed population abundance estimate and 95% confidence interval

Review: industry employer estimates



Industry (NAICS)	Adjusted 2017 QCEW firm count	Abundance estimate	Absolute error	Absolute percent error	Low 95	Hi 95
Other vegetable and melon farming	225	181	44	20%	128	284
Apple orchards	588	549	39	7%	483	633
Grape vineyards	156	149	7	4%	118	201
Berry (except strawberry) farming	176	180	4	2%	137	253
Fruit and tree nut combination farming	18	13	5	28%	8	>37.5
Other noncitrus fruit farming	713	695	18	3%	625	782
All other miscellaneous crop farming	209	217	8	4%	129	442

Employment estimation: method overview



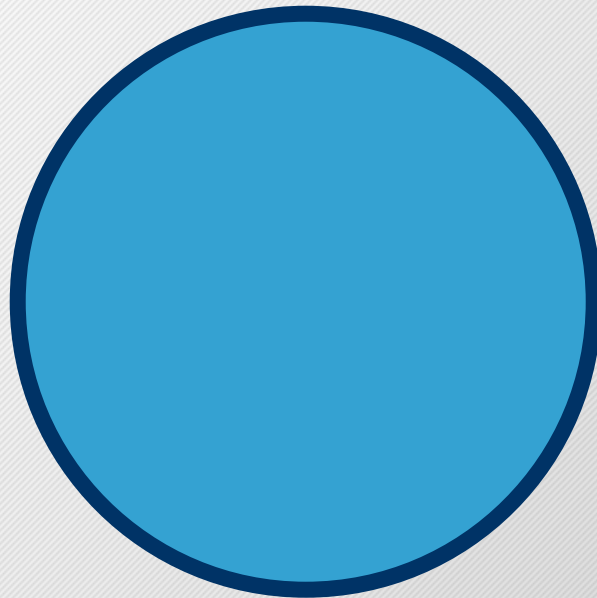
- Iterative proportional fitting (raking algorithm)
 - Repeatedly adjust a set of data (survey responses) so that its marginal totals match specified marginal control totals (population totals)
 - Iterative algorithm for estimating cell values of a contingency table such that the marginal totals remain fixed and the estimated table decomposes to an outer product
 - Consists of two cycles that checks convergence criteria over the control variables
 - Control totals = Employer estimates (capture-recapture)
 - Procedure results in calibration weights
 - Calibrated weights adjust survey responses for survey non-response, bias and employer representation

Employment estimation: method overview continued...

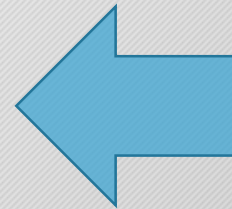
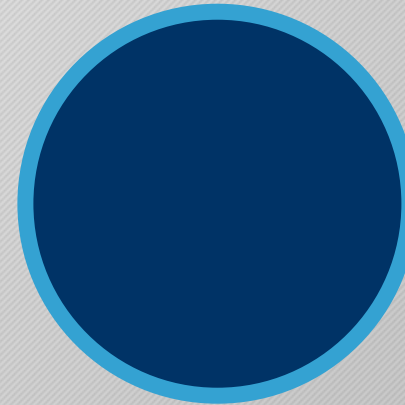


Raking algorithm example

Population margins



Sample margins



Employment estimation: method overview continued...



Base

Sample	A	B	C	Total
X	1	2	1	4
Y	3	5	5	13
Z	6	2	2	10
Total	10	9	8	27

Population	A	B	C	Total
X	?	?	?	9
Y	?	?	?	19
Z	?	?	?	15
Total	14	15	14	43



Iteration 1: row cycle

Raking (1)	A	B	C	Total
X	2.25	4.5	2.25	9
Y	4.384615	7.307692	7.307692	19
Z	9	3	3	15
Total	15.63462	14.80769	12.55769	43

Iteration 1: column cycle

Raking (1)	A	B	C	Total
X	2.0148	4.5584	2.5084	9.081624
Y	3.9262	7.4026	8.1470	19.47581
Z	8.0590	3.0390	3.3446	14.44257
Total	14	15	14	43



Employment estimation: method overview continued...



