



Department of
Primary Industries

Sydney Rock Oyster Breeding

Traits, progress and sustainable breeding

Shane Buckley (SRO BP Reference Group and Wapengo Rocks)

Michael Dove (NSW DPI) and Kyle Johnston (NSW DPI)

Sydney Rock Oyster Breeding: Traits, progress and sustainable breeding

This presentation has three components:

1. SRO breeding program progress: Michael Dove (NSW DPI)
2. Performance of families in the field: Kyle Johnston (NSW DPI)
3. Sustainable Sydney Rock Oyster Breeding: Shane Buckley (Wapengo Rocks)

Sydney Rock Oyster Breeding: Overview

- Family-based breeding
- Single pair of parents produces each family
- Annual breeding cycle: a new year class is produced annually
- Every family has an Estimated Breeding Value (EBV)
- EBVs identify families with the best genes for
 - QX survival
 - whole weight
 - meat condition
 - shell shape
- EBVs are updated in August so that the best families can be used for breeding in October



Sydney Rock Oyster Breeding: Overview

- Advantages of family based breeding vs mass selection:
 - more genetic information
 - increase genetic gains
 - estimate gains in heritable traits
 - multi-trait selection
 - control level of inbreeding



SRO BP Goal: A population of SROs that gets better over time

- Decrease the cost of production (via disease resistance, superior growth and uniformity)
- Increase product quality traits (via improved meat condition and shell shape)

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Loaded Files

Choose File Type

- All
-
- Reference Loads
- Input Trait Descriptor
 - Define Site
 - Define Genetic Groups
-
- Fertilisation
- Define Fertilisations
 - Input Broodstock Sample
 - Input Founder Genetic Groups
-
- Trial Deployment
- Define Progeny Test
 - Define Unit
-
- Data Inputs
- Input Unit Measurement
 - Input Individual Measurement

Recently Loaded Files

FILENAME	FILE_ID	OPERATION	USER_NAME	DTTM	DOCUMENT
2019_Measure_Individual_Site_2_2021-06-08.csv	587	Input_Individual_Measurement	KYLE	06-JUL-2021	Download
SRO_QX_H2_All_Trials_2021-06-08.csv	586	Input_Progeny_Test_Heritability	KUB008	08-JUN-2021	Download
Alias_QX_All_Trials_2021-06-04.csv	585	Input_Alias	KUB008	07-JUN-2021	Download
Job_QX_All_Trials_2021-06-04.csv	582	Input_Job	KUB008	04-JUN-2021	Download
Founder_Genetic_Group_Richmond_River_2021-06-03.csv	581	Input_Founder_Genetic_Group	ADMIN_SCOTT	03-JUN-2021	Download
Genetic_Groups_Richmond_River_2021-06-03.csv	580	Define_Genetic_Group	ADMIN_SCOTT	03-JUN-2021	Download
SRO_QX_H2_20170402_2021-06-03.csv	579	Input_Progeny_Test_Heritability	KUB008	03-JUN-2021	Download
Alias_QX_Indiv_20170402.csv	577	Input_Alias	KUB008	03-JUN-2021	Download
Job_QX_Indiv_20170402.csv	575	Input_Job	KUB008	03-JUN-2021	Download
2019_Measure_Unit_Site_4_2021-04-15.csv	573	Input_Unit_Measurement	KYLE	22-APR-2021	Download
2019_Define_Unit_Site_6_2021-04-15 (1).csv	572	Define_Unit	KYLE	22-APR-2021	Download
2019_Progeny_Test_Site_6_2021-04-15 (1).csv	571	Define_Progeny_Test	KYLE	22-APR-2021	Download

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2019_Progeny_Test_Site_6_2021-04-15 (1).csv	571 Define_Progeny_Test KYLE 22-APR-2021 Download

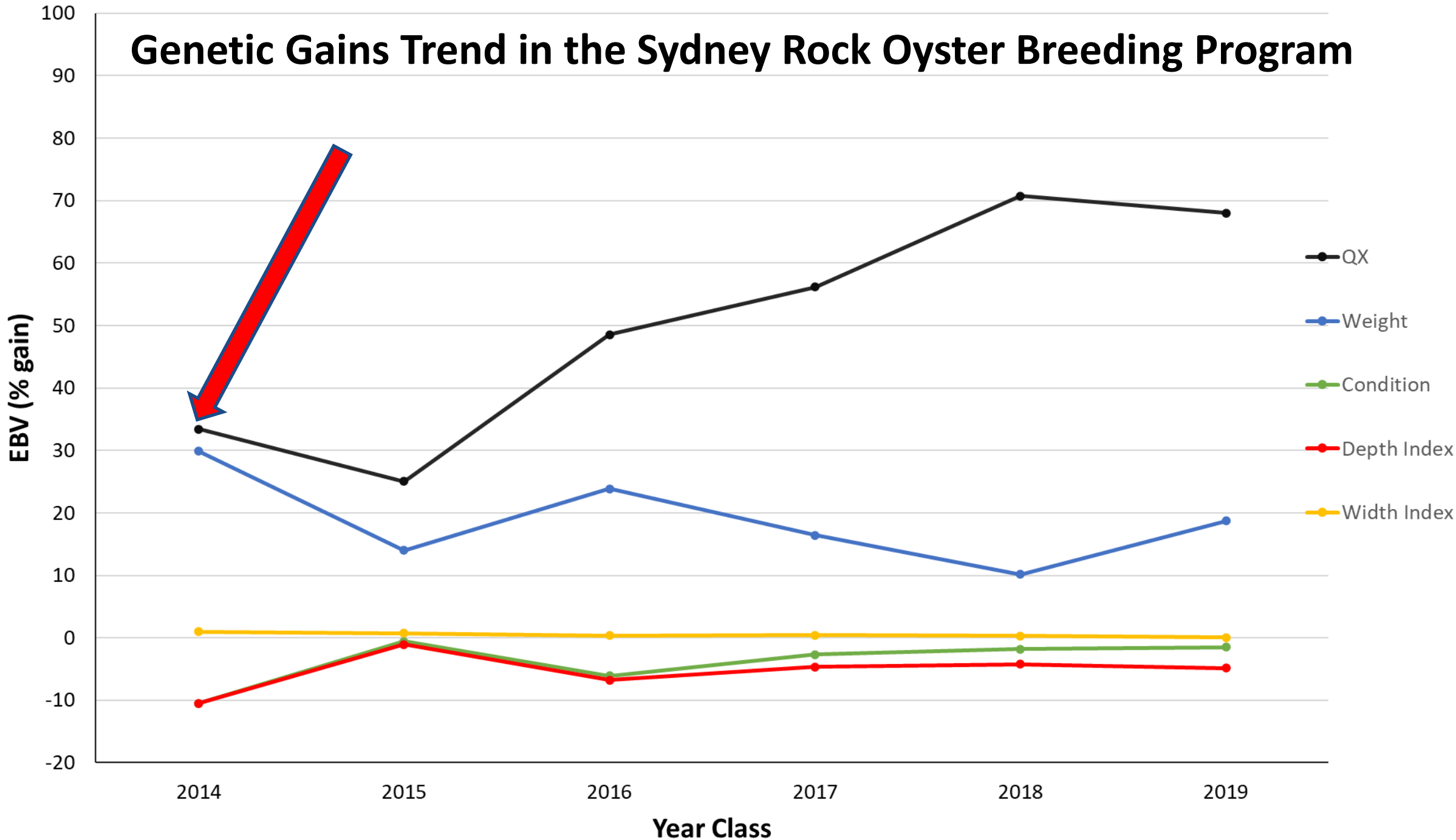
Commercial Traits:

