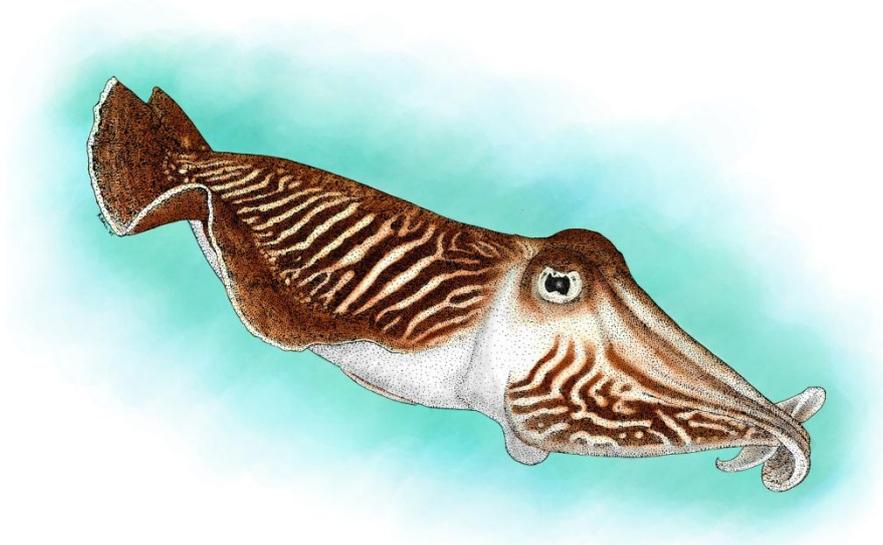


**Project title:**

**Pilot Project to investigate the survival rates of discarded cuttlefish.**



*The cuttlefish (Latin name: Sepia officinalis)*

**Date: February 2012**

**Project contract reference number: FES 251**

**Contractor:**

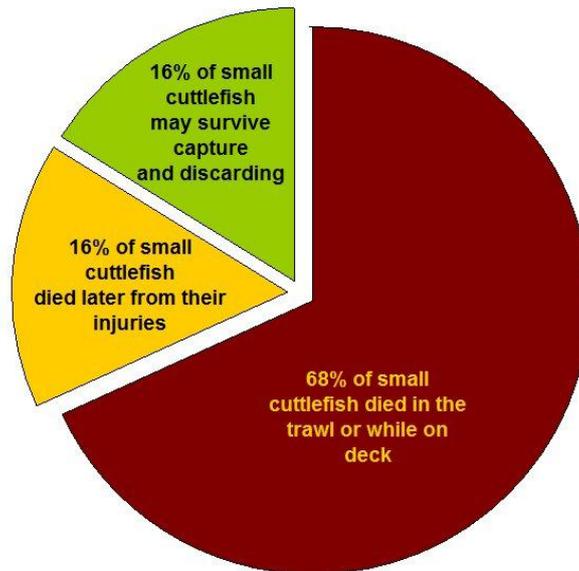
*Revill Nation Ltd. Registered Company (England and Wales) No. 3859768*

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## EXECUTIVE SUMMARY - Primary findings

***This work provides some useful insight and first estimates on the likely survival rate of discarded small cuttlefish.*** During trials onboard a SW commercial beam trawler it was found that 16% of small cuttlefish survived the capture, deck sorting and discarding process. The remaining 84% of small cuttlefish had all died either onboard or shortly thereafter. These trials were undertaken under full commercial fishing conditions in Jan 2012 (Area VIIe, outside 12 nm limit). If these findings are representative of the fishery more generally, there can only be modest potential conservation benefits from discarding such creatures in this fishery.

*How well do small cuttlefish survive if they are discarded?*



## EXECUTIVE SUMMARY - Context

***Reducing discarding in the UK is a priority for both the fishing industry and managers.*** In the southwest beam trawl fishery, considerable progress has been in recent years to reduce discarding. Significant reductions have been achieved through the use of more selective fishing gears and by a fuller use of the catch (i.e. developing new markets for previously under-utilised catch components).

