# Humane killing and processing of crustaceans for human consumption

**Crustaceans show responses consistent with signs of pain and distress.[1-6] They also have the cognitive capacity to remember, and learn to avoid, unpleasant stimuli.[7-9] As a result, RSPCA Australia considers that crustaceans should be captured, handled, transported, stored and killed humanely. This applies to all crustaceans, including crayfish, lobsters, crabs, Moreton Bay bugs and yabbies, whether the animal is to be eaten raw (sashimi) or cooked.**

Killing involves loss of sensibility (ability to feel pain), followed by death. For killing to be humane, either:

- the animal experiences an immediate loss of sensibility, or
- if loss of sensibility is not immediate, insensibility is induced without discomfort or pain.

Insensibility should persist until death intervenes.

A variety of methods are used to capture, hold, kill and process crustaceans. The methods used depend on the species involved, the scale of the processing operation (commercial or noncommercial) and the end product. In each case, crustaceans should be killed by the most humane method.

The legal status of crustaceans in Australia varies between different states and territories. In New South Wales, Victoria, the Northern Territory and the Australian Capital Territory, crustaceans are protected under the relevant animal welfare legislation (in some states, this only applies to crustaceans intended for human consumption). Penalties may apply if crustaceans are not treated humanely.

RSPCA

for all creatures **great** & **small**

## Skills and experience required

RSPCA Australia does not recommend that live crustaceans for human consumption are made available for purchase by the general public. Instead, they should be humanely killed by trained and competent personnel before purchase.

Training should include how to:

- appropriately handle and care for live crustaceans to minimise stress and suffering
- induce insensibility
- recognise signs of insensibility
- recognise signs of stress
- apply the method of killing
- operate and maintain any equipment involved in the killing process.

## Signs of insensibility

Signs of insensibility vary from species to species but generally include:[10]

- no resistance to handling – for example, the abdomen or tail can be easily extended or manipulated, and the outer mouthparts can be moved without resistance
- no control of limb movement
- no eye reactions when the shell is tapped
- no reaction when touched around the mouthparts.

## Signs of stress

Signs of stress include:

- thrashing
- autotomy (casting off of body parts, such as limbs).

## Acceptable stunning and killing methods

This advice is based on the available scientific evidence. However, further research is required before definitive conclusions can be drawn about the humaneness of stunning and killing methods for crustaceans.

| Method | Suitable for | Comments |
|---|---|---|
| **Stage 1: stunning** | | |
| Crustastun (electrical stunning in a water bath) | All species | Requires specialised equipment |
| Chilling in an ice slurry | All tropical crustaceans and temperate species that are susceptible to cold temperatures | A saltwater ice slurry must be used for marine species<br>Not recommended for temperate marine species that are adapted to colder temperatures |
| Chilling in air | Large crustaceans that are adapted to very cold temperatures | |
| **Stage 2: mechanical killing** | | |
| Splitting | Lobsters and similarly shaped species | |
| Spiking | Crabs | |

# Stunning methods

**Crustaceans must not be subjected to mechanical killing without first being rendered insensible using one of the following methods.**

## Electrical stunning

With sufficient electrical current, crustaceans can be rendered insensible within 1 second of current being applied – that is, an immediate loss of sensibility.[11]

Only purpose-built electrical stunning equipment (the Crustastun) should be used, in accordance with the manufacturer's instructions.[10] Failure to adequately electrically stun may have serious welfare consequences, including a high rate of autotomy.

## Chilling

Crustaceans are cold-blooded animals and reportedly enter a state of torpor at air temperatures of 4 °C or below. They are rendered insensible when their body temperature is sufficiently reduced by chilling.[3]

Scientific proof of the association between chilling and absence of discomfort, stress or pain is limited. However, this process is commonly considered to be effective, as crustaceans subjected to chilling do not show the behavioural signs of stress that occur when some other killing methods (such as boiling) are used.[12] Further research is needed to fully understand the effects of different chilling methods on crustacean welfare.

