Determining survival times of blue swimmer crab using conventional live packing techniques

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SEAFOOD SERVICES AUSTRALIA

Seafood DIRECTIONS

Project No. 2003/409

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OBJECTIVES:

1. Determine survival rates of blue swimmer crabs using traditional live packing techniques

Non Technical Summary

OUTCOMES ACHIEVED

Using a relatively simple tank system and basic onboard handling techniques blue swimmer crabs were able to be packed and held alive using dry packing techniques with low mortalities for 12 hours. This time is sufficient to allow transport to live domestic markets and potentially close export markets. (Singapore Taiwan).
Re-tanking packed product gave very high survival rates (up to 85%), which would allow receivers to re-tank product and hold live for sale.
Product that perished during transport can be cooked immediately with no apparent loss of quality i.e. no mushy meat occurred on cooking.

This project is a preliminary investigation into the potential for live shipping of blue swimmer crabs by traditional dry packing methods. The project adopted the findings of the WA project 'how to stop a blue crab feeling blue' for the onboard handling procedures then investigated different methods of dry packing the live crabs to determine the best packing method and the survival rate at different times post packing.

All trials were conducted using 36 litre polystyrene cartons, each layer of crabs were separated by a moist 5mm piece of foam. Coolant gels were used to maintain a cool temperature within the polystyrene cartons, these were separated from the crabs by a layer of woodwool and a 6mm C flute corrugated board.

Best results were obtained by:

- ❑ Purging crabs for a minimum of 2 days
- ❑ Thermal shocking at 5°C below holding temperature for 1 to 2 minutes
- ❑ Packing crabs head up
- ❑ Using 1Kg coolant gel packed on the bottom of the polystyrene carton
- ❑ Pumping oxygen into the polystyrene carton after packing

Survival rates of Blue Swimmer crabs using the above method are detailed in the table below. The original objective was to test against 12, 24 and 36 hours but due to very low survival rates at the longer periods, times were reduced to test against 12 and 18 hours.

	12 hours O_2 Injected		**18 hours O_2 Injected**	
	No.	**%**	**No.**	**%**
Live	61	83.5	53	66.2
Dead	12	16.5	27	33.8
Total	73	100	80	100.0

Most of the crabs that survived the pack outs appeared comatose and very weak when re-tanked but demonstrated surprisingly strong rejuvenation ability and high re-tanking survival. (Up to 85%)

Acknowledgements

- The Seafood Services Australia Seafood Industry Development Fund – For project funding
- Urangan Fisheries (Processor) – For contribution to project funding, supply of product, Use of facilities and personnel.
- Steven Willmont (Fishermen QLD) – For the capture of live product for trials
- Brett Fouchs (Fishermen QLD) - For the capture of live product for trials
- Ken Styles (Fishermen WA) – For information on live holding and transportation of product
- Richard Stevens – For assistance in experimental design of project.

Activities

Trial 1
An initial trial was conducted to compare 3 methods of packing (Claws up, claws down and flat) using 1Kg and 1.5Kg frozen coolant gels added to maintain chilled temperature. Survival rates were determined over a 24-hour period. See table 1.

Table 1 – Trial 1 comparison of coolant gel and packing style

Gel size	Style	Number packed	Survival	Percent Survival
1Kg	Flat	50	2	4%
1Kg	Head Up	53	5	9.4
1Kg	Head Down	54	1	1.8%
1.5Kg	Flat	42	0	0.0%
1.5Kg	Head up	51	0	0.0%
1.5Kg	Head Down	48	0	0.0%

The survival of crabs using 1.5Kg coolant gels at 24 hours was nil, survival rates using the 1Kg coolant gel was poor (approximately 10%). It is suspected that the initial thermal shock @ 6°C for 15 to 20 seconds and the holding temperatures were too low causing the high mortalities. In addition holding for 24 hours may have been too ambitious.

No significant difference were observed using the different packing methods. In this trial, although head up had the best survival rate.

Observations made when moving product from the fishing vessel to the live holding tanks showed the crabs became very docile with a 5 to 6°C temperature drop. Based on this information a second trial was conducted with thermal shocking for 2 minutes at 5°C less then the holding tank temperature I.e. tank temperature was at 22°C to thermal shocking at 17°C.

Trial 2
A modified version of trial 1 was conducted to compare 2 methods of packing (Claws up, claws down) using 750g and 1Kg frozen coolant gel packed on bottom. Survival rates were determined over a 10-hour period. Live product was re-tanked to determine survival rates over 48 hours. See table 2.

