Industry Report

A Survey of the Effects of Pacific Oyster Mortality Syndrome (POMS) on Pacific Oyster Farms in Tasmania, 2016 – 2017

Report prepared by Sarah Ugalde and Christine Crawford, Institute for Marine and Antarctic Studies

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This study aimed to improve knowledge of the effects of Pacific Oyster Mortality Syndrome (POMS) on oyster farms in south-east Tasmania by recording the views, data and observations of farmers during the summer season 2016/17. The survey information will contribute to the evolution of farm management and husbandry techniques to reduce the impact of POMS, and identify the industry's research priorities and information gaps.

Human ethics approval was attained through a Minimal Risk Application to the Tasmanian Social Sciences Human Research Ethics Committee, University of Tasmania (ethics reference number: H0016495). Participation was voluntary and confidential, and the survey conducted for each lease was issued a unique identifier code to comply with ethical requirements.

Survey data were collected for each lease by conducting structured, face-to-face interviews with oyster farmers from bays infected with POMS (Pitt Water, Pipeclay Lagoon, Blackman Bay, and Little Swanport). Data can be interrogated on two levels; lease-level and company-level. Lease-level data looks at differences between all leases, whereas company-level data looks at differences between all companies regardless of how many leases are managed by those companies.

This survey is planned to be repeated next Tasmanian POMS season, and questions will undergo a review process before the next survey. Following is (1) the survey information sheet, (2) survey questions and results, and (3) consent form. The information sheet and consent form were provided to survey participants prior to beginning the survey.

1. Information Sheet for Survey Participants

A Survey of the Effects of Pacific Oyster Mortality Syndrome (POMS) on Pacific Oyster Farms in Tasmania, 2016 – 2017

1. Background

Pacific Oyster Mortality Syndrome (POMS) was identified in oysters in southeastern Tasmania in January 2016. This disease, which is caused by the OsHV-1 virus, resulted in major mortalities of oysters. Subsequently research into POMS became a major component of the CRC-P Future Oysters, and IMAS was funded to undertake the project "Advanced understanding of POMS to guide farm management decisions in Tasmania". The Tasmanian Government also provided funds to support the Tasmanian oyster industry, including salaries for 12 months for Biosecurity and POMS Liaison Officers. The POMS survey is part of the CRC-P project and is a collaborative initiative between the Institute for Marine and Antarctic Studies (IMAS) and Department of Primary Industries, Park, Water, and Environment (DPIPWE).

The people undertaking this project are: Dr Christine Crawford (Senior Research Fellow, IMAS and Principal Investigator in the CRC-P), Dr. Sarah Ugalde (Junior Research Fellow, IMAS), Dr Emily Ogier (social science research fellow, IMAS), John Preston (Coordinator Oyster Biosecurity, DPIPWE), and Ellis Cox (POMS liaison officer, DPIPWE).

2. What is the purpose of the POMS Survey Project?

The aims of this project are as follows:

- To increase our knowledge of the POMS virus and oyster mortalities from observations and records generated by Pacific oyster growers during the POMS outbreak season 2016 – 2017.
- Provide this information to industry, looking for trends across farmers/growing areas, to inform farm management practices.
- Report results to industry through a workshop, tentative date June 14th, and industry report.

3. Why have I been invited to participate?

You are invited to participate in this survey because you are a farm manager, or equivalent, in an area that has been impacted to some extent by POMS. Your involvement is voluntary and you can stop at any time without consequences. By participating in the POMS Survey Project, you have the opportunity to:

- Tell us what you observed and think is important about POMS.
- Help us to get a better understanding of the effects of the virus across all impacted farms.
- Provide information to industry, government and researchers to underpin improved farm management practices and identify priority research areas next POMS season.

4. What will I be asked to do?

You will be asked to complete a survey of 35 questions per lease in a face-to-face meeting with John Preston and/or Sarah Ugalde at your or your business associate's depot, any one of your leases, or administrative building, or at a Bay Group meeting. The survey has five sections: background, POMS mortality, environment, genetics and husbandry information. There are two types of questions; open-ended questions seeking your ideas, observations, and comments, and closed-ended questions where you tick a box to tell us what you think. The survey takes approximately one hour to complete per lease.

5. *Are there any possible benefits from participation in this study?*

Yes – this is an opportunity to collect a lot information from many different leases that were impacted by POMS. The data will be analyzed to help us work out the key factors influencing mortalities and outbreak patterns. This will help you make decisions next POMS season. All this information will be made available to industry, but ensuring participant's confidentiality is maintained at all times.