One major benefit of chilling is that it reduces mobility. This makes crustaceans easier to handle and humanely kill, and also prevents individuals from injuring each other.[13]

### *Chilling in an ice slurry*

Tropical species of crustaceans and temperate species that are susceptible to cold temperatures may be stunned by chilling in an ice slurry.[14] Insensibility occurs more quickly in an ice slurry than in air at similar temperatures because water absorbs heat much faster than air.[3,15-16]

A saltwater ice slurry must be used for all marine species. Marine crustaceans should never be placed in a freshwater ice slurry because this is likely to induce osmotic shock.

Freshwater crustaceans should never be placed in a saltwater ice slurry.

Chilling in an ice slurry is not recommended for temperate marine species that are adapted to colder temperatures.[3,12] When a saltwater ice slurry is used, the salinity of the water in the slurry decreases as the ice melts, potentially causing osmotic shock if the animal is left in the slurry for too long. For cold-adapted species, this may occur before insensibility has been reached, unless the salinity of the slurry is maintained. Monitoring and proper control of salinity of the slurry may help to overcome this potential welfare problem.[3]

### *Chilling in air*

Large crustaceans that are adapted to very cold temperatures may be stunned by chilling in air. Chilling in air takes longer than chilling in an ice slurry because of the slower rate of heat transfer to air than to water.[3,14,17]

## **Procedure:** *chilling in an ice slurry*

1. Fill an insulated container (such as an esky) with crushed ice, and then add water; for marine species, add salt water, at the salinity (salt concentration) of sea water.
2. Make sure that:
   - the ratio of ice to water (salt water for marine species) is 3:1 – this will give a consistency of wet cement and a temperature of about –1 °C
   - enough ice is available to maintain the correct temperature throughout the chilling process.
3. Place the crustaceans in the ice slurry. Regularly check them for signs of insensibility (see 'Signs of insensibility'). The time required to induce insensibility will depend on the species, the size of the animals and their metabolic state. For many species, at least 20 minutes is required.
4. Once the crustaceans are showing signs of insensibility, mechanically kill them as soon as possible to ensure that they do not recover.

## **Procedure:** *chilling in air*

1. Place the crustaceans in a freezer. Regularly check them for signs of insensibility (see 'Signs of insensibility'). The time required to induce insensibility will depend on the species, the size of the animals and their metabolic state.
2. Once the crustaceans are showing signs of insensibility, mechanically kill them as soon as possible to ensure that they do not recover.

# Mechanical killing methods

**Once crustaceans are stunned and are showing signs of insensibility, they should be mechanically killed as soon as possible to ensure that they do not recover.**[16]

Crustaceans have multiple nerve centres (ganglia). Humane killing requires rapid destruction of all the nerve centres. It is not possible to kill crustaceans quickly by destroying just a single central location (unlike in vertebrates).

## Splitting

Splitting is suitable for lobsters and similarly shaped species. Lobsters have a chain of nerve centres running down their central length (ventral longitudinal midline) (Figure 1). All the nerve centres are beneath the longitudinal midline on the animal's undersurface, except the first nerve centre, the supraoesophageal ganglion, which is located at the top end of the chain and is reached through the head rather than the undersurface.[10,14]

Splitting involves rapidly cutting through the centre-line of the head, thorax (chest) and abdomen with a large, sharp knife. Cutting must occur along the longitudinal midline (lengthways) to destroy all the nerve centres (Figure 2).

## Spiking

Spiking is suitable for crabs. Crabs have two main nerve centres. One is located at the front of the animal, under a shallow depression. The other lies towards the rear of the animal and may have a small hole positioned over it (Figures 3 and 4).[10,14]

Crabs can be killed by rapid destruction of both nerve centres by piercing both ganglia from the underside of the crab with a pointed spike (e.g. a thick, pointed pithing instrument, an awl or a sharp-pointed knife).

Spiking must not be performed on lobsters because they have a long chain of nerve centres.