QX disease survival

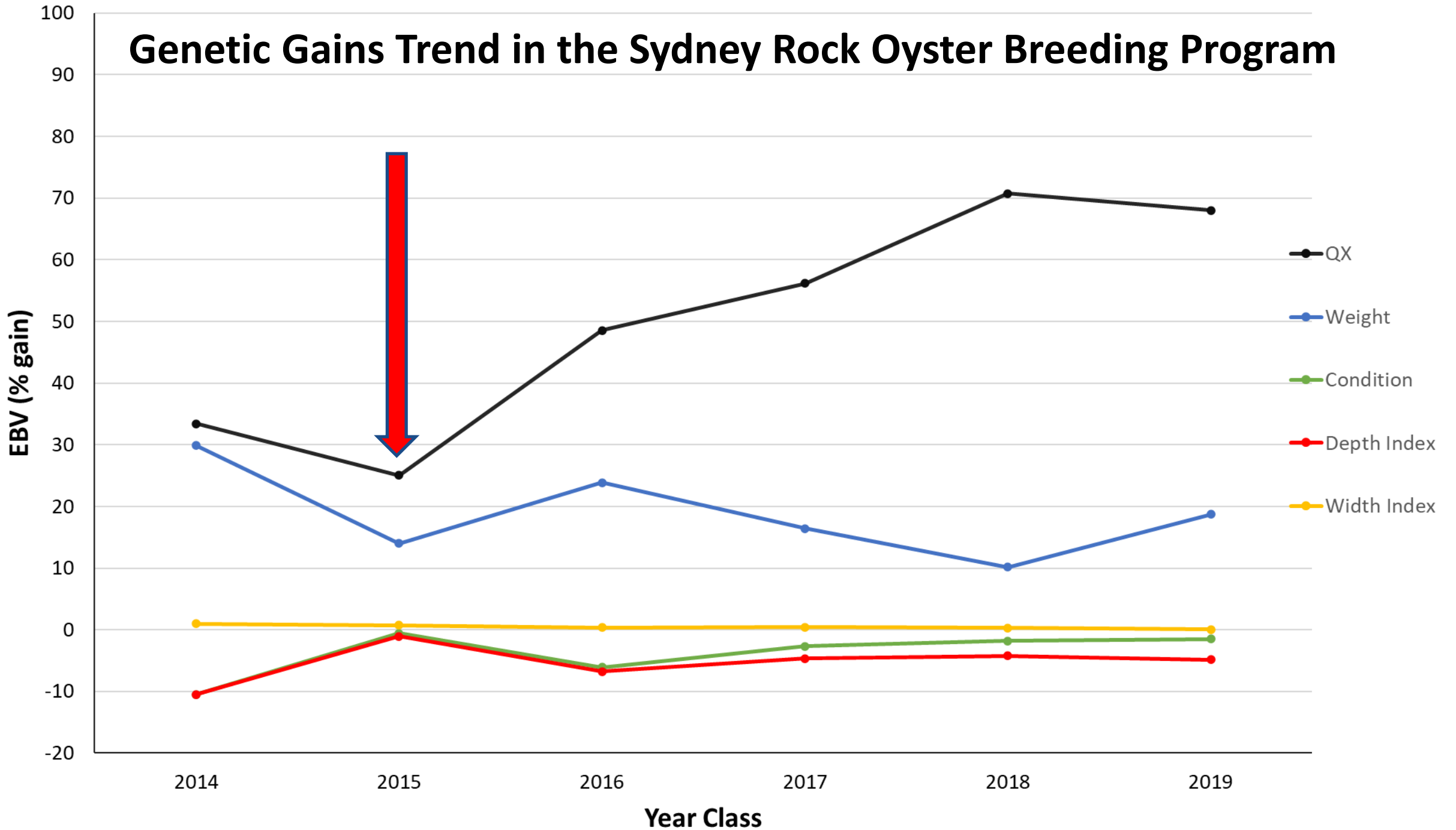
Whole Weight

Condition

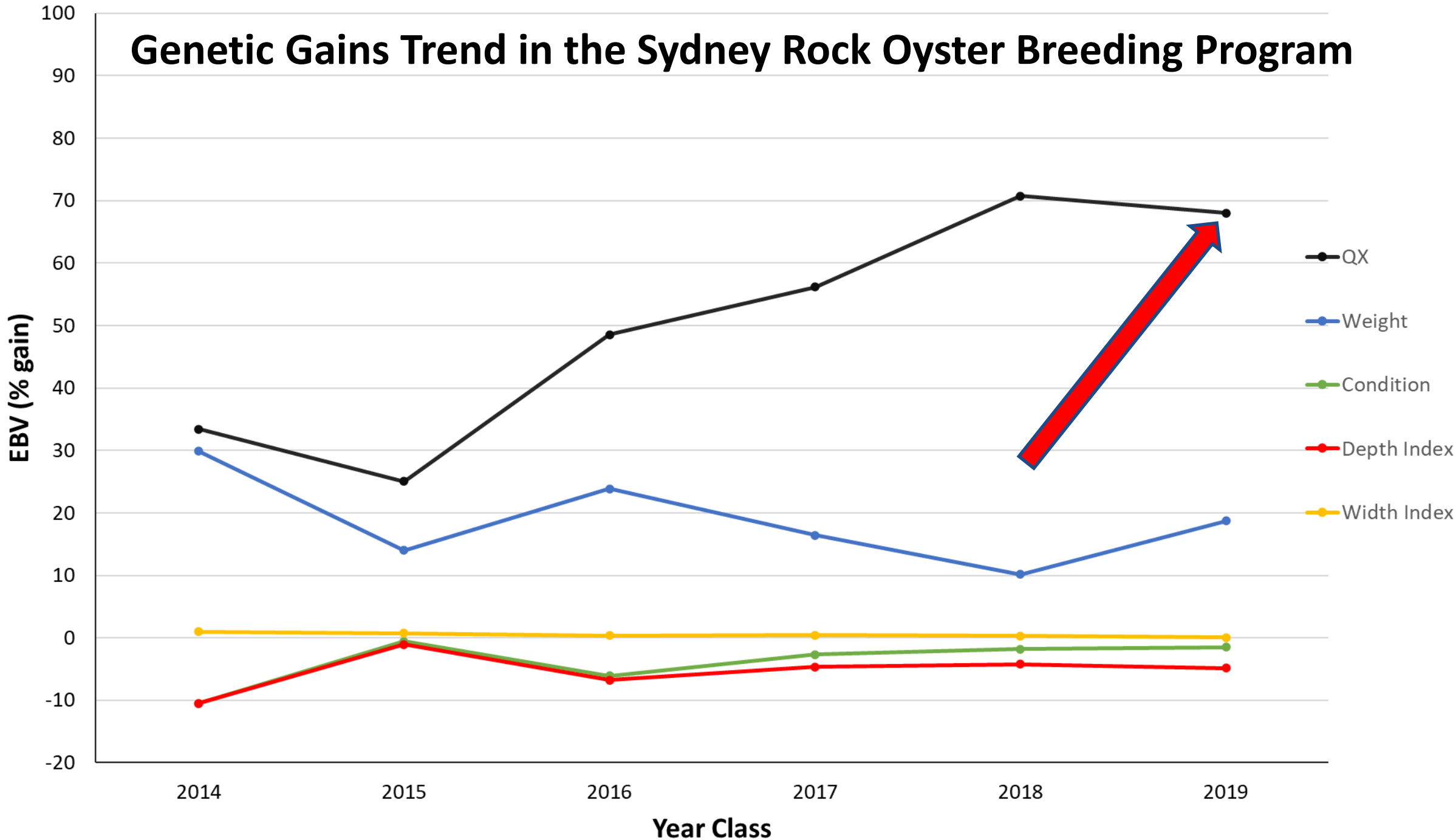
Genetic Gains Trend in the Sydney Rock Oyster Breeding Program