***The discarding of small cuttlefish (less than 15 cm) in the SW beam trawl fishery has however been a somewhat persistent feature.*** Many of these small cuttlefish are regularly discarded by some fishing skippers because they believe that once discarded, they will subsequently grow to a bigger, more valuable size which can be caught once again at a later date. The scientific evidence has been unclear if small cuttlefish can survive the capture and discarding process and opinion within the fishing industry has also been mixed on this issue.

***This study gives useful first insight into likely cuttlefish discard survival rates in this sector.*** The findings in this work should however, not be applied to other fisheries and similar repeat studies undertaken on other vessels in this fishery would help to further strengthen confidence in the estimates presented here.

## INTRODUCTION

**The fisheries management need underpinning this study:** Discarding of fish is widely regarded to be a waste of natural resources, unethical and widely disliked. “*Why catch fish and then throw them back into the sea?*” is a commonly heard comment. In the southwest (SW) offshore beam trawl fishery, considerable progress to reduce discarding has been made in recent years by the fishing industry. This has been achieved through the use of more selective fishing trawls and by increasing the utilisation of the catches (i.e. developing new markets for underutilised species). One species (small cuttlefish) is however regularly discarded for reasons which are somewhat unique.

It has been known for some time that many small cuttlefish (<15cm in length) are discarded in southwest (SW) fisheries (Cefas data). For example, in 2008, an estimated 306 tonnes of small cuttlefish with a market value of £0.75 million were discarded in the SW (Cefas).

Many of these small cuttlefish are regularly discarded by some fishing skippers because they believe that once discarded, they will subsequently grow to a bigger, more valuable size which can be caught once again at a later date. The scientific evidence has been unclear if small cuttlefish can survive the capture and discarding process and opinion within the fishing industry has also been mixed on this issue (interviews 2011).

There is an existing market for such small cuttlefish, but small specimens are less valued at market and fetch a lower price than the larger specimens. If discard survival rates of the small cuttlefish are low, the SW fisheries may be losing economic value as a consequence of this discarding.

This pilot study therefore aimed to provide some useful insight and guidance to the fishing industry and managers on this issue.

**The cuttlefish fishery:** Cuttlefish are fast growing cephalopods which live for around 2 years. They provide an important fishery resource for the UK. In the offshore SW UK beam trawl fisheries, the large specimens (15+cm) are caught in abundance during the economically important winter fishing season. When the smaller cuttlefish (<15 cm) migrate from their inshore birth grounds to deeper offshore waters, they can also be caught up in the trawl catches. Many of these smaller cuttlefish have been routinely discarded for the reason described previously.

## AIM OF THIS WORK

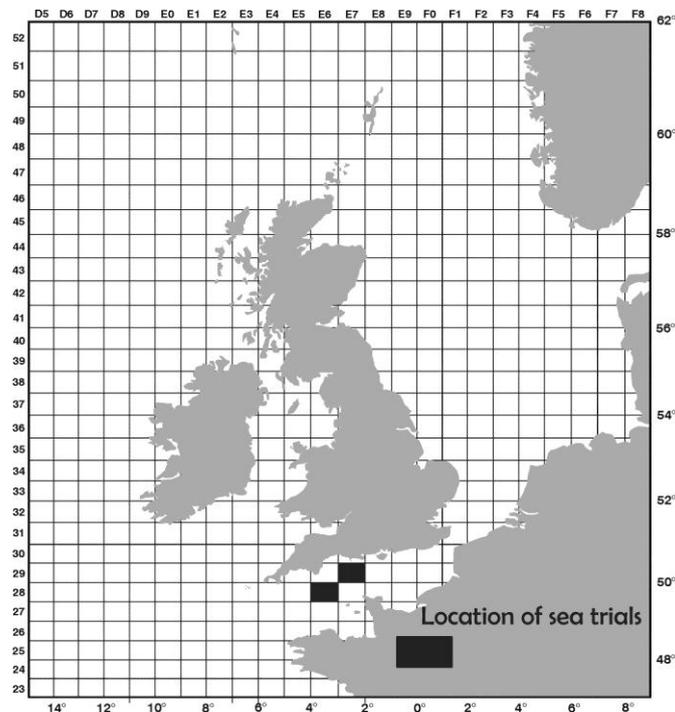
**Discard survival assessment on small cuttlefish (*Sepia officinalis*):** This work aimed to obtain estimates of the survival rates of discarded small cuttlefish (less than 15cm in length) onboard a commercial SW beam trawler operating under commercial fishing conditions.