Table 2 - Trial 2 (retrial) comparison of coolant gel size and packing style

Gel Size	750g		1Kg	
Packing Direction	**Head up**	**Head Down**	**Head Up**	**Head Down**
Alive	38	34	40	36
Dead	2	6	40	40
Percentage survival	95.0%	85.0%	100.0%	90.0%
Re-tanking 48 hours survival	26	25	34	22
Percentage survival of re-tanked crabs	68.4%	73.5%	85.0%	61.1%
Percentage survival of total crabs packed	65.0%	62.5%	85.0%	55.0%

Good survival rates were achieved at 10 hours using both packing methods and coolant gel sizes. Head up had the best overall survival rate, as did the packs containing 1Kg of coolant gel. Survival rates of re-tanked crabs after 48 hours was surprising high. The holding temperatures within the polystyrene cartons when using 750g and 1Kg coolant gels remained between 20°C to 23°C and 18°C to 21°C respectfully. The temperature of the Coolant gels placed into the polystyrene cartons were between –14 and –16°C.

Trial 3

Trial 3 looked at crabs packed with coolant gel on the top compared to crabs packed with coolant gel on bottom.
Crabs were packed using 1Kg coolant gels, heads up.
Product was inspected after 10 hours.

Table 3 – Trial 3 comparison of gel positioning

1Kg gel	Top	Bottom
Dead	**33**	**39**
Live	**7**	**1**
Percentage survival	**82.5%**	**97.5%**

Results indicate that better survival rates were obtained with gels placed on the bottom of the polystyrene carton and crabs packed above.
Higher mortalities were also observed in the top row of crabs where the coolant gel was packed on top.

Trial 4

Crabs were purged for 2 ½ days then packed heads up with 1kg of coolant gel on the bottom of the polystyrene carton. One half of the polystyrene carton were injected with oxygen. The trial was conducted over 12 and 18 hours. Due to poor results in initial trials, survival rates were not extended beyond 18 hours.

Table 4 - trial 4 comparison of oxygen injection

	12 hours O_2 Injected	12 hours No O_2	18 hours O_2 Injected	18 hours No O_2
Live	61	60	53	25
Dead	12	24	27	41
Percentage Survival	83.5%	71.5%	66.2%	40.9%
Re-tanking survival	59	56	44	19
Percentage survival of re-tanked crabs	96.7%	93.3%	83.0%	76.0%
% survival of total crabs packed	80.8%	66.6%	55.0%	28.7%

Results indicate that higher survival rates were achieved when oxygen was injected into the packs. Again the percentage survival of re-tanked product was high.

Benefits

With the large catches in blue swimmer crabs between February and May and again between September and November considerable price fluctuations occur due to an oversupply on the domestic cooked and raw markets. It is estimated that prices for live product into Australian markets would fit between mud crab and spanner crab prices returning between $15 and $19Kg. If live markets can be established and product shipped it should result in maintaining a strong return to the processors and fishers.

Additionally these results indicate that there is a potential for live shipments to Asia that would again assist in stabilising returns to fishers and processors.

Recommendations

This project was a preliminary look at survival rates and showed some promising results. More extensive work should include

- ❑ developing better onboard handling techniques,
- ❑ the use of better live holding systems including temperature control systems and
- ❑ the fine tuning of product selection during packing

Improvements in these techniques should improve / increase the survival rates and times achievable.

The biggest hurdle to overcome will be in determining which crabs will survive shipment and which are likely to perish. This will only be achieved with time and persistence on behalf of the processor. This researcher believes that there is a strong potential for live product throughout Australia and further a field (for export to Asia) but success will rely on industry persistence and need.

Conclusion

Survival rates of Blue Swimmer crabs were best achieved using the following methods

- Crabs were tied immediately after capture using methods outlined by Stevens and Squires, How to stop a blue crab feeling blue.
- Crabs should be purged for a minimum of 2 days allowing the weak / stressed crabs to acclimatise or perish. This will help in eliminating weak crabs during packing as they are difficult determine particularly after thermal shocking where crabs are semicomotosed.
- Thermal shocking was best achieved at 5°C below holding temperature for 1 to 2 minutes. Shocking at colder temperatures did not benefit packing and may have attributing to some of the mortalities in the initial trials.
- Packing crabs head up. It has been suggested that this method allows crabs to maintain water around their gills, which they foam to allow better oxygen transfer. Evidence of foaming was observed in many cases.
- Using 1Kg coolant gel packed on the base. High mortalities were experienced when packing crabs with more then 1Kg of coolant gel additionally gels resting on the heads of crabs appeared to cause greater mortalities either through restricting foaming or through cold shock to the head region.
- Pumping oxygen into the polystyrene carton after packing appeared to increase the survival rate of the crabs. This technique has been used in packing live spanner crabs in the past and is believed to assist with oxygen transfer during foaming. The results suggest this is highly possible.

