NATURAL HERITAGE TRUST
NATIONAL INVESTMENT STREAM PROJECTS and
NATIONAL COMPETITIVE COMPONENT PROJECTS

FINAL REPORT

Date of report: 11 March 2009

Project Title:

Trials of Seal Excluder Devices (SEDs) on a
South East Trawl Fishery Wet Boat

Proponent/Organisation Name:

South East Trawl Fishing Industry Association

Project Manager:

Name: Karen Roberts
Branch: Marine Environment Section
Department/Organisation: Fisheries and Forestry
Phone: (02) 6272 5171 Email Address: Karen.Roberts@Daff.gov.au

Full Project Duration

Start of Project Period:	01/03/2008	End of Project Period:	01/03/2009

FINANCIAL REPORTING

Commonwealth Funds contributed and expended for the purpose of the Project.

Project Budget

Item		Description	Amount		Ex GST	Inc. GST
Salaries	SED Trial and Project Coordination	Vessel and SED preparation, coordination of trials, reporting and extension of results. Evaluation of SED	30	$ 1,000.00	$ 30,000.00	$ 33,000.00
	1 Field scientist	14 Sea Days @ $600/day	14	$ 600.00	$ 8,400.00	$ 9,240.00
	1 Field scientist	4 Land Days @ $300/day	4	$ 300.00	$ 1,200.00	$ 1,320.00
	1 SED technician	14 Sea Days @ $600/day	14	$ 1,000.00	$ 14,000.00	$ 15,400.00
	Total Salaries				$ 53,600.00	$ 58,960.00
Operational	Fishing time offset	14 Days @ $1,500/day	14	$ 1,500.00	$ 21,000.00	$ 23,100.00
	SEDs	2 SED designs	2	$ 2,500.00	$ 5,000.00	$ 5,500.00
	SEDs	Modificaiton	2	$ 1,000.00	$ 2,000.00	$ 2,200.00
	Consumables	Stationery, waterproof data sheets, photocopying, mailing, phones etc	1	$ 1,000.00	$ 1,000.00	$ 1,100.00
	Camera Hire	Camera provided by AFMA			$ -	
	Total Operational				$ 29,000.00	$ 31,900.00
Travel	Airfares	SED Technologist MEL-HBA return 2 trips	2	$ 700.00	$ 1,400.00	$ 1,540.00
		SED Technologist MEL-NZ retrun 2 trips	2	$ 1,800.00	$ 3,600.00	$ 3,960.00
	Meals	Observer/Scientist 18 meals @ $100/day	18	$ 100.00	$ 1,800.00	$ 1,980.00
	Accomodation	Observer/Scientist 18 nights @ $120/night	18	$ 120.00	$ 2,160.00	$ 2,376.00
	Vehicle hire	6 days pre and post survey	12	$ 60.00	$ 720.00	$ 792.00
	Total Travel				$ 9,680.00	$ 10,648.00
TOTAL PROJECT					$ 92,280.00	$ 101,508.00

	NHT Funds ($ GST inclusive)
Commonwealth Funds provided during the Reporting Period	$50,754 on signing of agreement $25,377 on provision of startup report $25,377 on provision of draft final report $101,508 Total
Commonwealth Funds expended during the Reporting Period	**$86,724.66**
Commonwealth Funds not expended during the Reporting Period	**$14,783.34** AFMA / SETFIA support the suggestion that the remaining funds be retained to cover further extension and continued trials during 2009.

AIM

1. Design SEDs to suit a typical South East Trawl Fishery (SETF) wet boat and monitor their performance with respect to seal exclusion and fish escapement.
2. Determine potential for wider use of SEDs in the fishery.

INTRODUCTION

Over the last decade, fur seal populations around south-eastern Australia have increased significantly. This has resulted in increased levels of interactions with fishing vessels and higher levels of incidental capture of seals. To address this issue, industry has developed the "Industry Code of Practice to Minimise Interactions with Seals", and distributed education kits to increase the reporting of seal interactions, including the award winning "South East Trawl Fishery: Seal Bycatch – Guidelines for reporting and data collection". Industry has also initiated collaborative projects with researchers to reduce seal bycatch in the fishery. This work trialled and developed SEDs that worked successfully on the larger (45m+) blue grenadier vessels capable of freezing or processing at sea.