## METHODS

**Commercial beam trawler:** This study was entirely carried out during an 8-day fishing trip in January 2012 aboard a commercial beam trawler operating under standard commercial fishing conditions in ICES sub area VIIe (outside the 12 mile limit).



*The FV Barentssee (BM 361) The commercial twin beam trawler engaged in the trials*



*Location of sea trials (ICES rectangles E628 and E729 in sub-area VIIe)*

## METHODS



*(Left above) One of the two 12 m chain mat beam trawls used to catch fish on the FV Barentssee*

*(Right above) Hauling the catch aboard from one of the two beam trawls and emptying it into a deck hopper (fitted with spraying seawater)*

*(Below) Large cuttlefish are an important target species during winter and are usually caught on rough fishing grounds (a typical catch from the rough grounds obtained during the sea trials)*



## METHODS

**Cuttlefish survivorship (stage 1) Examination of cuttlefish for signs of life at the sorting table:** Approximately 2,000 cuttlefish were examined for signs of life once they had been hauled aboard and transferred by conveyor to the crew sorting table. The sorting table is the point at which the decision to discard to retain or discard a fish is made.

In total, the cuttlefish from 24 hauls were examined from the sorting table and were classified as either alive or dead. Cuttlefish were classified as dead if they exhibited all of the following characteristics: *No movement of body or fins, body floppy and lifeless, no blowing or respirations, producing no ink, noise, or body vibrations and no glowing around belly.*



*The catch is transported from the deck hoppers to the sorting bench by a conveyor. Here the crew will decide which fish to keep and which fish to return (discard) to the sea*

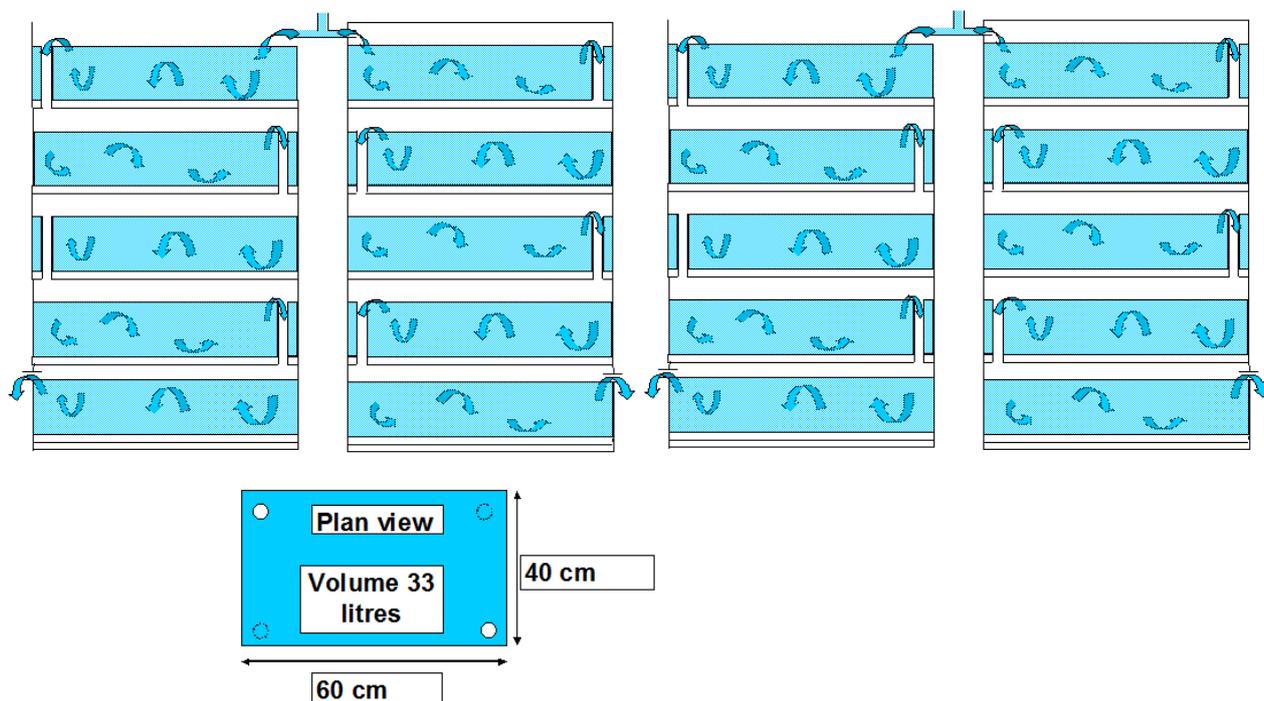
**Cuttlefish survivorship (stage 2) Keeping small cuttlefish in an onboard aquarium system:** A number of small cuttlefish which were found to be alive at the sorting table (i.e. from stage 1) were placed into a nearby onboard aquarium system. The aquarium system was supplied with a continuous flow of fresh seawater. This component of the study aimed to replicate the animal being discarded and returned to the sea. The cuttlefish were checked every 12 hours to see how many were surviving for a period of up to 72 hours. Dead animals were removed from the system. No feeding of the animals took place during the observation periods. This process was repeated several times with different batches of cuttlefish which had survived to the sorting table. In total, 88 small cuttlefish and 10 large fish were observed in the aquarium system.