6. *Are there any possible risks from participation in this study?*

There are no foreseeable risks arising from your participation in the study. If you change your mind about participating during the study, you are free to withdraw anytime up to 3 months after survey completion, and can do so without providing an explanation. If you choose to withdraw, all the data you provided will immediately be destroyed, and not included in the study. Beyond the 3 months, data will have already been aggregated and analysed.

7. *What about my confidentiality?*

We will combine the data from at least five leases so that individual lease information cannot be identified. We aim to present information at two scales: combined and individually for the four oyster growing areas impacted by POMS.

8. *What will happen to the information when this study is over?*

The raw data will firstly be input into an Excel spreadsheet and kept on an IMAS computer and a Biosecurity Tasmania computer that are encrypted with a password. These data will be analysed with statistical software, and results will be made available to DPIPWE and industry. After a maximum of 5 years (that is, in 2022), the paper surveys will be shredded. Electronic data will be destroyed using a permanent erasing software after a maximum of 10 years (2027).

9. *How will the results of the study be published?*

The results of the survey and other relevant research will be discussed with industry at a POMS workshop in June 2017, hosted by IMAS and DPIPWE. A report outlining the results of the survey for the POMS season 2016/17 will also be made available to the oyster industry.

A scientific paper may also be developed led by IMAS, although the workshop and industry report have priority.

10. *What if I have questions about this study?*

If you have any questions or comments, please contact one of the following people:

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This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee (HERC). If you have concerns or complaints about the conduct of this study, please contact the Executive Officer of the HREC (Tasmania) Network on +61 3 6226 6254 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number H0016495

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2. Survey Questions and Results

A Survey of the Effects of Pacific Oyster Mortality Syndrome (POMS) on Pacific Oyster Farms in Tasmania, 2016 – 2017

Section 1: Background Information

Question 1: How many hectares is your lease?

Question 2: How many developed hectares?

Question 3: Which farming methods do you use on this lease?

A total of 30 leases from 21 commercial companies participated in the survey (95% of eligible companies volunteered to respond). Details of participating bays are given below.

					Number of leases using each farming method		
Bay	**Number of companies**	**Number of leases**	**Average area of lease (ha)**	**Average area of developed lease (ha)**	**Intertidal racks**	**SEPA-type baskets**	**Subtidal**
Pipeclay Lagoon	5	10	4.60	4.45	10	7	0
Little Swanport	3	5	11.96	8.16	3	5	0
Blackman Bay	7	8	15.68	7.34	2	5	2
Pitt Water	6	7	13.43	12.68	5	7	0

Question 4: As of November 1 2016, how much stock do you have on this lease of each type and size class?

The number of oysters across all leases from four size classes are given below. These were a combination of genetically selected (i.e. ASI family lines), pre-exposed (i.e. oysters previously exposed to POMS) and naïve stock (i.e. oysters not previously exposed to POMS). We have not provided this additional detail because of low confidence in the data due to some response inconsistencies.

	Small spat under 4mm	**Large spat 4 to 10mm**	**Juveniles 11 to 50mm**	**Markets over 50mm**
Diploids	20,100,000 [1675000 doz]	8,321,000 [693417 doz]	31,179,000 [2598250 doz]	16,359,500 [1363292 doz]
Triploids	0	1,275,996 [106333 doz]	2,249,500 [187458 doz]	956,000 [79667 doz]

Question 5: How do you keep records of your oyster farm operation, e.g. oyster type, size/age, density, location on lease, handling and growth and survival?

Question 6: How often do you update these records?

Records of oyster farm operations were updated daily for 87% of leases, compared with 30% and 3% updating weekly or 'other' (e.g. only when farm is managed), respectively. These records were mostly managed through detailed white board notes (80% of leases), notebooks (50% of leases), or specific oyster management software (30% of leases). The remainder of companies keep limited written records or used excel spreadsheets. 67% of leases used a combination of more than one recording-keeping method.

Question 7: How do you rate the viability of your oyster operation after this second summer of POMS?

75% of companies rate their business operation as strongly viable, compared with 20% and 5% rating average and uncertain viability, respectively.

Section 2: POMS Mortality Information

Question 8: What average mortality have you experienced over summer when POMS was not present in Tasmania?

Question 9: What average mortality have you experienced over summer when POMS was present in Tasmania?