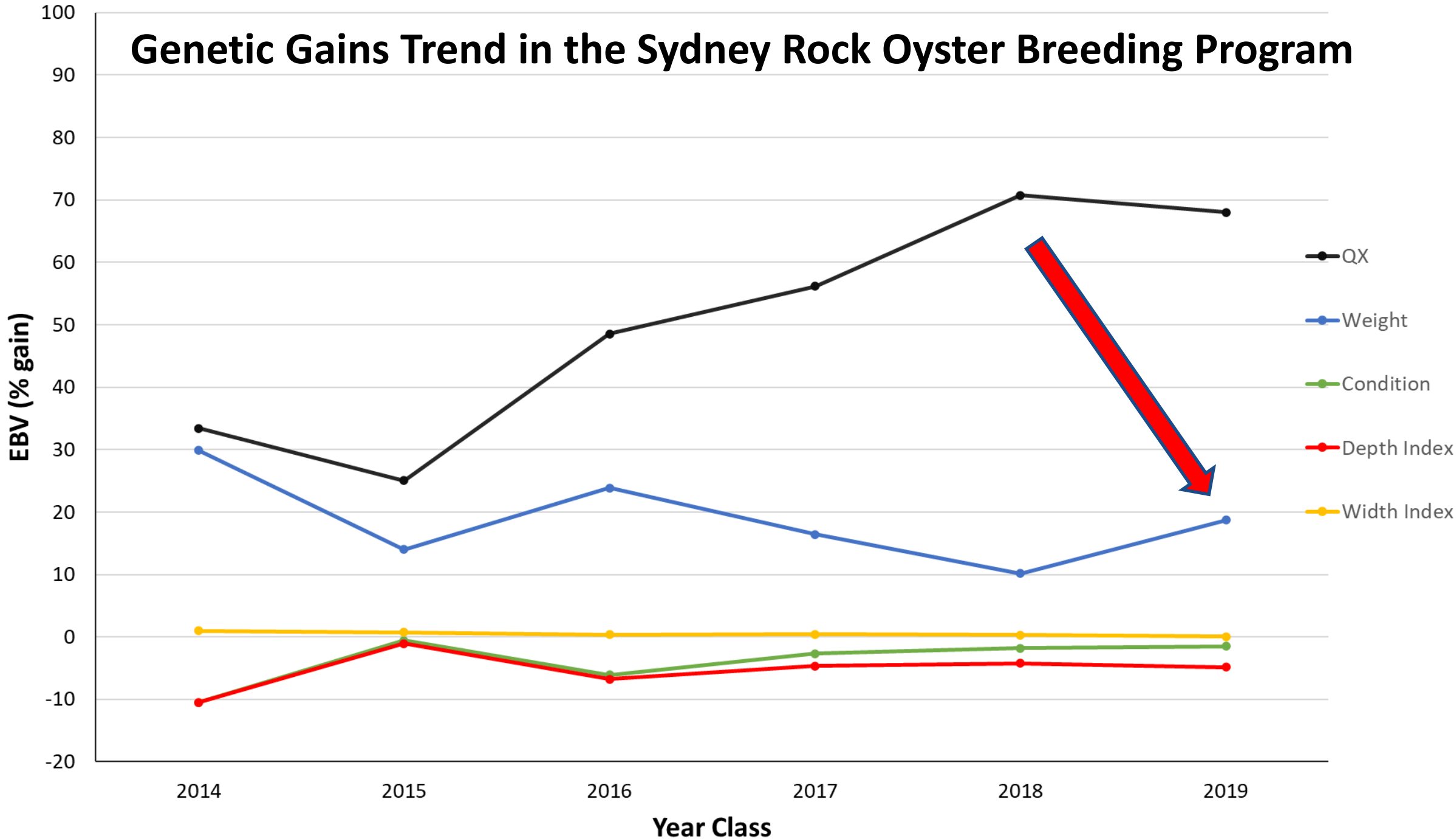
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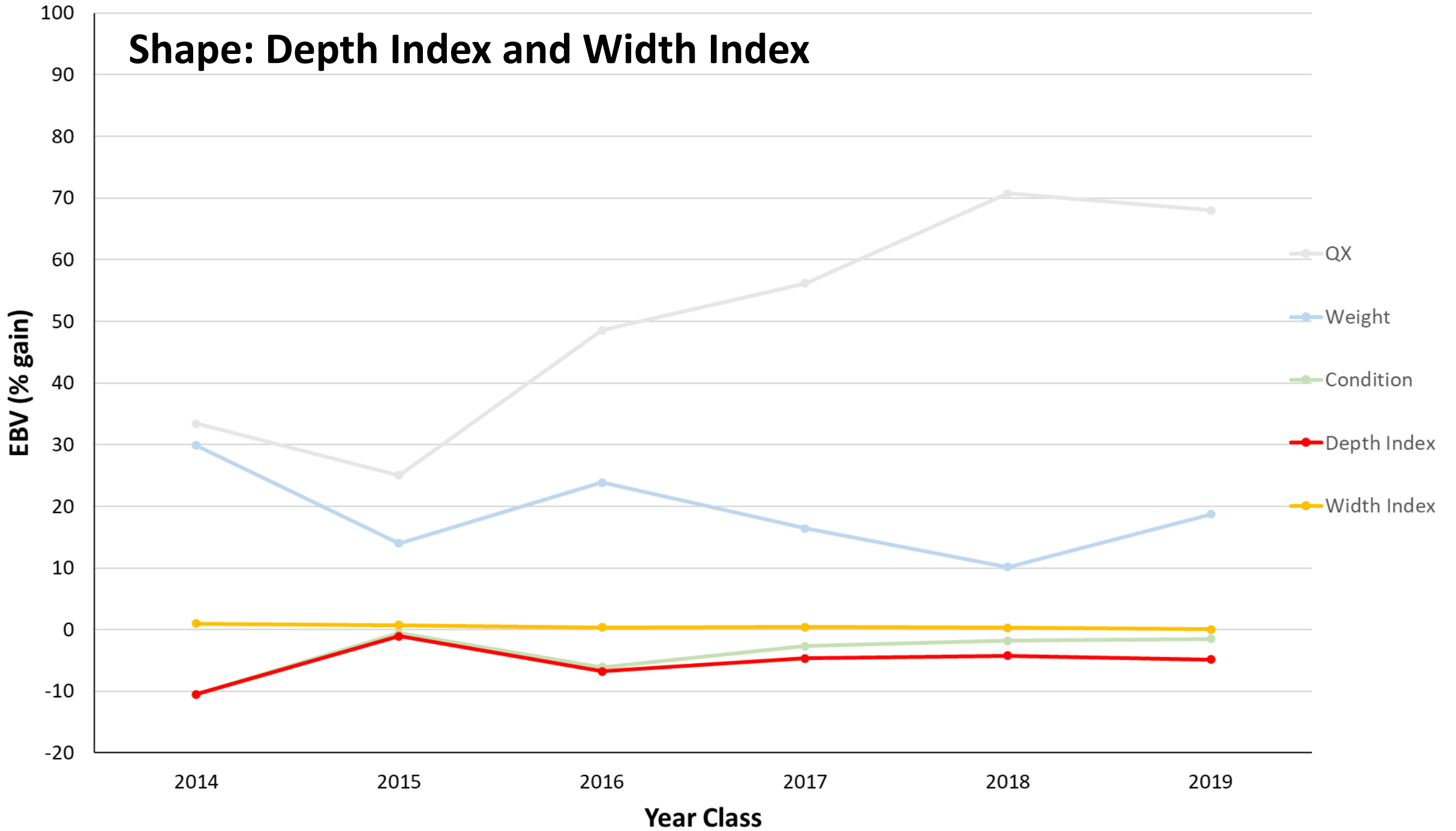