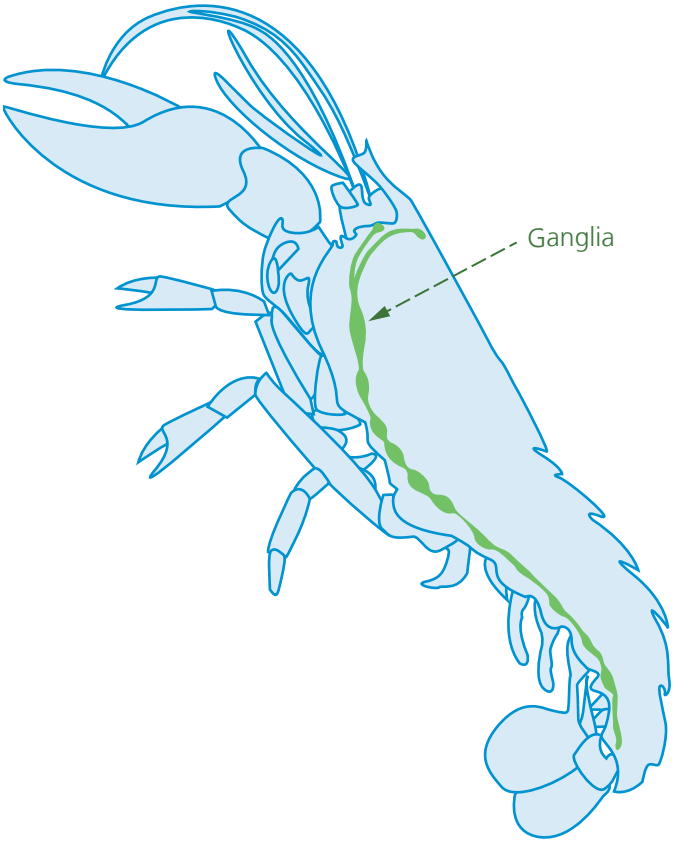


**Figure 1 Cross-section view of lobster, showing internal ganglia**

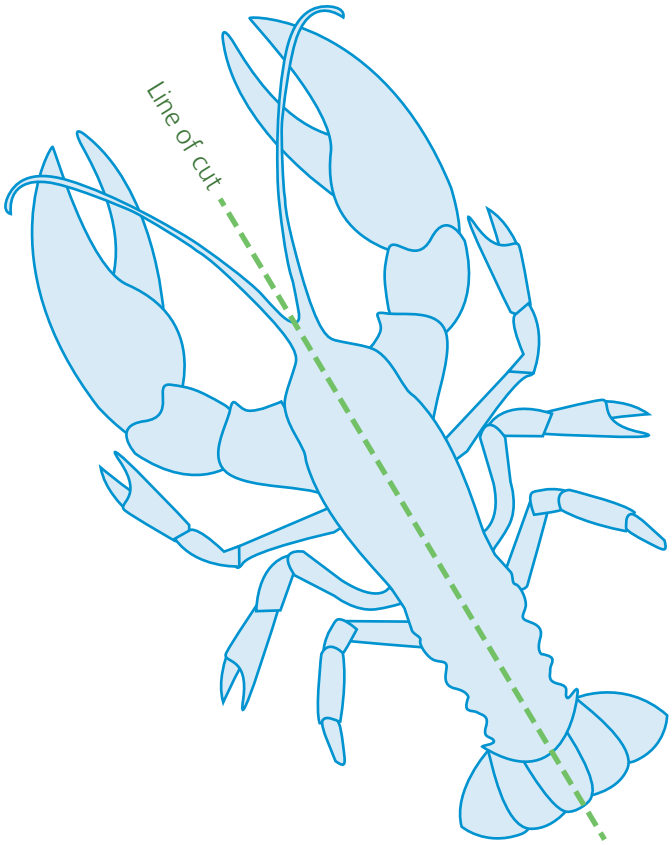


**Figure 2 View of lobster from above (or below), showing line of cut for lobster splitting**

## **Procedure:** *splitting*

1 Once the lobster is insensible, place it on a flat, nonslip surface, on its back, with claws tied to expose the undersurface clearly (only tie the legs after the lobster is insensible).[10,14]

2 Hold the lobster around the top of its head with firm pressure. Note the longitudinal midline on the lobster's undersurface.