Iteration 1: results

Raking (1)	A	B	C	Total
X	2.0148	4.5584	2.5084	9.081624
Y	3.9262	7.4026	8.1470	19.47581
Z	8.0590	3.0390	3.3446	14.44257
Total	14	15	14	43

Population	A	B	C	Total
X	?	?	?	9
Y	?	?	?	19
Z	?	?	?	15
Total	14	15	14	43



Iteration 2: row cycle

Raking (2)	A	B	C	Total
X	1.9967	4.5175	2.4859	9
Y	3.8303	7.2217	7.9480	19
Z	8.3701	3.1563	3.4737	15
Total	14.19702	14.89547	13.90751	43



Iteration 2: column cycle

Raking (2)	A	B	C	Total
X	1.9689	4.5492	2.5024	9.020525
Y	3.7771	7.2724	8.0008	19.05038
Z	8.2539	3.1784	3.4968	14.92909
Total	14	15	14	43



Employment estimation: method overview continued...



- Post-stratification adjustment

- Classifying sample units into groups after data collection using information collected in the survey and auxiliary information to adjust weights to population control totals or for nonresponse adjustment
- Adjusting the weights within each cell so that the weights sum to the known population marginal totals

- *Example:*

- 10 total employers in a specific population, all are surveyed, each have an initial weight of 1
 - 2 employers respond, initial weights of 1 get adjusted to 5, summing to 10

- Post-stratified weight: $w_{2j} = w_{1j} \frac{\sum_{i \in \mathcal{U}} \mathbb{I}[i \in \mathcal{C}_k]}{\sum_{l \in \mathcal{S}} w_{1l} \mathbb{I}[l \in \mathcal{C}_k]}$

- w_{1j} = base sample probability weight
 - $\mathbb{I}[\cdot]$ = indicator function taking the value of 1 when its argument is true and 0 otherwise
 - \mathcal{C}_k = post-stratification cells
 - \mathcal{U} = finite population
 - \mathcal{S} = sample of the finite population

Employment estimation: method overview continued...



Raking algorithm procedure

1. Initialize
 - Use the base weights to initialize the raked weight
 - Initialize the iteration counter $k \leftarrow 0$ and weights as $w_j^{0,p} \leftarrow w_{1j}$
2. Increment
 - Use the end result of the previous outer cycle iteration to initialize the weights for the current outer cycle iteration
 - Increment the iteration counter $k \leftarrow k + 1$, update the weights $w_j^{k,0} \leftarrow w_j^{k-1,p}$
3. Inner cycle (post-stratify)
 - Post-stratify with respect to the given control variable
 - Go over the control variables $v = 1, \dots, p$ and update the weights
$$w_j^{k,v} = \begin{cases} w_j^{k,v-1} \frac{T[X_v]}{x_{vj}} & x_{vj} \neq 0 \\ w_j^{k,v-1} \frac{T[X_v]}{\sum_{l \in S} w_l^{k,v-1} x_{vl}} & x_{vj} = 0 \end{cases}$$
4. Return the weights $(w_j^{k,p})$ at the final stage as the calibrated weights
5. Multiply the reported employment by the calibrated weights to determine total employment

Employment estimation: analytical steps



Employer estimation

- Descriptive statistics
- Model fitting
- Model selection
- Abundance estimate (employer estimate)

Identify estimation cells

- Identify employment estimation cells (job order identification)
 - What crop-variety-activities must we estimate for and analyze
- Attach finite population margins to sample data (employer estimate)

Employment estimation

- Initialize
- Increment (outer cycle iteration)
- Inner cycle iteration (post-stratify)
- Return calibrated weights
- Multiply reported employment by calibrated weights (employment estimate)

Employment estimation: method overview continued...