The original objective of this project was to test survival rates against 12, 24 and 36 hours but due to very low survival rates in the initial trials at the longer periods; survival times were reduced to 12 and 18 hours. Survival times achieved appear to eliminate live export shipments to USA / EU member countries but certainly make live shipment throughout the Australian domestic market viable and potentially close export markets such as Singapore, Taiwan and New Zealand.

References

Stevens R.N., Squires V.R. (1999) How to stop a blue crab feeling blue FRDC Project, Australia

Staff

Craig Winkel – Seafood Directions P/L
Keith Parker – Urangan Fisheries P/L
Nigil Devitt - Urangan Fisheries P/L
Brett Fouchs - Fishermen
Steve Willmont – Fishermen

Attachment 1 - Original contract

Objectives

Helpful hint: Project objectives should state succinctly in one sentence "what" is to be achieved rather than "why" or "how" it is to be achieved.

1. Determining survival rates of blue swimmer crabs using traditional live packing techniques

Background and Industry Consultation (200 words)

Helpful hint: Provide a brief background to this application including the process through which it was developed, the consultation with industry and other interested parties that took place before submission to SSA, the level of support from the beneficiaries identified in section 10 and from stakeholder groups throughout the seafood supply chain that will directly benefit from this project (e.g., commercial fishers, seafood processing, retail, customer, etc.).

With the large catches in blue swimmer crabs between February and May and again between September and November considerable price fluctuations are seen, prices drop to as low as $5.00Kg (QLD stock) during the peak of the season. It is estimated that prices for live product in Asia would fit between mud crab and spanner crab returning between $15 and $19Kg. The largest Asian market for live blue swimmer crabs is in Fukuoka (Japan) European markets are expected to be much higher if achievable.

This project is a preliminary investigation into the potential for live shipping of blue swimmer crabs by traditional dry packing methods. The project will adopt the findings of the WA project 'how to stop a blue crab feeling blue' for the onboard handling procedures then investigate different methods of dry packing the live crabs to determine the best packing method and the survival rate / survival time post packing. Our investigations have shown live sand crabs are received dry packed at the Fukuoka markets (Japan).

This project was proposed by industry (Urangan Fisheries) and contribution commitments (cash, product & operational) given. Further consultation with several live crustacean processors and QSMA representatives was undertaken to gauge interest and knowledge. Industry interest by QLD processors and fishers is high. Discussions have also given a starting point for the project as crabs have been successfully potted and held live in tanks for several weeks. (Survival rates in holding tanks appear much higher then spanner crabs).

Need and Industry Development Priorities (100 words)

Helpful hint: Succinctly define the need for the project. In particular identify the priorities specified in relevant industry development plans that the proposal addresses. Industry R&D plans may be found at http://seafoodservices.com.au/sidf/plans and http://www.frdc.com.au/research/strategy/index.htm.

Need

Due to new and proposed fisheries and other management regulations the Queensland seafood industry (both fishers and processors) is in economic turmoil. Without optimising income from our dwindling allocation of resources it is unlikely that many in the industry will survive. This project if successful will open the way for the development of a new value added product that will see greater returns to both fishers and processors. Without value adding our harvest and achieving higher returns this industry will not be able to sustain the present number of fishers and processors.

Priorities

This project address QFIRAC'S strategic goal –'Fisheries resources are utilised to their maximum value' using their strategy of 'optimising supply to markets and market development'. It also addresses the WA FRAB Strategic goal 'increased economic benefits to the community from fish and other living aquatic' resources.

Methods (200 words)

Helpful hint: Summarise the technical, scientific, and/or other methods or protocol to be used.

1. Urangan fisheries will supply and fit a live holding tank onto one of their crab vessels
2. Urangan fisheries and Seafood Direction will construct a small live holding tank for the crabs
3. Crabs will be potted and cold shocked to allow the claws to be tied using the nipper gripper developed in WA project
4. Crabs will be swam for a minimum of 24 hours to allow purging
5. Prior to packing crabs will be inspected for condition and only strong crabs will be packed.
6. Crabs will be cold shocked to reduce metabolic rate
7. Crabs will be packed to10Kg in 36litre polystyrene eskies, initial trial will compare 3 methods of packing (Claws up, claws down and flat) with a 1Kg frozen gel pack added to maintain chilled temperature. Survival rates will be determined over a 24 hour period
8. The method with the highest survival rate will then be tested using different size gel packs 750g, 1Kg and 1.25Kg gel packs. Gel packs will be tested both top and bottom. Temperatures of the packs will be monitored over a 24 hour period and survival rates determined. Survival rates will be tested at 12 hours – Domestic market. 24 hours - Asian market and 36 hours – European market.
9. Live product will be re-tanked and survival over 48 hours will be determined.