**Combining the results from Stage 1 and Stage 2 cuttlefish survivorship observations:** The combined cuttlefish survivorship data (i.e. from both Stage 1 and Stage 2) provided our best overall estimate of discarded cuttlefish survival from a commercial fishing vessel.

## METHODS

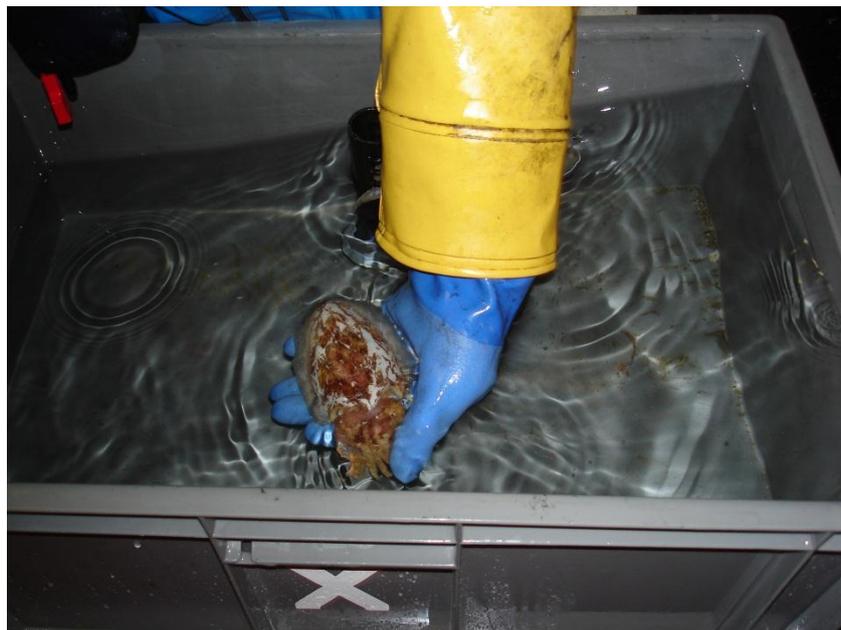
### Vessel, trip and aquarium details

Vessel, trip and aquarium details	
Vessel name and numbers	FV Barentssee BM 361 (RSS No B13137)
Fishing gear details	2 x 12m beam trawls Chain mats, 180mm mesh in body of trawl with 95mm cod ends Trawls fitted with stone released slits (4 meshes deep up from cod ends)
Vessel details	Main engine power 880 kW vessel overall length 30 m
Vessel owners	Langdon and Philip Ltd, Brixham
Area fished	ICES rectangles E729 and E628 in ICES sub area VIIe
Water depth	65-75 m
Towing speed	3.5 – 4 knots
Fishing grounds	Racetrack, Channel separation zone (rough ground)
Primary target species	Cuttlefish, monkfish, flatfish species (soles, plaice, brill, turbot etc.)
Trip dates	21 – 29 January 2012
Catch processing	Haul duration -90 mins, Deck hoppers and conveyor sprayed with seawater, time taken to clear deck & sorting table 20-30 mins
Aquarium water temperature	11°C (+/- 0.5°C)
Aquarium water flow rate	17.5 L/minute through each tank
Single aquarium tank dimensions	60 x 40 x 18 cm (33 Litres)
No of aquarium tanks onboard	20 (4 stacks of five tanks)
Cuttlefish stocking densities	Up to 5 per tank (small cuttlefish) 1 per tank (large cuttlefish)