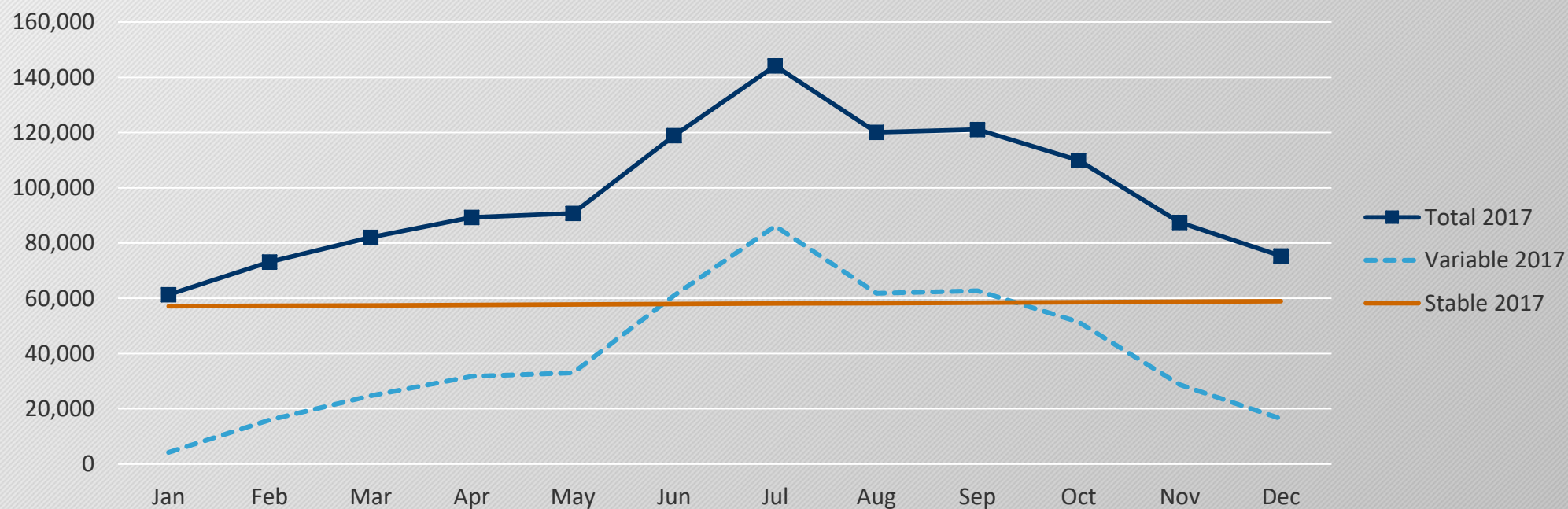


- General requirements:
 - Summed marginal cell values must be non-zero
 - Marginal column and row values must sum to the same value
 - Sample cell values should be smaller than population cell values
- Assumptions:
 - Population in question is finite
 - Each employer has the same initial probability (base weight) of responding

Example results: application to estimate industry peak employment



Monthly variable, stable and total covered employment in agriculture



Example results: application to estimate industry peak employment continued...



Industry (NAICS)	Estimated peak employment	Reported peak employment (2017)	2017 peak variable industry employment (QCEW)	Absolute error	Absolute percent error
Other vegetable and melon farming	4,328	874	2,584	1,744	67%
Apple orchards	23,821	5,284	23,603	218	1%
Grape vineyards	3,785	1,777	3,574	211	6%
Berry (except strawberry farming)	6,432	1,274	6,125	307	5%
Fruit and tree nut combination farming	1,603	1,313	1,402	201	14%
Other noncitrus fruit farming	26,926	8,839	25,042	1,884	8%
All other miscellaneous crop farming	6,353	841	6,000	353	6%
Aggregate	73,248	20,202	68,331	4,917	7%

Example results: application to estimate peak crop activity employment



Crop	Activity	Estimated employment	Reported employment	Proportion reported	Threshold	Determination
Apples	Harvesting	33,946	5,899	17%	15%	Yes
Berries	Harvesting	6,826	1,533	22%	15%	Yes
Cherries	Harvesting	30,604	10,604	35%	15%	Yes
Pears	Harvesting	12,325	2,265	18%	15%	Yes
Grapes	Harvesting	5,529	621	11%	15%	No

Example results: application to estimate peak crop variety activity employment



Crop	Variety	Activity	Estimated employment	Reported employment	Proportion reported	Threshold	Determination
Apple	Braeburn	Harvesting	1,942	385	20%	25%	No
Apple	Cripps pink	Harvesting	2,239	875	39%	20%	Yes
Apple	Fuji	Harvesting	14,069	2,365	17%	15%	Yes
Apple	Gala	Harvesting	23,763	3,627	15%	15%	Yes
Apple	Golden delicious	Harvesting	8,602	1,602	19%	15%	Yes
Apple	Granny smith	Harvesting	16,409	1,978	12%	15%	No
Apple	Honeycrisp	Harvesting	17,442	2,988	17%	15%	Yes
Apple	Red delicious	Harvesting	13,646	2,722	20%	15%	Yes

Example results: application to estimate peak crop variety activity employment continued...