It is estimated that hundreds of seals are caught annually in the "wet boat" sector (small 18–23 m trawlers that uses ice/brine with no freezing/processing capacity) of the SETF. This project seeks to modify and trial two existing types of SEDs on a typical SETF wet boat to determine their potential for wider use in the fishery.

BACKGROUND

The Southern and Eastern Scalefish and Shark Fishery (SESSF) is a multi-species multi-gear fishery situated off the south-east coast of Australia. It is Australia's largest scalefish fishery, providing most of the fresh fish to domestic markets. Following the recent Structural Adjustment Package, there are now 50 active permits in the trawl sector (SETF) of the SESSF which land about 20,000 tonnes of fish annually, worth $43.6 million in 2005/06 (ABARE 2007). Most of the trawl vessels are "wet boats" that deploy demersal trawls and use ice/brine to store the fish. There are a few factory vessels with freezing/processing capacity that operate in the winter blue grenadier fishery off western Tasmania using midwater trawls.

The most commonly found seals in south-east Australian waters are the Australian fur seal, *Arctocephalus pusillus doriferus*, and the New Zealand fur seal, *A. forsteri*. The populations of both species are estimated to be increasing (Kirkwood *et al.*, 2005; Goldsworthy *et al.* 2003). These seals forage in similar areas to the operation of trawl vessels in the SESSF (Arnould and Hindell, 2001) and also feed on offal and fish discarded from wet boats. Not unexpectedly, there are an increasing number of interactions between trawlers and seals.

Seals are protected in Commonwealth waters under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999 (they are also protected in State coastal waters under relevant State legislation). Under this Act it is the responsibility of fishers to "take all reasonable steps to ensure that all protected species are not killed or injured as a result of fishing". All incidents involving seals (alive or dead) must be reported to the Australian Government Department of the Environment, Water, Heritage and the Arts.

Factory trawlers targeting blue grenadier have made significant efforts to reduce their seal bycatch (Tilzey *et al.* 2006). Comparatively little work has been conducted in the remainder of the fishery operated by the wet boat sector. Analysis of data collected by observers aboard wet boats (Knuckey & Bosschietter, 2002) indicated that seals were caught in about one in every fifty shots, but this incidental catch rate varied greatly across the fishery and in different seasons and depths. Little other information is available on the seal–fishery interactions. Recently, there has been a targeted education campaign to improve the reporting of seal interactions by the wet boat sector (Stewardson and Knuckey 2007a, b; Knuckey and Stewardson 2007) to help address this issue.

METHODS

SED Design and Construction

A generalised diagram of a SED is provided in Figure 1 showing the grid, hood and important specifications. These designs have largely been adapted from bycatch exclusion devices used for turtles and sealions in other fisheries. In the SESSF, SEDs have been specifically designed for factory boats operating in the winter blue grenadier fishery off western Tasmania (Tilzey *et al.* 2006).

A New Zealand seal expert/SED Technologist, Mr Martin Cawthorn was employed by the project to come across to Australia and work with the SETF fishers on the design and trials of the SEDs. He came across from New Zealand to Lakes Entrance during the last week in March 2008 and spoke with the project skippers Mr Tony Guarnaccia and Mr Rod Casement about SED design that would most suit their vessels. Measurements of the nets and codends were made to enable design and construction to begin. Mr Cawthorn spent time looking over the vessels and net design to determine the initial design of a SED to suit these types of vessels.

Based on Mr Cawthorn's March visit and discussion with SETF fishers, the following issues were highlighted as important considerations in the construction and deployment of the SEDS:

- Vessel deck layout:
  Deck layout is compromised by the placement of a large frame structure over the fish sorting pounds. Available deck space may make handling SEDs and other mitigation gear difficult.

- Vessel operation:
  On hauling onto the net drum, the body of the net is hauled up and over a vertical transom onto a net drum, the codend is then lifted onto the frame to facilitate emptying into the fish pounds.