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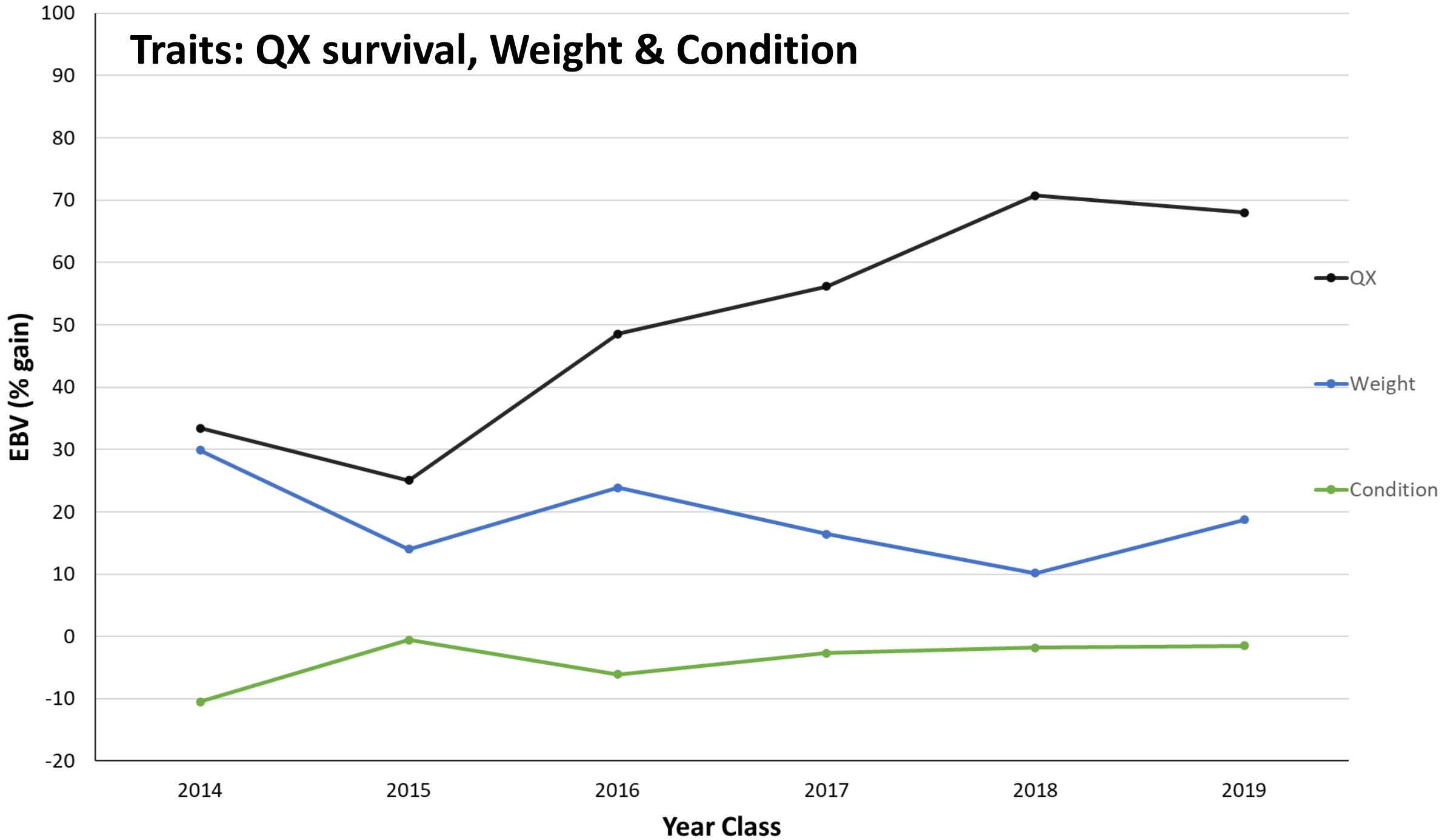