*A schematic diagram of the 20 compartment aquarium system held onboard*

## METHODS



*Cuttlefish were kept in a stacking aquarium system to simulate them being returned to sea (i.e. discarded). They were kept in the aquarium system for up to 72 hours.*

## RESULTS

*The numbers of small cuttlefish (<15 cm) dead / alive by the time they reached the sorting table (Stage 1) (i.e. Normal point of discarding)*

<b>Stage 1</b> Haul No.	No. of small cuttlefish alive	No. of small cuttlefish dead	% of small cuttlefish surviving to the sorting table
1	12	28	30%
5	15	15	50%
22	21	41	34%
23	46	56	45%
24	25	61	29%
25	18	67	21%
36	18	68	21%
38	40	44	48%
51	19	40	32%
52	27	30	47%
54	13	49	21%
55	23	43	35%
56	17	50	25%
64	18	111	14%
No. of hauls 14	Total number of small cuttlefish found to be alive when examined 312	Total number of small cuttlefish found to be dead when examined 703	Average survival rate of small cuttlefish to the sorting table 32%

*The numbers of large cuttlefish (15cm and above) dead / alive by the time they reached the sorting table (Stage 1) (i.e. Normal point of discarding)*

<b>Stage 1</b> Haul No.	No. of large cuttlefish alive	No. of large cuttlefish dead	% of large cuttlefish surviving to the sorting table
26	106	0	100%
28	128	0	100%
35	146	1	99%
37	144	3	98%
39	108	0	100%
50	107	3	97%
53	121	0	100%
54	75	3	96%
55	80	4	95%
56	112	2	98%
No. of hauls 10	Total number of large cuttlefish found to be alive when examined 1127	Total number of large cuttlefish found to be dead when examined 16	Average survival rate of large cuttlefish to the sorting table 98%

## RESULTS

*The numbers of small cuttlefish surviving in the onboard aquarium system (stage 2).  
(Note: All cuttlefish in stage 2 had already survived through stage 1 to the sorting table)*

<b>Stage 2</b>	No. surviving	No. that died during this period	Stage 2 survival rate
Small cuttlefish survival trials No 1			
<b>Subsequent survival of small cuttlefish in the onboard aquarium</b>			
36 small cuttlefish survivors from stage 1 were placed into the aquarium			
After 12 hours in the aquarium	31	5	86%
After 24 hours in the aquarium	31	0	86%
After 48 hours in the aquarium	27	4	75%
After 60 hours in the aquarium	19	8	53%
After 72 hours in the aquarium	19	0	53%
Estimated survival rate of small cuttlefish through stage 2			53%
<b>Stage 2</b>	No. surviving	No. that died during this period	Stage 2 survival rate
Small cuttlefish survival trials No 2			
<b>Subsequent small cuttlefish survival in the onboard aquarium</b>			
40 small cuttlefish survivors from stage 1 were placed into the aquarium			
After 12 hours in the aquarium	40	0	100%
After 24 hours in the aquarium	38	2	95%
After 48 hours in the aquarium	28	10	70%
After 60 hours in the aquarium	26	2	65%
After 72 hours in the aquarium	(terminated due to bad weather)		
Estimated survival rate of small cuttlefish through stage 2			65%
<b>Stage 2</b>	No. surviving	No. that died during this period	Stage 2 survival rate
Small cuttlefish survival trials No 3			
<b>Subsequent survival of small cuttlefish in the onboard aquarium</b>			
12 small cuttlefish survivors from stage 1 were placed into the aquarium			
After 12 hours in the aquarium	12	0	100%
After 24 hours in the aquarium	12	0	100%
After 48 hours in the aquarium	9	3	75%
After 60 hours in the aquarium	5	4	41%
After 72 hours in the aquarium	4	1	33%
Estimated survival rate of small cuttlefish through stage 2			33%
Average survival rate of small cuttlefish through stage 2 (72 hours in seawater aquarium)			50%