3 Use a large, sharp knife (preferably as long and deep as the lobster – for example, a French cook's knife) for the cuts, and a mallet to force the knife quickly through the animal. Keeping the knife oriented with the midline, place the knife on the head beneath the mouth parts. Cut through the head at this point to pierce and destroy the first nerve centre (supraoesophageal ganglion).

4 Next, cut along the longitudinal midline on the undersurface to pierce and destroy the rest of the chain of nerve centres in two stages, starting near the junction of the abdomen and the thorax. Direct the first cut straight towards the head, and the second backwards, towards the tail (Figure 2).

**Lie the lobster flat on its back and cut through the midline with a large, sharp knife.**
(Image: Scott Phillips, Fine Cooking Magazine, © 2009 The Taunton Press Inc., www.finecooking.com)

5 After cutting in half lengthways through the longitudinal midline, rapidly remove the chain of nerve centres at the front end (chest and head) of the lobster (see Figure 1).

6 Complete the cutting procedure in less than 10 seconds.

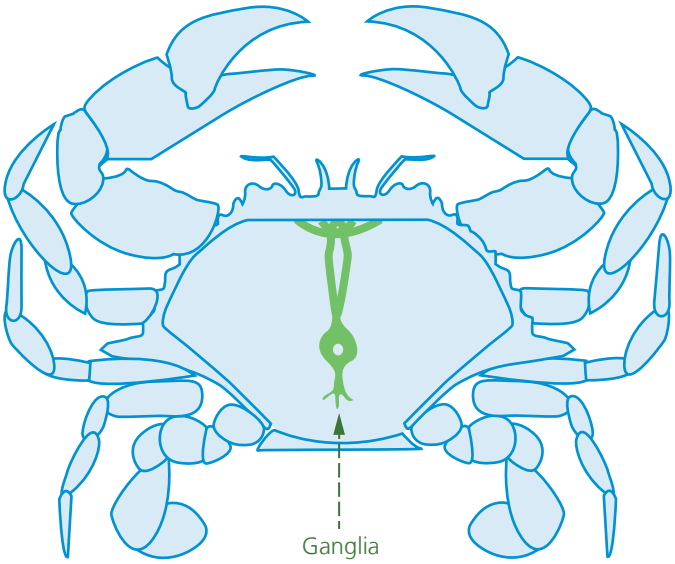


**Figure 3 Topside of crab, showing internal ganglia (nerve centres)**

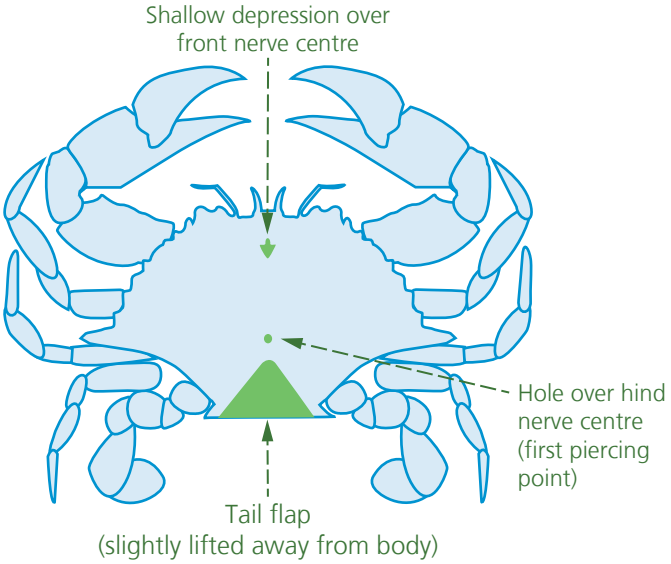


**Figure 4 Underside of crab, showing reference points for spiking**

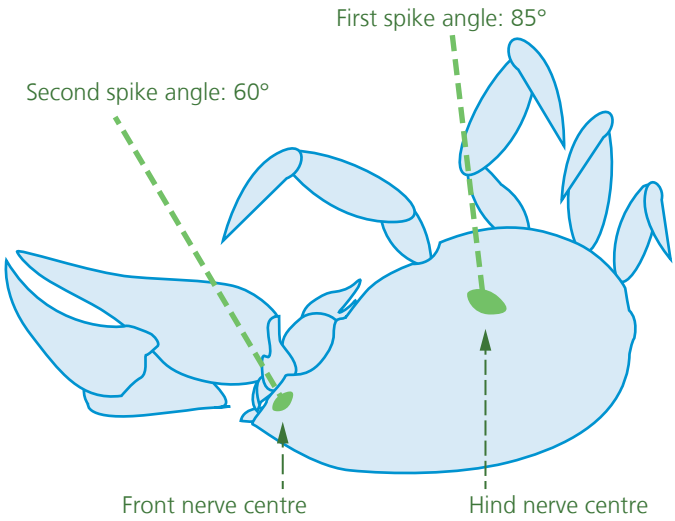


**Figure 5 Cross-section view of crab, showing angles for spiking**

## **Procedure:** *spiking*

1. Once the crab is insensible, place it on its back on a flat, nonslip surface.[10,14]
2. Lift the abdominal flap (tail flap) and insert a pointed spike such as an awl or sharp-pointed knife all the way through the rear nerve centre. Insert through the hole over the rear nerve centre at an angle of 85° to the horizontal (see Figures 4 and 5).