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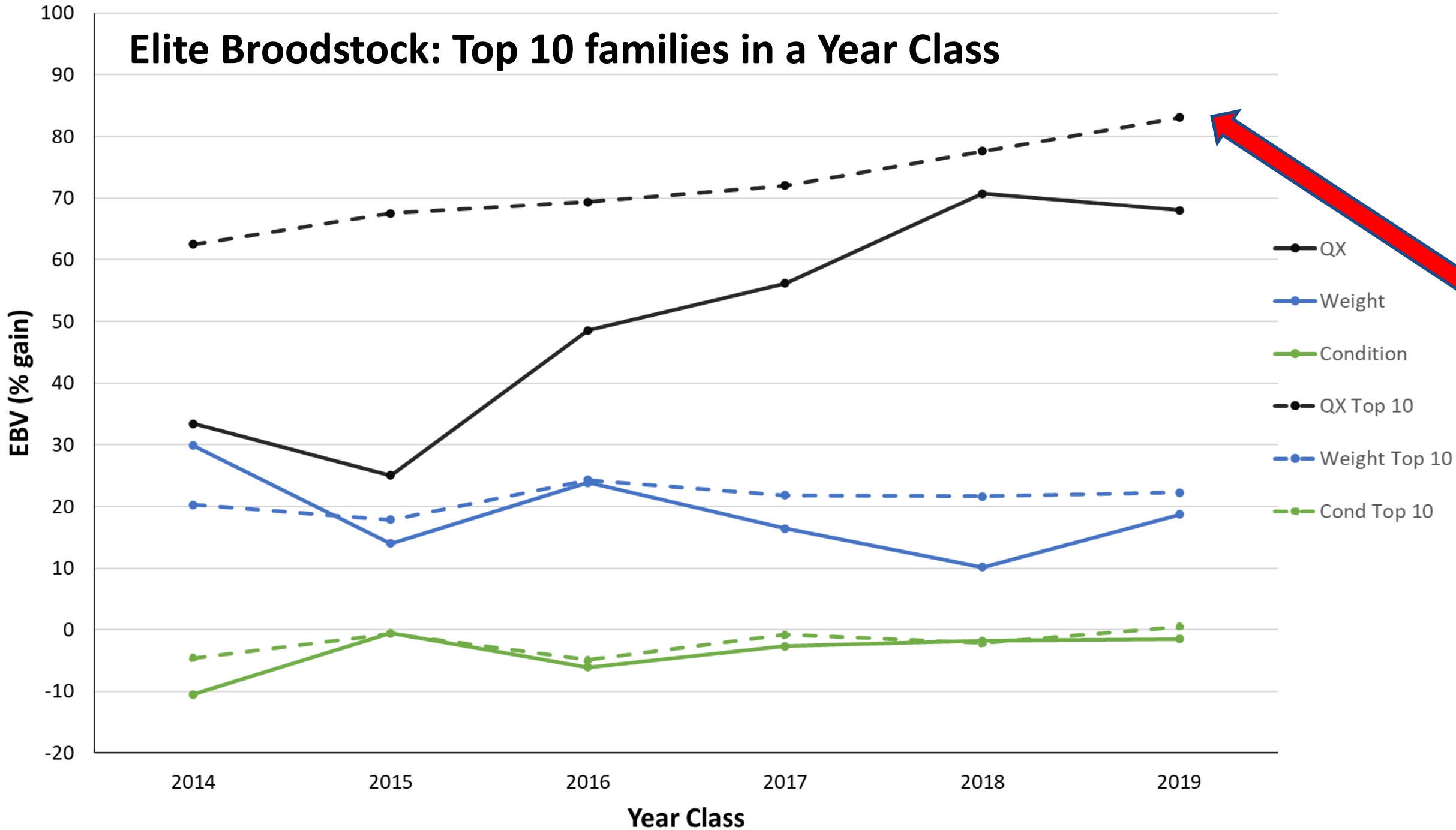
Shape: Depth Index and Width Index