- Catch composition:
  Catches may include 20–25 common species including large skates and rays. Large sponges can also create problems. A large catch may be 10–15 tonnes.

- Predicted operational problems:

Handling with limited deck space; clearance above the deck; clogging/entanglement by skates, rays and sponges, dimensions of net rollers and drums.

Based on the above, the broad SED specifications were determined based on:

- working circumference of the net
  (Number of meshes round, stretched mesh length knot - knot).
- Number of sections
  (need to fold around net drum and be more workable on small deck).
- Dimensions of each section
- Material for grid construction
  (steel, "plastics", carbon fibre etc all options being investigated)
- Solid versus tubular s/steel ie weight consideration and strength.
- Handleability
  (safety, utility)
- Animals, fish etc to be excluded
- Cost

The project trialled three SED designs during two trips on different SETF trawl vessels:

1. **Motnets SED** (designed by Mr Martin Cawthorn; fabricated by Motueka Nets Ltd, Nelson, NZ and installed by Tony Guarnaccia)
2. **Guarnaccia Soft SED** (generally based on the Motnets design; fabricated in a more flexible material by SETF fisherman Mr Tony Guarnaccia)
3. **Bennett SED** (designed and fabricated by Mr Peter Bennett; installed by David Guillot). This SED was adapted from the TEDS used on the fish trawlers in the Northern Territory and Queensland largely to reduce the capture of turtles, large sharks and rays.

The Motnets and Guarnaccia Soft SEDs were both trialled on the 23 m fishing vessel, the Lady Miriam, owned by Mr Tony Guarnaccia of Lakes Entrance and skippered by Mr Trevor (Bluey) Hunt. The Bennett SED was trialled on the 21.6 m fishing vessel, the Western Alliance, owned by David Guillot of Lakes Entrance and skippered by Neil McCallum.

Motnets SED

The Motnets SED was constructed to fit the operational parameters of the Lady Miriam's primary net. The SED was constructed of 20 mm stainless steel bar and fabricated into three separate grid sections (to allow greater flexibility when being wound around a net drum), each hinged together with Hammerlock links (Figure 2a). The grid was constructed of vertical bars set at 230 mm centres welded to a surrounding frame. The SED was sewn into an extension piece/lengthener at and angle of about 45° from the vertical. On the top panel of the net, a triangular escape hatch, about 1.2 m from the apex to the base was cut along the mesh bars back to the top bar of the SED grid. Over this escape hatch, a hood of 40 mm mesh extended forward (towards the mouth of the net), from the top bar of the SED to a point just forward of the escape hatch apex (Figure 2b). Attached to the leading edge of the hood was a kite made from 300 mm wide conveyor belting designed to provide lift to open the hood when the net is being trawled. The purpose of the SED is to prevent seals from entering the codend where they are more likely to drown. Instead, it passively directs the animals to the permanently open escape hatch above. The hood has the effect of providing a dark area above the escape hatch which appears to prevent fish from recognising the escape hatch as an exit. The kite and small meshes direct a positive flow of water down through the upper section of the grid which assists the direction of the fish through the grid into the codend.

Guarnaccia Soft SED

The Guarnaccia Soft SED was constructed of polypropylene and metal combination wire (Figure 3). The dimensions of the Guarnaccia Soft SED were taken directly off the Motnets SED. The outside ring was fabricated from 2.5 cm diameter combination wire with the ends swaged together. The vertical “bars”, spaced at 230 mm centres were swaged to the outer ring and the spacings maintained with two swaged horizontal bars. The grid structure was then sewn into an extension piece of 90 mm mesh netting at the same 45° angle as the Motnets grid. An escape hatch of similar dimensions to the Motnets SED was cut along the mesh bars from the apex back to the top bar of the grid and a hood with kite attached. The entire package could then be inserted into the net joining the codend and extension piece with simple “zipper“ stitches.