Crop	Variety	Activity	Estimated employment	Reported employment	Proportion reported	Threshold	Determination
Berry	Blueberry	Harvesting	5,377	1,389	26%	15%	Yes
Berry	Raspberry	Harvesting	2,086	745	36%	25%	Yes
Berry	Strawberry	Harvesting	459	364	79%	60%	Yes
Cherry	Dark red	Harvesting	16,849	7,079	42%	15%	Yes
Cherry	Red	Harvesting	28,320	5,064	18%	15%	Yes
Cherry	Yellow	Harvesting	15,190	3,695	24%	15%	Yes
Pear	Bartlett	Harvesting	9,443	1,753	19%	15%	Yes
Pear	Bosc	Harvesting	9,872	730	7%	15%	No
Pear	D'Anjou	Harvesting	8,820	1,164	13%	15%	No

Moving forward



- March, 2019
 - Final employer and worker survey analysis and estimation
- April, 2019
 - Conference call with all stakeholders presenting final results
 - Feedback period of approximately one week
 - Submission of final results to USDOL
 - Publication of final results is contingent upon USDOL
 - Begin administrative planning for 2019 survey iteration

References



- Deming, W.E, Stephan, F. (1940). “On a least squares adjustment of a sampled frequency table when the expected marginal totals are known”. *The Annals of Mathematical Statistics*, **11**(4), 427-444.
- Deming, W.E. (1943). “Statistical adjustment of data”. *Bureau of the Census and Bureau of the Budget, Washington*. New York: Wiley.
- Holt, D., Smith, T.M.F. (1979). “Post stratification”. *Journal of the Royal Statistical Society. Series A (General)*, **142**(1), 33-46.
- Ireland, C.T, Kullback, S. (1968). “Contingency Tables with Given Marginals”. *Biometrika*, **55**(1), 179-188.

References



- Lumley, T. (2004). “Analysis of complex survey samples”. *Journal of Statistical Software*, **9(1)**, 1-19.
- Lumley, T. (2017). “survey: analysis of complex survey samples”. *R package version 3.32*. <https://cran.r-project.org/web/packages/survey/survey.pdf>
- Rao, J.N.K, Yung, W., Hidiroglou, M.A. (2002). “Estimating Equations for the Analysis of Survey Data using Poststratification Information”. *The Indian Journal of Statistics*, **64(A2)**, 364-378.
- Valliant, R. (1993). “Poststratification and Conditional Variance Estimation”. *Journal of the American Statistical Association*, **88(421)**, 89-96.

Contact information



Steven Ross, Director
Employment Security Department
Labor Market Information
Labor Market and Economic Analysis
(360) 507-9615
sross@esd.wa.gov

Gustavo Avilés, Manager
Employment Security Department
Program Evaluation, Research & Analysis
Labor Market and Economic Analysis
(360) 507-9552
gaviles@esd.wa.gov

Joshua Moll, Research Economist
Employment Security Department
Program Evaluation, Research & Analysis
Labor Market and Economic Analysis
(360) 507-9554
jmoll@esd.wa.gov

Toby Paterson, Research Economist
Employment Security Department
Program Evaluation, Research & Analysis
Labor Market and Economic Analysis
(360) 742-2491
mpaterson@esd.wa.gov

Agricultural Survey Quarterly Meeting

Joshua Moll,
Research Economist
Employment Security Department
Labor Market and Economic Analysis
Program Evaluation, Research & Analysis

Presented 02/01/2019



**Employment
Security
Department**
WASHINGTON STATE

Agenda

- Survey background
- Overview of H-2A program
- Employer estimation
- Moving forward

Survey background

- What:
 - Wage rates and employment practices for agricultural worksites in Washington state
- Why:
 - U.S. Department of Labor (USDOL) requires survey every year for occupations and activities that involve temporary foreign workers
 - USDOL uses survey results to establish wage rates and employment standards for agricultural employment contracts