Shown below are average mortality percentages and [range] of estimated mortalities between seasons. Oyster mortality in 2016/17 season was lower than 2015/16 season across all size classes, but still much higher than pre-POMS season mortalities.

Oyster size class	Pre-POMS	2015/16 summer	2016/17 summer
Small spat (less than 4 mm)	7% [0 – 20%]	58% [0 – 95%]	46% [10 – 82%]
Large spat (4 – 10 mm)	5% [0.5 – 20%]	85% [50 – 99%]	44% [5 – 89%]
Juvenile (10 – 50 mm)	3% [0 – 10%]	59% [0 – 90%]	26% [0 – 90%]
Market (more than 50 mm)	1% [0.25 – 5%]	36% [0 – 70%]	11% [0 – 50%]

Question 10: What differences in mortalities have you experienced on this lease in relation to selective breeding?

Genetic mortality and [range] for naïve unchallenged stock was higher than for naïve pre-exposed oysters for all size classes of spat, juvenile, and market. Similarly, mortality of genetically-selected (estimated breeding value about 40%) unchallenged stock was higher than pre-exposed oysters for all oyster size classes. Spat with an 80% estimated breeding value (no larger fish available) had an average mortality of 40% across 5 leases. Mortalities marked with ** are from 3 or less leases, and have a lower confidence.

Genetics and Exposure	Spat (0 – 10 mm)	Juvenile (10 – 50 mm)	Market (> 50 mm)
Naïve, unchallenged	75% [46 – 85%]	28% [0 – 75%]	33% [6 – 90%]
Naïve, pre-exposed	50% [one lease] **	21% [0 – 60%]	10% [0 – 20%]
~ 40 % EBV, unchallenged	63% [50 – 79%] **	28% [0 – 60%] **	16% [2 – 30%] **
~ 40 % EBV, pre-exposed	34% [30 – 40%]	13% [5 – 30%]	2% [2 – 3%] **
~ 80 % EBV, unchallenged	40% [10 – 82%]		

Question 11: Have you experienced several POMS events this summer?

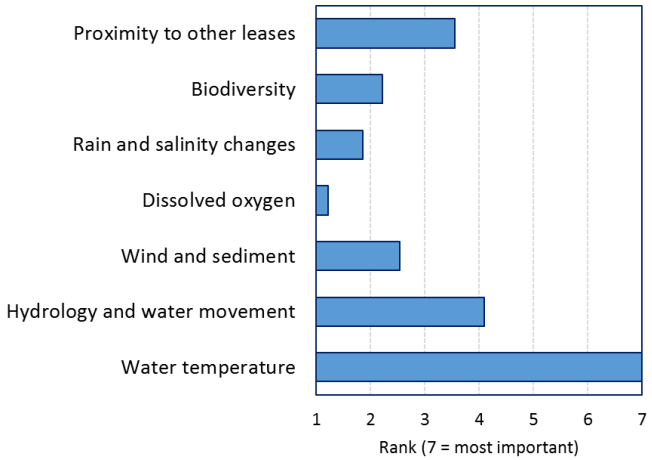
Question 12: If yes, details of when and overall mortality percentage on each occasion.

61% of leases exhibited more than one POMS event, compared with 18% exhibiting just one event. The remainder were unsure. Within bays, 40% of Pipeclay Lagoon leases exhibited more than one event, and at Blackman Bay half the leases had more than one POMS event and the other half were unsure. One POMS event was recorded on 86% of leases at Pitt Water, and 80% of leases at Little Swanport. Only 42% of survey respondents could give estimates of overall mortality on each POMS event, with the remainder either unsure/not checked between events (37% of leases) or mortalities not able to be estimated (e.g. minimal mortalities, lease de-stocked, 21% of leases). Of those survey respondents providing mortality estimates between POMS events, 73% of leases had higher mortalities in the first event when compared with the following event(s).

Section 3: Environmental Information

Question 13: In general, which of these environmental factors do you think are most important for reducing mortalities on this lease? Please rank from 1-6, where 1 is the most important and 6 is the least important (or 7, if included an 'Other' factor). Note: not in relation to your lease, but overall husbandry factors.

Companies ranked environmental factors as shown in the figure below. Almost all respondents ranked water temperature as the most important factor in reducing mortalities, followed by hydrology/water movement and proximity to other leases.



Question 14: How do you keep an eye on your water temperature?

Water temperature is monitored by 91% of companies using live-streaming fixed sensors (deployed by the Yield), and 52% use their own sensors/thermometers. 43% of companies use a combination of both types of temperature sensing equipment.