Bennett SED

The Bennett SED is a one piece design with seven vertical bars spaced 157 mm apart swaged to each end as well as to a centre, horizontal cross-bar (Figure 4, Figure 5a). Vertical bars consist of 16 mm stainless steel wire covered by polyurethane tube. The outer frame is constructed of stainless steel tube curved at a small angle giving the Bennett SED a slight overall curve Figure 5b. Its flexibility meant that it was easily wound around a net drum. Consistent with trials of this design in the Pilbara trawl fishery (Stephenson and Wells, 2006; Stephenson *et al.*, 2006), the escape hatch was positioned on the underside of the net to aid the removal of large rocks and sponge as well as seals. Escape was thought possible despite the hatch being on the bottom of the net, because this section of the net is not in constant, hard contact with the sea floor. Stephenson and Wells (2006) and Stephenson *et al*. (2006) showed that using this configuration significantly reduced unwanted catches of dolphins, large sharks, turtles and large rays. A sock was sewn around the escape hatch to reduce incidental loss of fish. The Bennett SED was trialled on the fishing vessel Western Alliance, initially using no floatation.

Underwater video

Footage of the operation of the SEDs was taken with underwater, digital video cameras to study the effectiveness with respect to loss of catch and excluding seals. The video camera used was constructed by SciElex and supplied by the Australian Fisheries Management Authority. Video footage of SED operations was collected on the Lady Miriam and the Western Alliance to monitor: (a) seal encounters and escapement, (b) fish loss, (c) technical aspects of SED design, (d) onboard handling of SEDs and (e) OH&S issues.