Survey background

- Who:
 - Agricultural business under certain industry codes (NAICS)
 - Agricultural workers involved in apple and cherry harvesting
- How:
 - Survey development and administration
 - Data collected is aggregated and analyzed by ESD
 - Results provided on Employment & Training Administration (ETA) 232 forms

Overview of H-2A program

- Regulated by USDOL
- Used when there is a perceived shortage of domestic workers
- Employment is seasonal or temporary
- Employment of H-2A worker must not negatively impact wages and employment practices for similarly employed domestic workers

Employer estimation

- ESD requirements
- Caveats of estimation
- Estimation method
 - Method overview
 - Method assumptions
 - Analytical steps
- Results of application
 - Industry estimation
 - Crop estimation
 - Crop variety estimation

Employer estimation: ESD requirements

- USDOL/ETA form 232 requires:
 - Total number of employers contacted during the survey
 - Total number of respondents
 - Total number of U.S. workers reported by employers
 - Estimated number of U.S. workers
 - Estimated number of employers
 - Estimated number of crop variety growers

Employer estimation: caveats of estimation

- ESD administrative databases are limited:
 - Unemployment Insurance covers employers by NAICS and worksite location
 - Recorded by NAICS industry, not by crop or crop-variety
 - Single worksites can produce multiple crops and crop varieties
 - Reporting lag
 - Administrative databases do not tell us who qualifies for the survey

Employer estimation: method overview

- Classical capture-recapture estimators:
 - Classical experiment is to study the demographic characteristics of an animal population and determine the population size
 - Animals are captured, marked with a tag and released back into the population
 - The operation gets repeated several times
 - Each animal is associated with a capture history
 - Capture histories indicate a “catch” or a “miss” by a binary vector (1 or 0)
- General form of a population size estimator:
 - $\hat{N} = n + \mu_0$
 - n , is the number of units caught at least once
 - μ_0 , is the estimated number of units missed
 - \hat{N} , is the estimated population size

Employer estimation: method overview continued...

- History of capture-recapture and applications:
 - Originally developed in the field of wildlife management (*Petersen, 1896*)
 - Petersen estimator
 - Gained popularity with a treatment by Chapman (*Chapman, 1951*) in the field of ecology
 - Log-linear treatment of capture-recapture estimators was later applied by Fienberg and Cormack (*Fienberg, 1972; Cormack, 1989*) to deal with heterogeneity of individual behaviors, which can bias estimators of abundance
 - Has been further applied to fields such as: epidemiology, the evaluation of census undercount and software testing (*International Working Group for Disease Monitoring and Forecasting, 1995 a,b; Darroch, Fienberg, Glonek & Junker 1993; Wohlin, Runeson & Brantestam 1995; Ebrahimi 1997; Briand, El Emam, Freimut & Leiterberger, 2000*)

Employer estimation: method overview continued...

- Log-linear models for capture recapture:
 - 1) Determine the probability of a unit to experience a capture history
 - Example: Determine the likelihood of a crop-variety firm responding to the surveys
 - 2) From understanding the probability of capture, the expected number of units having a capture history can be determined
 - 3) The expected number of units having a capture history then is re-expressed as a log-linear model
 - Expression as a log-linear model aids in reducing inherent bias from the data and allows the fitting of a regression model to estimate abundance
 - 4) Fit a log-linear model
 - Poisson regression, deals with count data
 - Helps us identify bias, correct any bias found and produce a stable estimate
 - Enables the estimation of firms missed during the search occasions
 - 5) Abundance estimation
 - Produces final abundance estimate
 - Uses the number found at least once and the estimated number missed

Employer estimation: method overview continued...