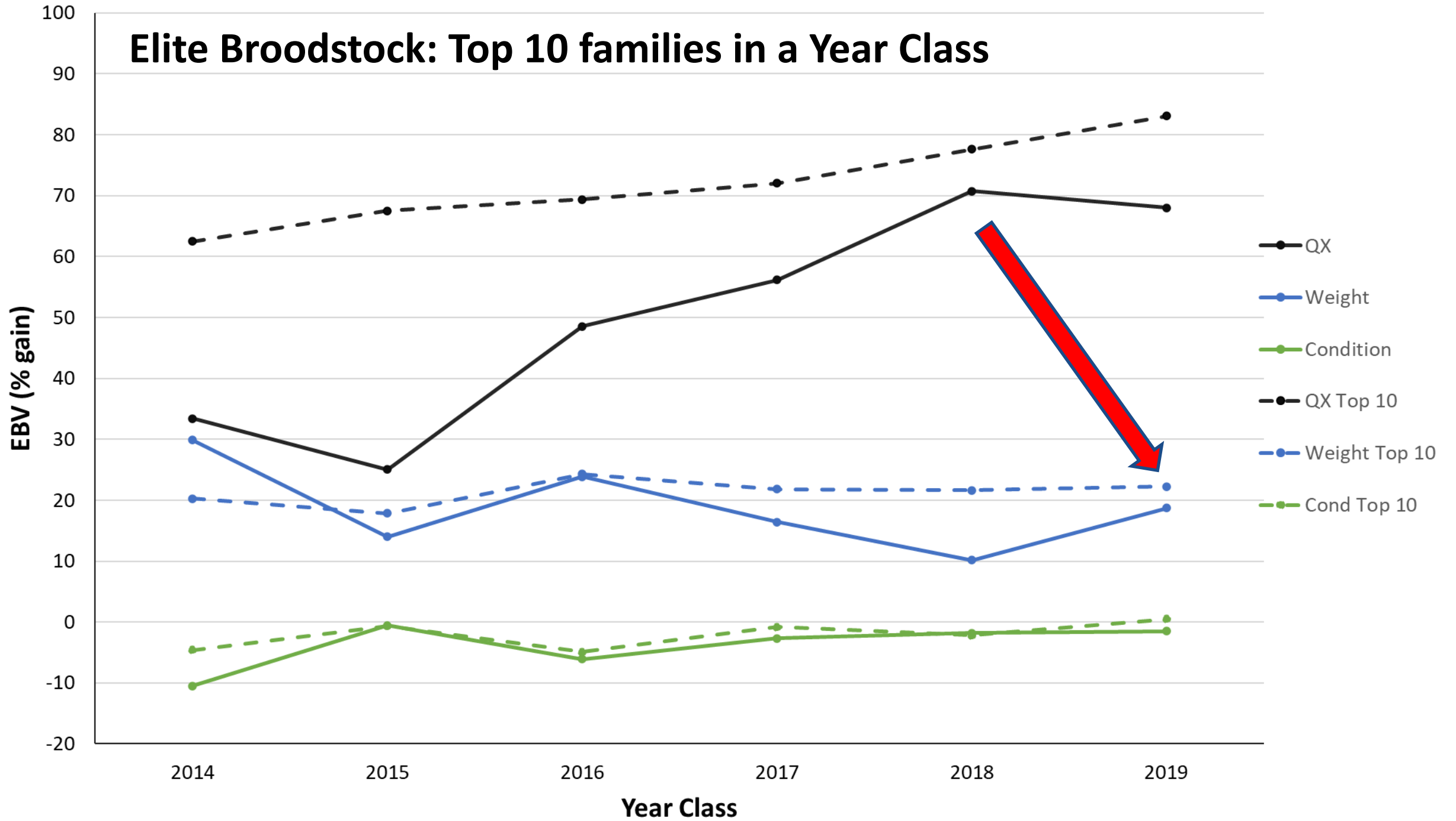
Traits: QX survival, Weight & Condition



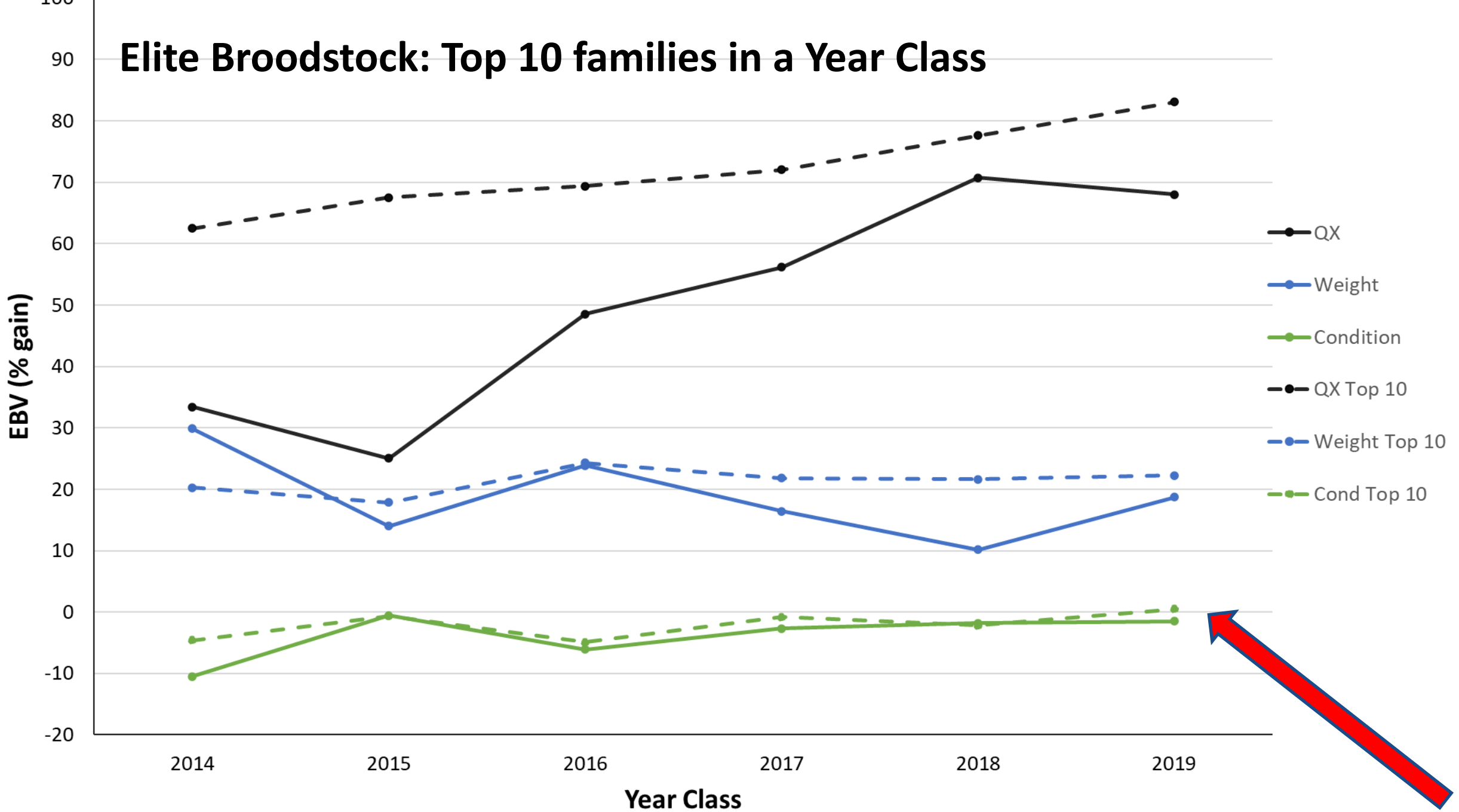
Elite Broodstock: Top 10 families in a Year Class