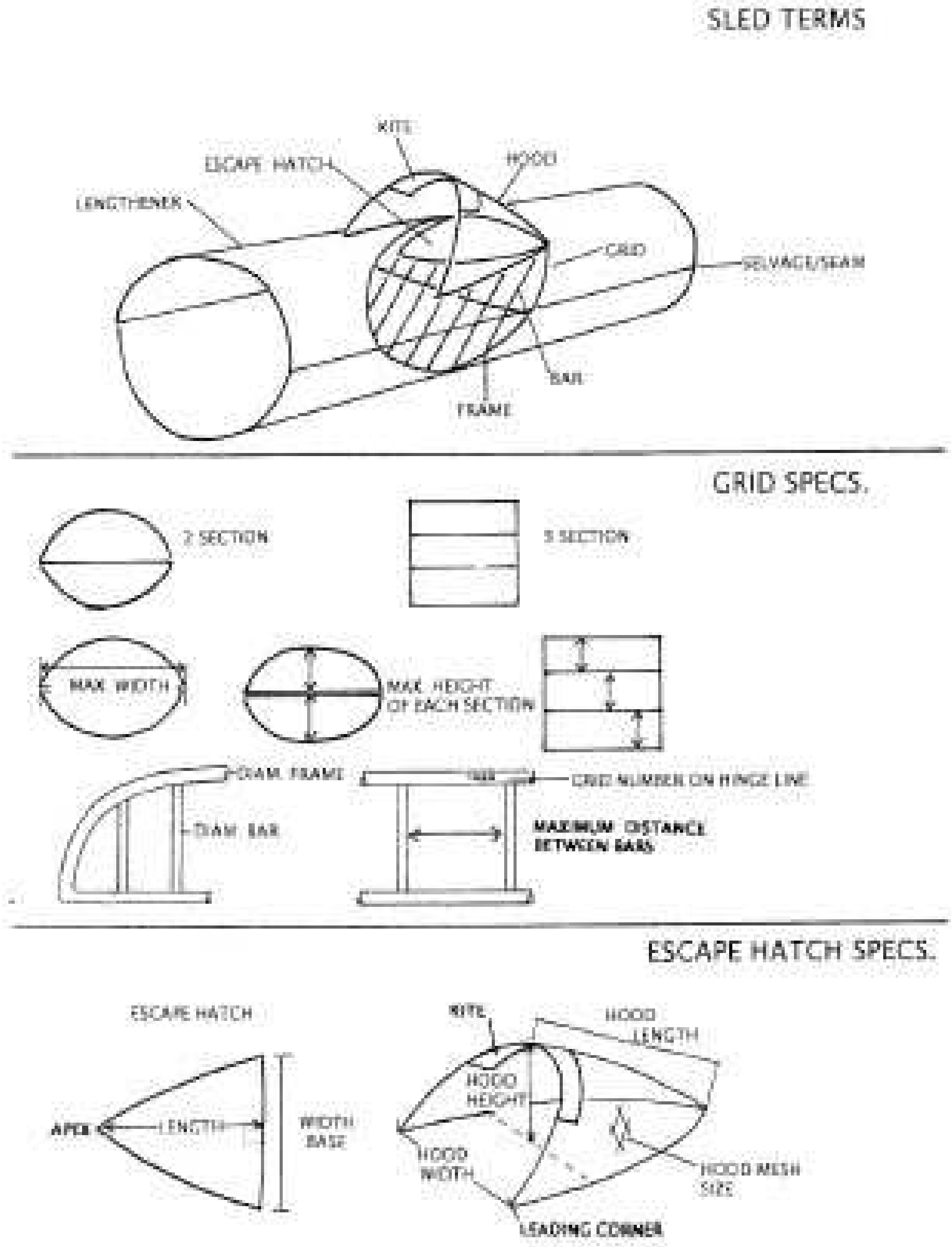

Figure 1. Diagram of a generalised SED showing the terms used to describe the different parts of the SED, including grid and escape hatch specifications (from Cawthorn).