Question 15: What temperature regimes do you consider to be required for a POMS outbreak?

Question 16: Do you think temperature spikes or troughs are a contributing factor in triggering POMS outbreaks?

60% of companies think the average water temperature needed to trigger an outbreak is 18-20ºC, compared with 10%, 25%, and 5% of companies for less than 18ºC, 20-22ºC, and more than 22ºC, respectively. These average temperatures were mostly thought to be maintained for 4–5 days (25% of companies), 7 days (30% of companies), or 2 weeks (25% of companies) to trigger an outbreak. Others thought less than 4 days and more than 2 weeks (each 10% of companies) was needed. 69% of companies thought water temperature spikes (maximum temperatures) and troughs (minimum temperatures) play an important role in triggering or deactivating outbreaks, and of these, 56% considered troughs more important than spikes.

***Question 17:* If you experienced several POMS events, did the temperature regimes differ between POMS events?**

Of the leases that experienced more than one POMS event, 50% of companies noted there was an observable difference in temperature regimes leading up the event (e.g. a steady increase in average temperature for the first event, compared with high temperature spikes and troughs for the second event).

Question 18: Did POMS affect some parts of your lease more than other parts?

Question 19: Did you observe any evidence for water movements being involved in the transfer or severity of POMS disease?

On 38% of leases, POMS affected some parts of the lease more than others parts, compared with 48% of leases having no observable differences. Differences were not generally attributed to water movement, with 72% of leaseholders having no evidence that water movement was involved in the transfer or severity of disease. However, some leaseholders suggested that either high or low flow was associated with disease.

Question 20: What is the distance to the nearest stocked neighbouring lease?

Details on nearest stocked neighbouring lease was only collected for 57% of survey respondents (range: 2 to 1000m) due to the question being added part way through completion.

Question 21: Are there large populations of feral oysters anywhere near you lease?

Question 22: If yes, were these feral oysters affected by POMS?

Half of the leases had nearby large populations of feral oysters (50% of leases), and of these leases with nearby large populations, 53% were affected by POMS mortalities (7% were not affected).

Section 4: Genetic Information

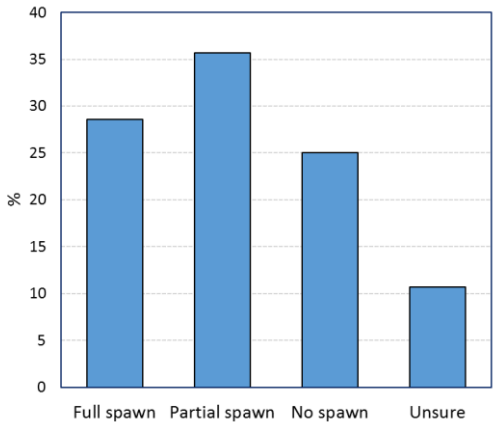
Question 23: What was the difference in mortalities between triploids and diploids?

Question 24: If you have triploids and diploids, were there differences between them (e.g. size, age, where on the lease)?

5 leases from 3 locations stocked diploids and triploids with no differences between them (e.g. oyster size, age, location on lease). Of these leases, all triploids (average mortality: 80%) had higher mortalities compared with diploids (average mortality: 43%).

Question 25: Did the oysters on your lease spawn this summer?

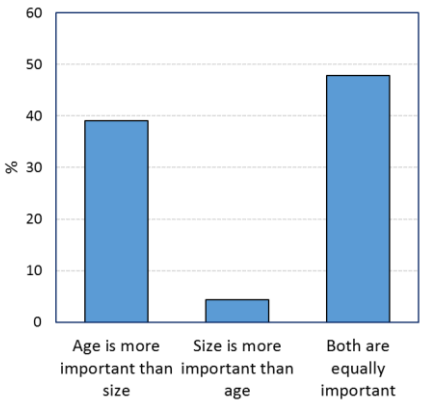
A full spawning was observed on 29% of leases, and a partial spawn on 35% of leases. 25% of leases had no spawning, and 11% of leases were unsure if a spawning had occurred. A few farmers noted a connection between spawning and mortalities.

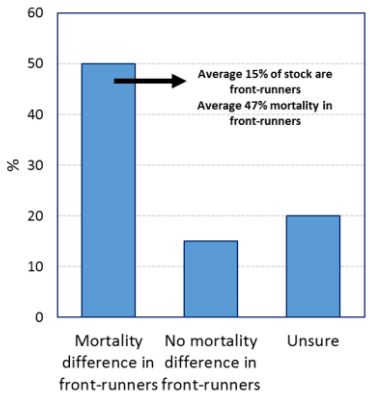


Question 26: Do you believe oyster size or age from spawning is more important in surviving a POMS outbreak?