## RESULTS

*The numbers of large cuttlefish surviving in the onboard aquarium system (stage 2).  
(Note: All cuttlefish in stage 2 had already survived through stage 1 to the sorting table)*

<b>Stage 2</b>	No. surviving	No. that died during this period	Overall % survival rate
Large cuttlefish survival trials No 1			
<b>Subsequent survival of small cuttlefish in the onboard aquarium</b>			
Ten randomly chosen large cuttlefish survivors from stage 1 were placed into the aquarium			
After 12 hours in the aquarium	10	0	100%
After 24 hours in the aquarium	10	0	100%
After 48 hours in the aquarium	10	0	100%
After 60 hours in the aquarium	10	0	100%
After 72 hours in the aquarium	10	0	100%
Estimated overall survival rate of large cuttlefish			100%

*The small cuttlefish were all less than 15cm whereas the large cuttlefish were 15cm and above*

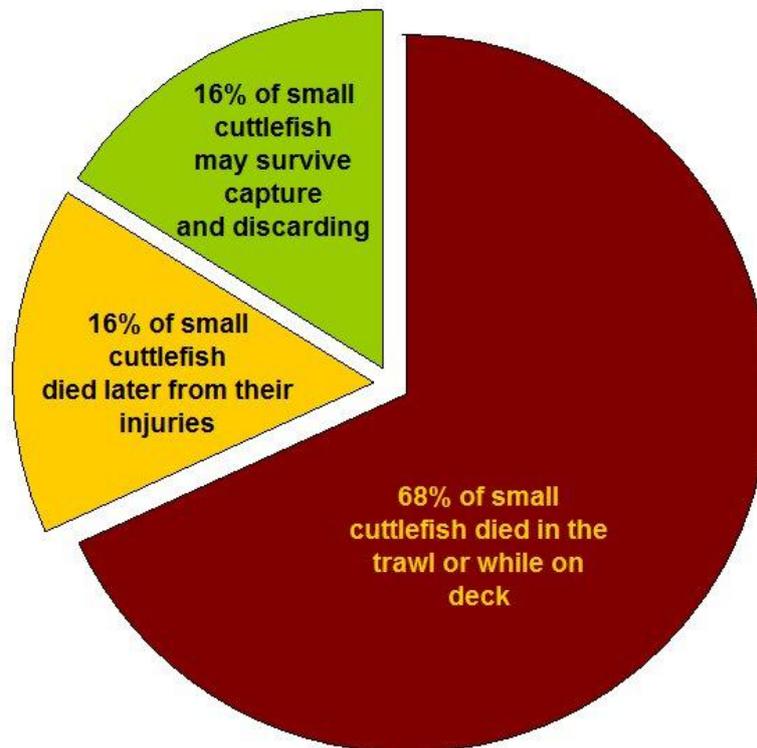


## RESULTS

### Summary overview of cuttlefish survival rates

Small cuttlefish survival trials No 1	Small cuttlefish	Large cuttlefish
<b>Stage 1– Survival in the trawl and to the sorting table</b>		
Average survival rate <i>(based on examinations of 2,000 cuttlefish from 24 hauls)</i>	32%	98%
<b>Stage 2 –Subsequent survival of living cuttlefish transferred from the sorting table to the aquaria system</b>		
Average survival rate <i>(based on observations in the aquaria of 88 small cuttlefish and 10 large cuttlefish)</i>	50%	100%
<b>Stage 1 and 2 combined – Estimated potential discard survival rate</b>		
Estimated overall survival rate for cuttlefish	16%	98%