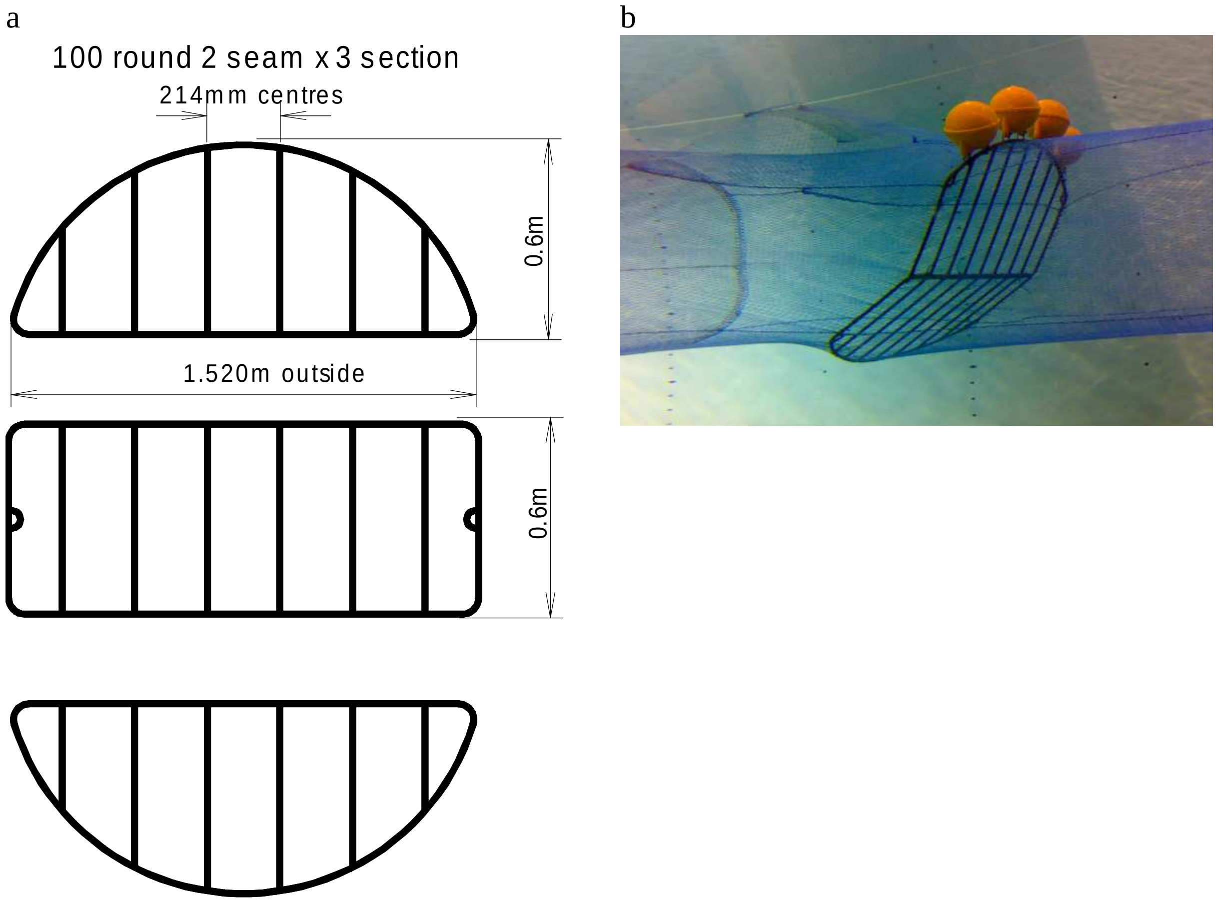

Figure 2. a) Design of the Motnets SED (note: mesh hoods were used with this design); b) image of a bycatch reduction device in a flume tank similar to that being developed as a SED for the SESSF wet boat fleet.

Figure 3. Construction of the Guarnaccia Soft SED

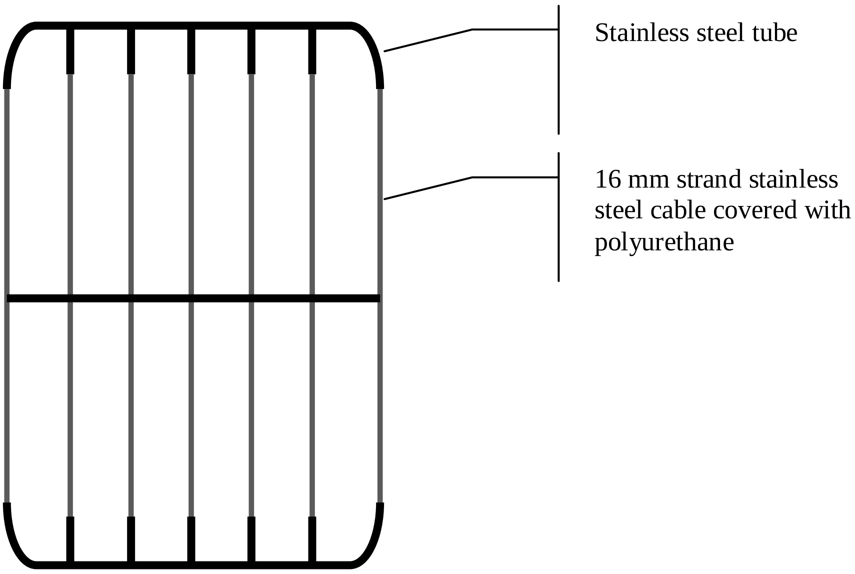

Figure 4. The construction of the Bennett SED, trialled on the Western Alliance. The escape hatch was positioned on the underside of the net to aid the removal of large rocks, rays and sponge as well as seals.