2. Repeat this process through the front nerve centre. Insert the spike through the shallow depression at the front of the body at an angle of 60° to the horizontal (see Figures 4 and 5).
3. Complete the spiking procedure in less than 10 seconds.

**Lie the crab on its back and pierce it with a sharp, pointed object such as a knife.**
(Image: www.fishfiles.com.au)

# Unacceptable killing methods

**The following methods of processing crustaceans must not be used because they cause an unacceptable degree of pain and suffering to the animal:**[10,14]

- Separating the abdomen (tailpiece) from the thorax – that is, tailing – or removing tissue, flesh or limbs while the animal is still alive (including when it is insensible) and before destroying the front and rear nerve centres (crabs) or chain of nerve centres (lobsters).
- Cutting crustaceans into sections while the animal is still alive (even when it is insensible) and before destroying the nerve centres.
- Placing live crustaceans (including when insensible) into hot or boiling water before destroying the nerve centres.
- Placing live marine crustaceans (including when insensible) in fresh water. Marine crustaceans suffer and die from severe osmotic shock when placed in fresh water.
- Microwaving live crustaceans (including when insensible).
- Removing crustaceans from the water and allowing them to die from lack of oxygen as a result of desiccation of their gill tissue.
- Placing crustaceans in a container of water without adequate aeration, causing death from lack of oxygen.
- Exposing crustaceans to caustic chemicals.
- Causing traumatic injury without first inducing insensibility and destroying the nerve centres.
- Serving any dish involving a live crustacean for consumption.

## Anaesthetic agents

Anaesthetic agents (AQUI-S and clove oil) are not included as acceptable methods for the humane killing of crustaceans because it is not yet known whether they are safe for human consumption.