Elite Broodstock: Top 10 families in a Year Class



Elite Broodstock: Top 10 families in a Year Class



Future Opportunities:

Genomics: FRDC Project 2021-22 "Assessment of the utility of genomics for SRO breeding"

- Study of the oyster's genes
- Identify oysters with the best genes for QX survival, Growth and Condition
- Increase selection accuracy and gains
- Identify genes linked with climate change resilience

Increase gains in QX survival using:

- Within family selection in Port Stephens
- QX survivors as broodstock
- Two seasons of exposure to QX disease

UNSW Collaboration: Breed oysters that can adapt and persist to climate change

Provide a tool to respond to unidentified future threats and needs



University of the
Sunshine Coast

Queensland, Australia



Australian Government

**Fisheries Research and
Development Corporation**



UNSW
SYDNEY

Science in the field

TRAY LAYOUT YC2019 ADULT QX EXPOSURE DEPLOYED 15 DECEMBER 2020

14/4/21

L	D	L	D	L	D	L	D	L	D
45	46	4	15	42	8	16	49	2	spare
33	40	8	52	51	2	14	47	2	1 41 15
55	45	5	39	50	1	49	49	1	58 48 2
spare			29	52	0	40	42	8	34 44 6

Rep2

10	42	9	23	47	3	28	47	3	14 49 1
33	54	14	40	42	8	13	48	2	3 41 9
49	49	1	47	46	4	spare			27 44 6
spare			42	42	7	46	44	6	41 48 1

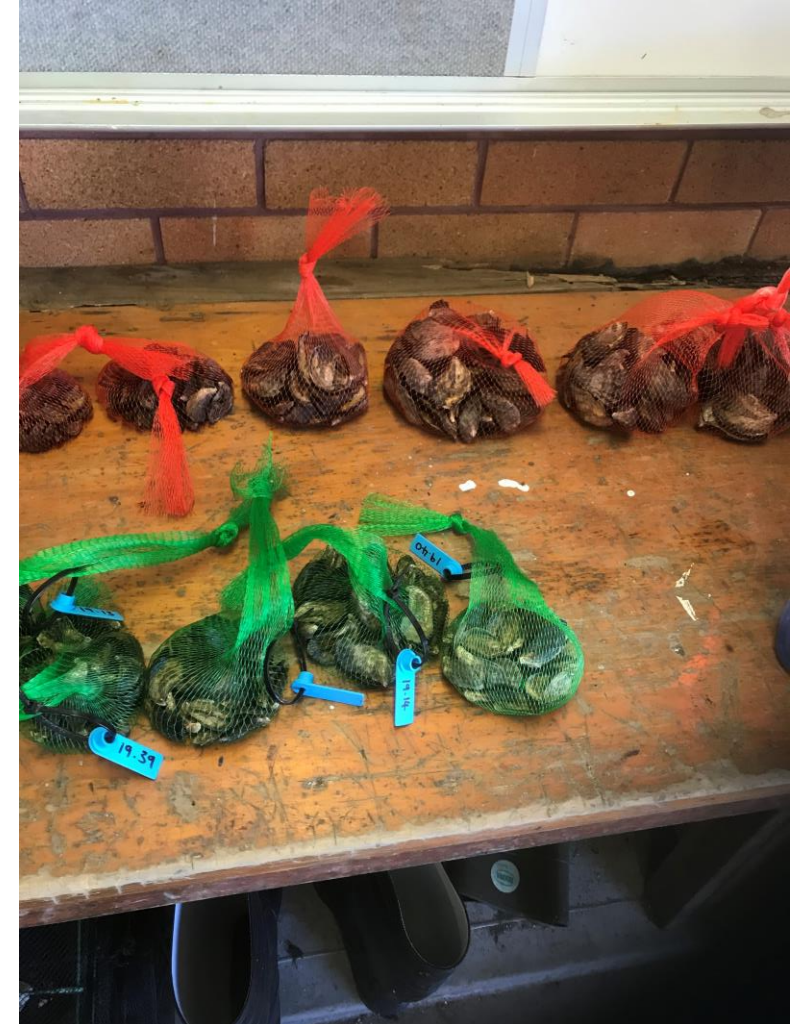
Rep3

7	45	5	11	49	2	50	50	0	spare
8	49	2	48	42	7	34	45	5	spare
13	48	2	38	44	5	29	42	8	18 30 19
4	24	26	45	40	11	53	45	4	14 50 1

3	5031	21	55	47	3
spare			47	42	8
17	48	2	52	49	1
12	47	3	37	49	0

Rope
Scallops
Pearls
Tray layout

Not shown



YC2019 Adult
 QX Exposure-
 Deployed 15th
 Dec 2020

Tray 5- Replicate 1

	Apr21			Jul21		
Family	Live	Dead		Family	Live	Dead
13	46	4		13	42	4
3	34	17		3	22	14
44	40	9		44	34	7
11	50	1		11	47	3

YC2019 Adult
 QX Exposure-
 Deployed 15th
 Dec 2020

Tray 11- Replicate 2

	Apr21			Jul21		
Family	Live	Dead		Family	Live	Dead
	11	50	0	11	49	1
	6	48	2	6	43	4
	39	50	1	39	39	11
	1	44	6	1	30	17

YC2019 Adult
 QX Exposure-
 Deployed 15th
 Dec 2020

Tray 15- Replicate 3

	Apr21			Jul21			
Family	Live	Dead		Family	Live	Dead	
	11	48	2		11	45	3
	8	49	2		8	34	13
	13	48	2		13	44	3
	4	24	26		4	10	11