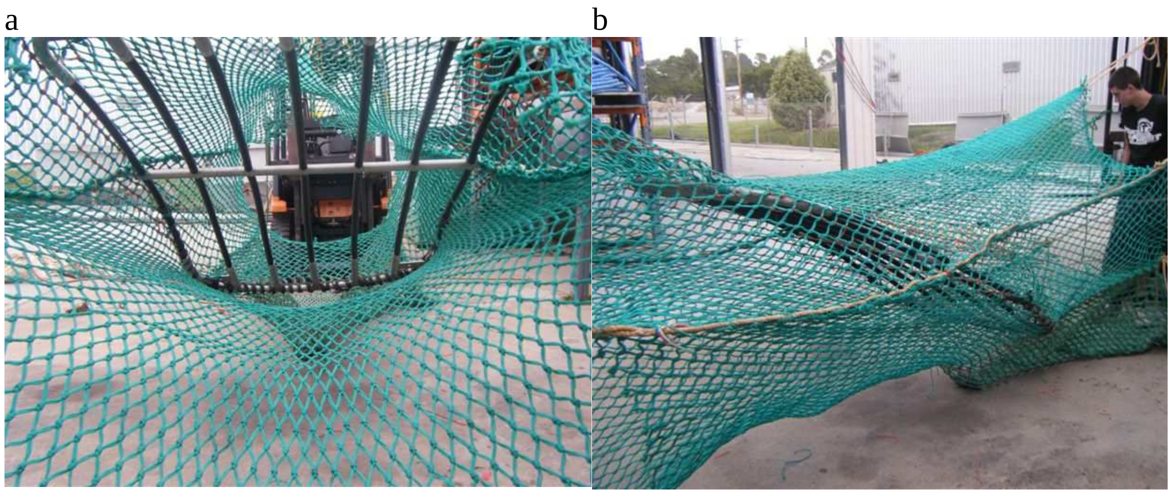

Figure 5. Position and installation of the Bennett SED in the net of the Western Alliance view from a) forward of the SED and b) at the side, showing the slight curve of the SED.

Sea Trial 1

The first sea trial took place over five days during August 2008 on the 23 m fishing vessel, the Lady Miriam.

The trawl grounds worked in eastern Bass Strait extend to the shelf edge. The usual inshore working depth ranges from about 24–162 m (45–100 fm). Shot duration is normally 3–4 hours and large catches will be about 10–15 tonnes.

The trawl nets used on the Lady Miriam varied in size and design but were typically constructed of 90 mm stretched mesh netting with a codend about 33 meshes long x 100 meshes around. The nets were sometimes deployed with an extension piece/lengthener of 90 x 50 x 100 meshes around. Two SEDs were trialled during this trip, the Motnets SED and the Guarnaccia Soft SED.

Video Recording

The camera records onto an Archos recorder system providing about 10 hours recording time. Illumination was white light produced by a cluster of LED bulbs in a single unit. Before deployment, the Archos unit would require setting up and activating. The recorder was inserted into the recorder casing and the 'O' ring-sealed and the end-cap fixed to the housing with eight hex head bolts. The separate camera and light units were connected to the recorder via wet plugs on the housing. The entire camera unit sat in a square frame attached to the net in the optimum viewing position, in this case, about 75 cm from the apex of the escape hatch facing downstream. At this distance the entire escape hatch and hood assembly was visible. Four pins on the camera frame dropped into corresponding holes on the net frame and were secured with 'R' clips and a safety line. This arrangement allowed the camera to be mounted on top or inside the net attached to the same frame without altering the position. As soon as the trawl was hauled aboard at the end of the shot the camera was removed and the light disconnected. The housing would be opened, the recorder removed and the video files immediately downloaded onto a laptop computer. The Archos system records at a typical rate of about 1 GB per hour. A new file would be created when recording began. When the maximum file size is reached a new file is started automatically. Hence trawls deployed for 2–3 hours would be recorded as 3–4 separate files. These were labelled with the shot number followed by a suffix a, b, c, etc. depending on the number of files for the particular shot. Depending on the total time of shots the batteries would power the recorder and lights for up to two shots. However on most occasions batteries were changed after each shot. The downloaded underwater footage was reviewed at normal speed between shots. Where possible the footage was used to make any necessary adjustments to gear.

On 23 August 2008, following downloading of the video files the camera was reassembled, checked and the light would not illuminate. On inspection it was found the battery wires had chafed through the insulation exposing the copper wires within. These had shorted on the inside of the housing melting the insulation. The burned section of the wires was removed and the wires rejoined. Regrettably the short circuit had apparently destroyed the battery reducing recording intervals to alternate shots.

Sea Trial 2

The second sea trial took place on the vessel Western Alliance from 22 February to 28 February 2009. This vessel is owned by Mr David Guillot and was skippered by Mr Neil McCallum.

Video Recording

The video unit used during the second trial consisted of a 1000MSW housing fitted with Sony HDR-CX7E Video and was illuminated using a 1000MSW housing fitted with 8 x creexr high bright blue LEDs (Figure 6). These units were constructed by Raytech Services Pty Ltd, Western Australia. More than five hours continuous recording was possible using standard definition onto a 16GB memory card. The housings were attached to the net or SED at a variety of locations to get different viewing angles. As soon as the trawl was hauled aboard at the end of each shot the camera was removed and the light disconnected. The housing would be opened, the recorder removed and the video files immediately downloaded onto a laptop computer. Where possible the footage was used to make any necessary adjustments to gear.