Question 27: Have you noticed any difference in mortality in front-runners in your stock?

48% of companies thought oyster age and size were equally important, whereas 39% thought that age was more important than size in surviving POMS. One reason for this could be that front-runners had a higher mortality than the rest of the stock in 50% of leases. From the leases with higher mortalities in front-runners, 15% of the total amount of stock was categorised as 'front-runners', and these had estimated 47% average mortality.

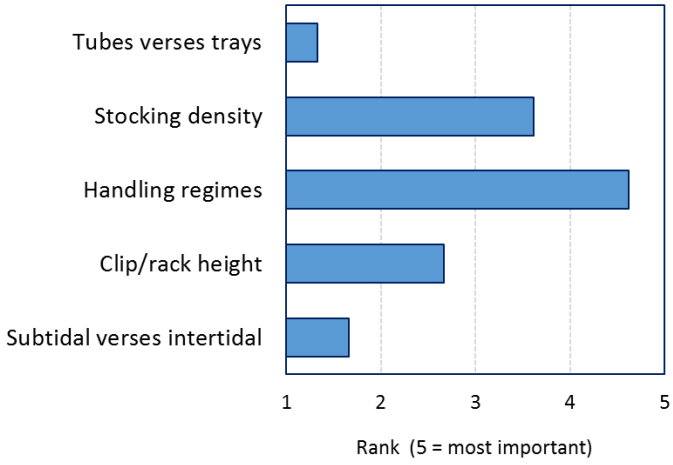




Section 5: Husbandry Information

Question 28: In general, which of these husbandry factors do you think are most important for mortalities? Please rank from 1-6, where 1 is the most important and 6 is the least important (or 7, if included an 'Other' factor). Note: not in relation to your lease, but overall husbandry factors.

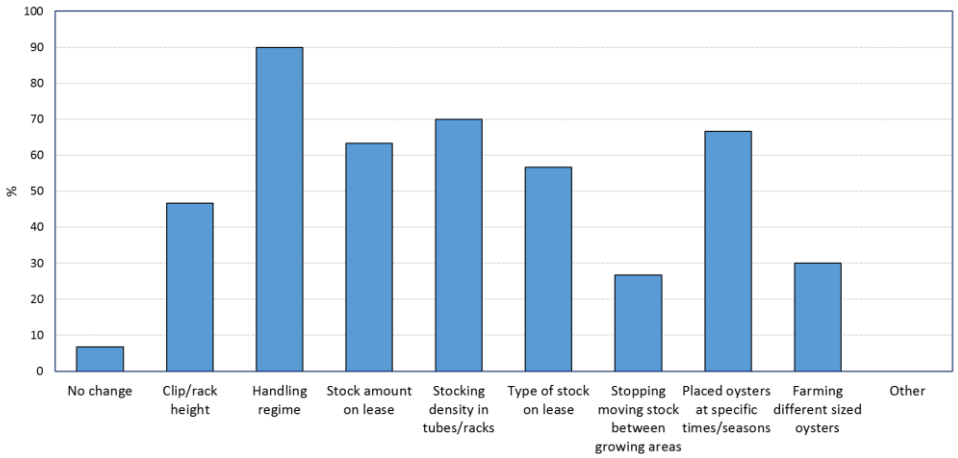
Companies ranked husbandry factors as shown in the figure below. Handling regimes and stocking densities are the most important husbandry factors.



Question 29: How did you vary your farm management in response to POMS?

Question 30: Are you likely to use the same farm management strategy next POMS season?

7% of leaseholders did not change their management in response to POMS. 90% of leaseholders modified handling regimes on their leases, followed by 70% and 66% of leaseholders who modified stocking density and placed oysters at specific times/seasons (i.e. window farming), respectively. 17% of leaseholders will use the same management strategy next season, compared with 80% that will make a few changes to their management strategy (the remainder of leaseholders are unsure).



Question 31: Did you handle oysters 1-2 weeks prior to observed mortalities?

Question 32: Once POMS mortalities had been observed in your growing area, did you stop handling?