Port Stephens condition experiment



Estimated Breeding Values

Rankings change quickly as new families outperform their parents

2017 YC

FAM_ID	RANK
2017031	1
2017067	2
2015025	3
2015008	4
2017001	5
2015007	6
2015009	7
2017028	8
2017011	9
2017068	10
2017019	11
2017065	12
2017014	13
2017066	14
2017010	15
2014023	16
2016062	17
2017002	18
2015006	19
2016064	20

2019 YC

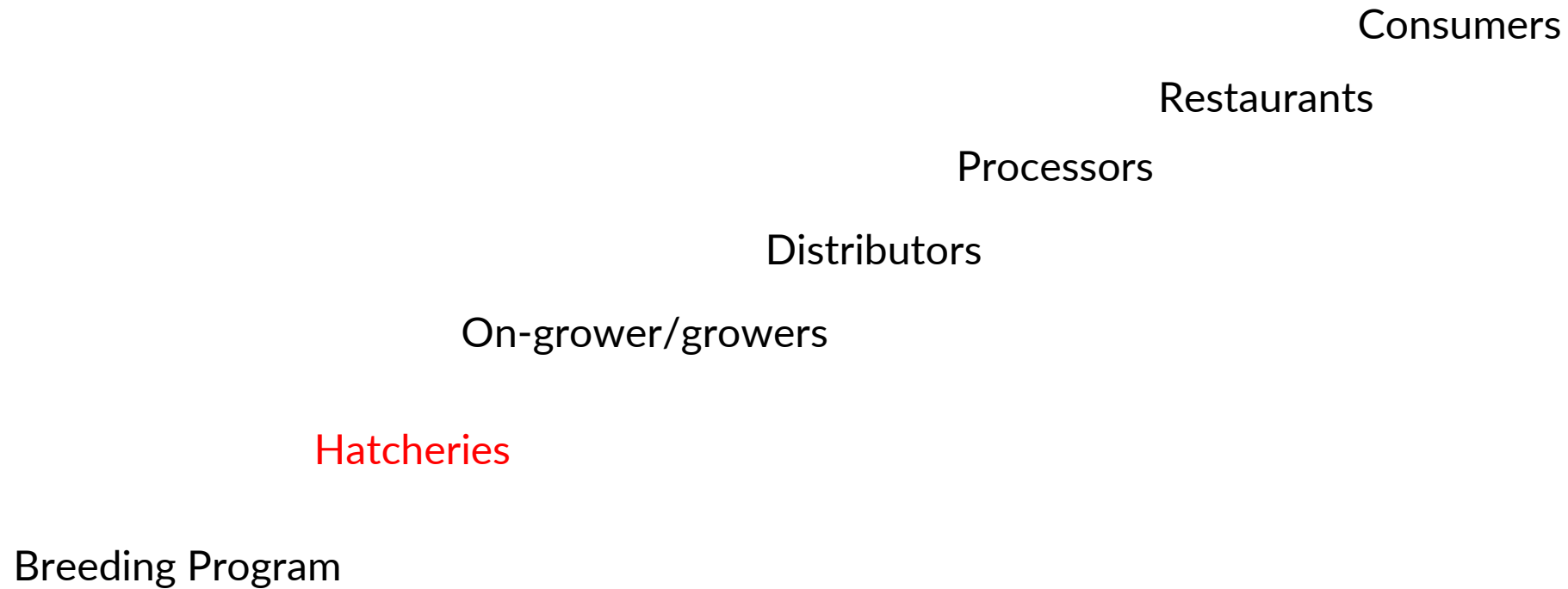
FAM_ID	RANK
2019011	1
2019013	2
2019024	3
2019021	4
2017031	5
2019026	6
2019012	7
2019038	8
2019058	9
2018029	10
2017067	11
2018043	12
2019015	13
2019043	14
2019036	15
2015025	16
2018047	17
2015008	18
2017001	19
2018007	20

Other works in the field

- FRDC funded QX window in Port Stephens
- Moving Key Broodstock to known QX hotspots in Port Stephens
- Commercial proof-of-concept for QX survival
 - Four estuaries
 - Elite commercial family deployed with a control
 - Evaluated over two seasons of QX exposure

VALUE-CHAIN MAP (SRO Breeding Program)

What impact will you have ?



CANVAS WALKTHROUGH: SRO Breeding Program

1. Problem

- Economic production
- Oyster survival
- Timely Supply
- Reliable Supply
- Inefficient Processes

4. Solution

Education/demonstration

MVP

Deploy existing selected lines to industry
Assess value proposition

Metrics

Output KPIs
Improved Survival
Improved growth/condition ++
Customer Industry feedback

3. Unique Value Proposition

- No other identified solution to the problem
 - oysters dying from disease
 - limproving characteristics, growth/condition/robust/shell shape etc.
 - Insurance to future challenges
- IP/processes – services to other industries?

Unfair Advantage

- Existing Program, multiple generations
- Experienced and knowledgeable team
- Passionate supporters
- Government supported

2. Customers

- Hatcheries
- Oyster growers
- Government
- Universities & research providers
- Other?

Early Adopters

- Business minded
- Technology up-takers
- Measures (Outcome focused)
- Have an immediate problem to solve

5. Channels

- Face to Face
- Pilot reports
- Industry groups
- Workshops
- News – updates/social media

Costs

OPEX - \$500k pa TBC?

Revenue

- License/service fee on units delivered?
- Other?

YOUR PIXAR PITCH (SRO Breeding Program)

Once upon a time... #Oysters Died & took a very long time to reach market

One day... #Breeding kept oysters alive and they grew faster

Because of that ... #Confidence, Growth, Profitability returned

Because of this... #Industry became sustainable, profitable and innovative

Until finally... #Consumers can get fantastic oysters all year



SRO Sustainable Breeding Program Reference Group

Rob Redmayne	Brad Verdich
Ian Duthie	James Brown
Andrew Williamson	Brandon Armstrong (NSW Shellfish Committee)
Henry Hewish	Ian Crisp
Kim Weston	Shane Buckley (NSW Shellfish Committee)
Todd Graham (NSW Oyster Committee)	Emma Wilkie
Mike Dove	Ian Lyall and Wayne O'Connor (co-chairs)