- Base types of general linear models:
 - M_0 : all capture occasions are independent with a common probability of being caught
 - M_t : each capture occasion has its own capture probability (temporal effect or change)
 - Best suited for three or more search occasions
 - M_b : a unit's behavior changes after the first capture (behavioral effect or change)
 - Best suited for three or more search occasions

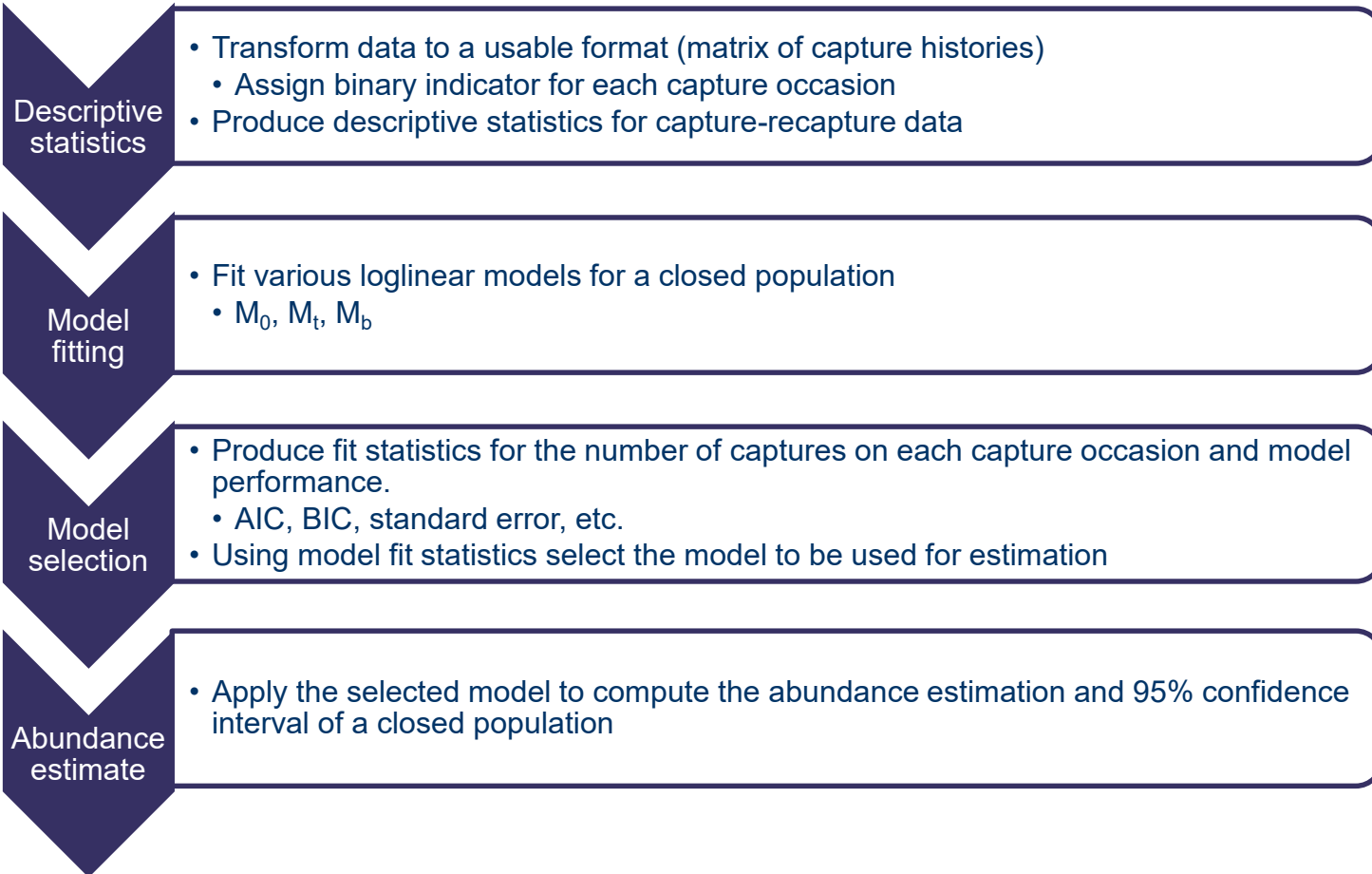
Employer estimation: general model requirements and assumptions

- General model requirements:
 - Have at least two capture occasions
 - *Example:* Two agricultural survey iterations
 - Capture occasions occur over a short period of time
 - Search procedures are conceptually equivalent
 - *Example:* Survey forms and the type of search being conduct are the same
- Assumptions:
 - Population in question is closed:
 - The population is finite
 - Immigration into the population area is negligible
 - Mortality rates are negligible
 - *Example:* the size of the closed population does not drastically vary over a short period of time

Employer estimation: overview continued...