### How well do small cuttlefish survive if they are discarded?



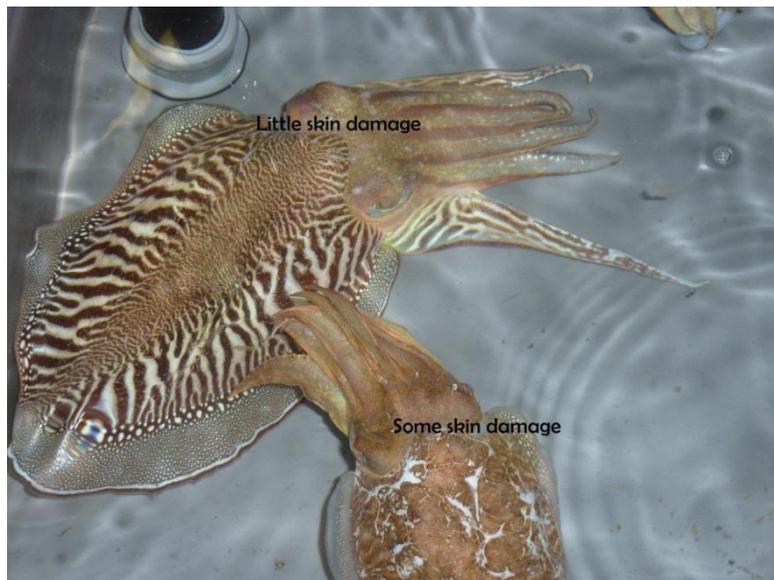
## DISCUSSION

**The small cuttlefish appear to be more delicate than the larger ones:** During the sea trials it appeared that the larger cuttlefish were able to survive trauma caused by trawling and deck sorting than the more delicate small cuttlefish. Most of the small cuttlefish had damaged or torn skin when examined. Quite often bone was exposed through the damaged areas of tissue in the small specimens.

The larger cuttlefish exhibited a much higher survival rate and where skin damage was present it was proportionately at a much lower level than on the smaller specimens.



*(Left) Small cuttlefish caught in the trawl and all showing signs of skin damage  
(Right) Large cuttlefish caught showing much less evidence of skin damage  
(Below) Some cuttlefish in the aquarium system*



## CONCLUSIONS AND LIMITATIONS

***These conclusions apply only to offshore beam trawlers:*** This work was undertaken onboard a large twin beam trawler (>300 HP) operating in offshore waters (outside 12 mile limit) in ICES sub area VIIe. The findings in this work are therefore only applicable to this particular group of fishing vessels. The findings in this work are not transferable to other fishing sectors.

***All of the data arises from one fishing trip.*** The data in this study was obtained during one fishing trip on one vessel. However, the vessel chosen was fairly typical of this fishing sector and it was fishing on classic cuttlefish fishing grounds in the peak winter season. The results obtained may therefore provide a useful first estimate of cuttlefish discard survival rates for this particular important sector of the fishing industry.



*Typical mixed catches caught during the trip in the hopper (including cuttlefish)*

***Only a small proportion of small cuttlefish are likely survive the capture and discarding in this fishery.*** Small cuttlefish are not targeted in the offshore beam trawl fishery as they are of relatively low value, compared to the larger specimens. This work indicates that relatively few small cuttlefish (16%) of those which were caught survived the capture and discarding process. The potential conservation benefits from discarding such small cuttlefish in this sector may therefore be quite modest.

***Most of the small cuttlefish die during trawling and deck sorting.*** This work identified that the majority of small cuttlefish (68%) in the catches were dead by the time they reached the sorting table. A further 16% of the small cuttlefish catch appeared to die within the next 3 days as a result of traumas received during the catch and deck process, giving rise to a total mortality rate of 84%.

## CONCLUSIONS AND LIMITATIONS



*Typical mixed catches caught during the trip in the hopper (including cuttlefish)*

***This study gives useful first insight into discarded cuttlefish survival rates.*** Some useful insight into estimating the survival rates of discarded small cuttlefish in this fishing sector have been obtained in this study. Further data obtained from other vessels in this fishery would help to strengthen the estimates. It is possible that the survival rate of such small cuttlefish could be lower in situations which increase the likelihood of further trauma during the catch and sorting process, i.e. on vessels using longer towing times, longer deck processing times, no water spraying of catches, in trawls with smaller meshes and not rigged with stone release slits etc.

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## ACKNOWLEDGEMENTS

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*John Hingley (Brixham)*

*Dr Emma Jackson (The Marine Biological Association of the United Kingdom, Plymouth)*

*Defra (London)*