# Glossary

| | |
|---|---|
| abdomen | The part of the crustacean's body between the thorax and the tail; in crabs, the abdomen is very small. |
| autotomy | The casting off by an animal of a part of its body, when under threat – for example, limbs, in the case of crustaceans. |
| crustacean | Aquatic arthropods with a segmented body, an exoskeleton and jointed, paired limbs; they include rocklobsters, crabs, Moreton Bay bugs, freshwater crayfish (such as yabbies) and prawns. |
| ganglion | Nerve centres (plural: ganglia). |
| humane killing | Killing that involves either immediate loss of sensibility or induction of insensibility without discomfort or pain, followed by death while the animal is insensible. |
| osmotic shock | Drawing of water into a crustacean's body cells via osmosis, causing the cells to rupture (which is likely to cause suffering). |
| pain | An unpleasant sensation and feeling associated with actual or potential tissue damage. |
| sensibility | An animal's ability to feel pain. |
| stress | An organism's attempt to maintain homeostasis in response to environmental challenge. |
| stunning | Induction of insensibility. |
| thorax | The middle section of the body of a crustacean; fused with the head in most larger crustacean species. |
| torpor | A state of mental and motor inactivity with partial or total insensibility. |

# References


1 Elwood RW (2012). Evidence for pain in decapod crustaceans. *Animal Welfare* 21(S2):23–27.

2 Barr S, Laming PR, Dick JTA & Elwood RW (2008). Nociception or pain in a decapod crustacean? *Animal Behaviour* 75:745–751.

3 European Food Safety Authority (2005). Opinion on the 'Aspects of the biology and welfare of animals used for experimental and other scientific purposes'. *EFSA Journal* 292:1–46.

4 Broom DM (2007). Cognitive ability and sentience: which aquatic animals should be protected? *Diseases of Aquatic Organisms* 75:99–108.

5 Appel M & Elwood RW (2009). Motivational trade-offs and potential pain experience in hermit crabs. *Applied Animal Behaviour Science* 119(1–2):120–124.

6 Appel M & Elwood RW (2009). Gender differences, responsiveness and memory of a potentially painful event in hermit crabs. *Animal Behaviour* 78(6):1373–1379.

7 Elwood RW & Appel M (2009). Pain experience in hermit crabs? *Animal Behaviour* 77:1243–1246.

8 Elwood RW, Barr S & Patterson L (2009). Pain and stress in crustaceans? *Applied Animal Behaviour Science* 118:128–136.

9 Magee B & Elwood RW (2012). Shock avoidance by discrimination learning in the shore crab (*Carcinus maenas*) is consistent with a key criterion for pain. *Journal of Experimental Biology* 216:353–358.

10 RSPCA UK. Humane electrical stun/killing of Crustacea. www.rspca.org.uk

11 Roth B & Øines S (2010). Stunning and killing of edible crabs (*Cancer pagurus*). *Animal Welfare* 19(3):287–294.

12 Yue S (2008). *The welfare of crustaceans at slaughter*, Humane Society of the United States.

13 Davidson GW & Hosking WW (2004). *Development of a method for alleviating leg loss during post-harvest handling of rock lobsters*, project 2000/251, Fisheries Research and Development Corporation & Geraldton Fishermen's Cooperative, Geraldton.

14 NSW Department of Primary Industries. Humane harvesting of fish and crustaceans. www.dpi.nsw.gov.au/agriculture/livestock/animal-welfare/general/fish/shellfish

15 Tseng Y, Xiong YL, Webster CD et al. (2002). Quality changes in Australian red claw crayfish, *Cherax quadricarinatus*, stored at 0 °C. *Journal of Applied Aquaculture* 12(4):53–66.

16 Beatty SJ, Morgan DL & Gill HS (2004). Biology of a translocated population of the large freshwater crayfish, *Cherax Cainii*. Austin & Ryan, 2002 in a Western Australian river. *Crustaceana*, 77 (11):1329–1351.

17 Queensland Department of Agriculture and Fisheries (2015). Freshwater crayfish for lab examination. www.daff.qld.gov.au/fisheries/aquaculture/management-and-policies/freshwater-crayfish-for-lab-examination

18 Roth B & Grimsbø E (2013). *Electrical stunning of edible crabs*, report 18/2013, Nofima, Tromsø. www.nofima.no/filearchive/Rapport%2018-2013.pdf



**For more information contact RSPCA Australia.**

**Web: rspca.org.au**
**Email: rspca@rspca.org.au**
**Tel: 02 6282 8300**


RSPCA
for all creatures **great** & **small**