- Log-linear model fitted with a Poisson Regression for capture-recapture experiments (M_0):
 - 1) Probability of a unit to experience a capture history, ω ,:
 - $\Pr(\omega) = (1 - p)^{t - \sum \omega_j p \sum \omega_j}$
 - $t = \text{capture occasions}$
 - $p = \text{single capture probability to all units}$
 - $\sum \omega_j = \text{the number of times the unit is caught}$
 - 2) Therefore, the expected number of units in the population having a capture history ω is:
 - $\mu_\omega = N(1 - p)^{t - \sum \omega_j p \sum \omega_j}$
 - 3) Expected frequency re-expressed as a log-linear model:
 - $\mu_\omega = \exp\left(\log(N((1 - p)^t) + \sum \omega_j \log\left(\frac{p}{1 - p}\right))\right)$
 - 4) Fit a log-linear model:
 - $E(Y) = \exp(X\beta)$
 - Y is equal to the $(2^t - 1) \times 1$ vector of the observed frequencies n_ω
 - X is a $(2^t - 1) \times 2$ design matrix
 - $\beta = (\gamma, \beta)^t$
 - 5) Abundance estimate:
 - $\hat{N} = n + \exp(\gamma)$
 - $\exp(\gamma) = \exp(\log(N((1 - p)^t))) = N(1 - p)^t = N \times \Pr(\omega_0) = \mu_0$
 - $\omega_0 = \text{the unobservable capture history of zero capture}$
 - $\mu_0 = \text{the expected number of units never captured}$

Employer estimation: analytical steps



Results: application to estimate industry firm abundance

- Method was applied to survey data collected from 2015 and 2017:
 - 2015 and 2017 data was made compatible in order to apply this technique
 - 2017 survey data was far more granular in terms of what crop-varieties were allowed to be report
 - Comparison against adjusted 2017 average annual firm counts by six digit NAICS code from QCEW
 - QCEW firm counts were adjusted to meet the scope of the survey
 - Ratios of eligibility were extracted from 2015 (74%) and the most recent 2018 (80%) survey disposition records and then averaged
 - Therefore, on average 77% (0.77) are considered eligible under the scope of the survey
 - Example: $100_{total\ firms} \times 0.77_{eligible} = 77_{adjusted\ firms}$

Results: Industry estimates

Industry (NAICS)	Adjusted 2017 QCEW firm count	Abundance estimate	AE	APE	Low 95	Hi 95
Other vegetable and melon farming	225	181	44	20%	128	284
Apple orchards	588	549	39	7%	483	633
Grape vineyards	156	149	7	4%	118	201
Berry (except strawberry) farming	176	180	4	2%	137	253
Fruit and tree nut combination farming	18	13	5	28%	8	>37.5
Other noncitrus fruit farming	713	695	18	3%	625	782
All other miscellaneous crop farming	209	217	8	4%	129	442

Results: Crop estimates

Crop	Abundance estimate	Low 95	Hi 95	Occasion 1 (2015)	Occasion 2 (2017)	Both occasions
Apples	943	830	1086	316	292	98
Berries	249	191	344	61	87	22
Cherries	759	665	880	235	276	86
Grapes	266	200	379	70	76	20
Pears	513	418	649	131	159	41

Results: Crop variety estimates

Crop	Variety	Abundance estimate	Low 95	Hi 95	Occasion 1 (2015)	Occasion 2 (2017)	Both occasions
Apple	Braeburn	105	42	>315	11	18	2
Apple	Cripps pink	113	45	>338	5	25	2
Apple	Fuji	360	247	577	61	81	14
Apple	Gala	646	506	859	133	159	33
Apple	Golden delicious	439	324	634	82	110	21
Apple	Granny smith	455	278	865	54	74	9
Apple	Honeycrisp	476	327	757	56	113	15
Apple	Red delicious	423	310	618	63	121	20

Results: Crop variety estimates continued...