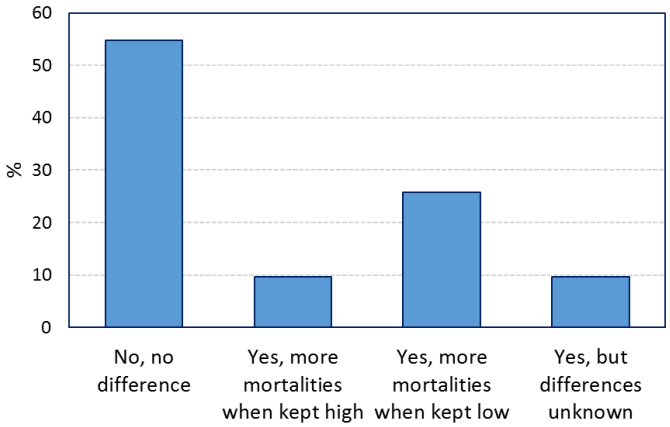
65% of leaseholders handled stock 1-2 weeks prior to observed mortalities. Of the selected farmers who handled stock 1-2 weeks prior, 27% continued to handle them after mortalities were observed.

Question 33: What percentage of market-sized oysters did you notice were gaping?

Gaping market-sized oysters were noticed on 50% of leases, with an average of 13% of the stock gaping (range: 0.5 to 60%). The remainder either were not looking for gaping oyster (27% of leases) or had already destocked their lease/had no market sized oysters (23% of leases).

Question 34: Did you observe any differences in mortalities between the same stock at different heights in the water column?

55% of leases had no difference in mortality in relation to rack or clip height. 26% of leases showed higher mortality when kept low in the water column, compared with 10% of leases when kept high.



Question 35: Did you observe higher mortalities in the same stock when they were held at different stocking densities?

Question 36: Has your stocking density changed because of POMS?

Stocking densities mostly had little observable effect on mortalities with 61% of leases having no difference in mortalities when held at different stocking densities (6% had higher mortalities when stocking densities were greater than normal). However, it appears that there may have been some confusion by respondents over stocking density in baskets/tubes with stocking density across the lease, and the results for this question, therefore has a lower confidence level.

Where applicable, 84% of leases had different stocking densities because of POMS, with an average reduction of 35% compared with years prior to POMS.

37. Finally, can you identify any areas of research that you believe would be beneficial to your operation in the future (not compulsion to answer)?

Companies identified areas of research that would be beneficial to future operations are given below. Only data relating to farm management has been supplied, which excluded research areas of harmful algal blooms/biotoxins and genetic breeding. Continuous data collection and predictive modelling was the highest priority for industry, following by virus dynamics and oyster physiology.

Research Area	Response (%)
Continuous data collection and predictive modelling	21
Virus dynamics and oyster physiology (including spat exposure)	17
No comment / unsure	14
Temperature moderation and manipulation	14
Handling regimes	7
Infrastructure (including sub-tidal farming)	7
Overcatch and feral oysters	7
Stocking densities	3
Bay-specific differences	3
Oyster size in relation to disease susceptibility	3
Hydrology and water movement	3

Thankyou to all those who participated in the POMS survey. Your information will go towards better understanding POMS in Tasmania. For more information, please contact John Preston, Christine Crawford, or Sarah Ugalde (contact details available on the information sheet).

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3. Consent Form

A Survey of the Effects of Pacific Oyster Mortality Syndrome (POMS) on Pacific Oyster Farms in Tasmania, 2016 – 2017

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1. I agree to take part in the research project named above.
2. I have read and understood the Information Sheet for this project.
3. The nature of the project has been explained to me.
4. I understand that the project involves completion of a survey of approx. one hour duration.
5. I understand that participation involves no foreseeable risks.
6. I understand that all research data will be securely stored on a computer at the Institute for Marine & Antarctic Studies, University of Tasmania and at Biosecurity Tasmania. Raw data will be destroyed after five years for paper surveys, and 10 years for electronic data, by being shredded or permanently deleted with erasing software.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researchers will maintain confidentiality and that any information I supply to the researchers will be used only for the purposes of the research.
9. I understand that the results of the project will be discussed and published so that I cannot be identified as a participant.
10. I understand that I can withdraw at any time during the interview, and for a period of 3 months after its completion, and all associated data will be destroyed. Beyond this date, data will have been analysed and aggregated.

Statement made by Participant:

Participant's name: _____

Participant's signature: _____ Date: _____

Statement made by Investigator:

□ I have explained the project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

The participant has received information about the survey where my details have been provided so I can be contacted prior to consenting to participate in this project.

Participant's name:_____

Investigator's signature:_____ Date: _____