Crop	Variety	Abundance estimate	Low 95	Hi 95	Occasion 1 (2015)	Occasion 2 (2017)	Both occasions
Berry	Blueberry	182	117	328	35	46	9
Berry	Raspberry	69	51	104	22	33	11
Berry	Strawberry	37	20	105	9	12	3
Cherry	Dark red	444	332	641	40	200	18
Cherry	Red	725	551	1001	167	118	28
Cherry	Yellow	441	308	685	57	111	16
Pear	Bartlett	400	308	547	83	121	26
Pear	Bosc	469	200	>1406	18	57	3
Pear	D'anjou	355	248	557	60	86	15

Moving forward

- January 31st, 2019:
 - Survey administration and data collection closed
 - Worker survey response rate: 42.91%
 - Employer survey response rate (1/20/2019): 42.14%
- February 28th, 2019:
 - University of Washington delivers final survey data set to LMEA
- March, 2019:
 - Agricultural survey quarterly meeting to discuss worker estimation method (announcement of date and time will follow shortly)
 - Final employer and worker survey analysis and estimation
- April, 2019:
 - Conference call with all stakeholders presenting final results
 - Feedback period of approximately one week
 - Submission of final results to USDOL
 - Publication of final results is contingent upon USDOL
 - Begin administrative planning for 2019 survey iteration

References

- Briand, L.C., El Emam, K., Freimut B.G. & Leiterberger O. (2000). “A comprehensive evaluation of capture-recapture models for estimating software defect content. *IEEE Transactions on Software Engineering*, **26**, 518-540
- Chapman (1951). “Some properties of the hypergeometric distribution with applications to zoological census.” *University of California Public. Stat.* **1**, 131-160.
- Cormack, RM (1989). “Loglinear models for Capture-Recapture.” *Biometrics*, **45**, 395-413.
- Darroch, J.N., Fienberg, S.E., Glonek, G. & Junker, B. (1993). “A three sample multiple capture-recapture approach to the census population estimation with heterogeneous catchability.” *Journal of the American Statistical Association*, **88**, 1137-1148.
- Ebrahimi, N. (1997). “On the statistical analysis of number of errors remaining in a software design document after inspection.” *IEEE Transactions on Software Engineering*, **26**, 529-532.
- Fienberg, S.E. (1972). “The multiple recapture census for closed populations and incomplete 2^k contingency tables.” *Biometrika*, **59**, 591-603.

References continued...

- IWDGMF (International Working Group for Disease Monitoring and Forecasting) (1995a). "Capture-recapture and multiple-record systems estimation, I: History and theoretical development. *American Journal of Epidemiology*, 142, 1047-1058.
- IWDGMF (International Working Group for Disease Monitoring and Forecasting) (1995b). "Capture-recapture and multiple record systems estimation, II: Applications in human diseases. *American Journal of Epidemiology*, 142, 1059-1068.
- Petersen, C.G.J. (1896). "The yearly immigration of young plaice into the Limfjord from the German Sea." *Rep. Danish Biol. Sta.* 6, 1-48.
- Wohlen, C., Runeson, P. & Brantestam, B. (1995). "An experimental evaluation of capture-recapture in software inspection." *Software Testing, Verification and Reliability*, 5, 213-232.
- Rivest, L.P. & Baillargeon, S. (2007). "Rcapture: Loglinear Models for Capture-Recapture in R". *Journal of Statistical Software*, **19**(5).
- Rivest L.P. & Baillargeon, S. (2014). "Rcapture: Loglinear Models for Capture-Recapture Experiments. *R package version 1.4-2*. <https://cran.r-project.org/web/packages/Rcapture/index.html>
- Rivest, L.P. & Levesque, T. (2001). "Improved Log-linear Model Estimators of Abundance in Capture-Recapture Experiments." *Canadian Journal of Statistics*, **29**, 555-572.

Contact information

Steven Ross, Director
Employment Security Department
Labor Market Information
Labor Market and Economic Analysis
(360) 507-9615
sross@esd.wa.gov

Gustavo Avilés, Manager
Employment Security Department
Program Evaluation, Research & Analysis
Labor Market and Economic Analysis
(360) 507-9552
gaviles@esd.wa.gov

Joshua Moll, Research Economist
Employment Security Department
Program Evaluation, Research & Analysis
Labor Market and Economic Analysis
(360) 507-9554
jmoll@esd.wa.gov