Figure 6. Camera and light housing constructed by Raytech Services and used during the 2nd sea trials of the Bennett SED.

On the Lady Miriam, trawls are hauled over a vertical transom (no ramp) then up over a 2 m high, 20 cm diameter stainless steel deck frame before being taken up on one of two net drum winches. The upper drum is about 1 m long and the lower split into two 92 cm wide sections. The codend is hauled aboard over the deck frame and the contents dropped into the pounds beneath the frame for sorting. Fish are boxed and put below deck where they are cooled with Refrigerated Sea Water (RSW). The codend and adjacent meshes are shaken and picked clean by the crew before each shot.

Motnet SED

Of the 5 tows the Motnet SED was deployed there were at least 3 occasions where hard contact with the bottom had caused the upper grid section to slip in its hammerlock connections and deform into a "lazy Z" shape rather than maintaining a straight line at 45°. Despite the SED attitude being flatter than it should have been, most fish species passed through the bars with little difficulty and the video record suggests that escapement was insignificant. The obvious exception was the very large skates and rays that stuck to the bars. The hood section of the SED remained fully inflated throughout all tows. In an attempt to get the grid to sit up straighter three extra floats were attached to the outside of the top bar to provide extra buoyancy. The novelty of the SED to the crew and its weight required new handling techniques on board. The SED was positioned a long way down the net and when stowed on the net drum tended to fold on top of the existing netting (Figure 7). Without a grid (or with the soft SED), the netting will fold up as it is wound on the net drum.

It is important to stress that any properly made rigid grid must conform to the operational dimensions of the net during trawling which is considerably wider than when the net is wound onto the net drum. Consequently, the SED may require a different method of stowage rather than on the net drum – which would be tedious and unworkable. Alternatively, the grid could be redesigned to fold wholly or in part, or it could be manufactured of flexible materials such as carbon fibre or fibreglass so that it suited the dimension of the net, yet was able to be rolled up onto the net drum.

It is important to realise that having rigid objects moving at head height above a moving deck is not appropriate from a safety point of view, and there was concerns from the crew about the safety of the rigid grid system.

Guarnaccia Soft SED

The Guarnaccia Soft SED was trialled during 9 different shots. The fabrication of flexible grids always involves major compromises. In rigid grids, the supporting frame allows tension to be put on the vertical bars to allow seals and other large animals to slide along the bars toward an escape exit. If the frame itself is soft and flexible three things happen:

1) the vertical bars cannot be sufficiently tensioned to exclude unwanted species,
2) as the net undulates along the bottom, the entire grid will deform and the vertical bars squash down and spread forming elliptical holes through which determined animals such as seals can pass, and
3) because the structure is flexible, when a large animal comes into contact with the grid it will sag, like a trampoline, as there is nothing to hold it rigid and animals have difficulty pushing off it.

For the above reasons, there was not great expectations for the success of the Soft SED and the problems above became apparent during the trials. Despite this, the Guarnaccia Soft SED was worth testing to demonstrate these issues to fishermen and to show how it performed compared to a rigid grid. The other value of this trial was that it demonstrated the ease of handling of soft grids in how they were able to be rolled up on the net drum. This pointed the way to a future design which would be some compromise between the rigidity of stainless steel grid and ease of use of a more flexible grid yet maintaining the ability to deflect seals.

Seal Exclusion

Only one Australian fur seal was taken during the 19 shots made between 20 August 08 and 25 August 08. A sub-adult male Australian fur seal entered the net via the net mouth during shot 6. It travelled down the net and passed through the Guarnaccia Soft SED into the codend. Soon after it entered the codend a large number of skates were taken and became stuck to the flexible vertical combination wire “bars” barring the passage of the fur seal back out of the net to open water. Its only other escape route from the net, ie. the escape hatch, was closed with the hood sewn shut over the aperture. Based on observations of the dead seal on deck, it was probable that this seal died just prior to hauling, i.e., carcass still warm with no obvious evidence of rigour mortis..

Video Observations

In the 5 days at sea on the Lady Miriam, the camera was deployed on 14 (74 percent) of the 19 trawl shots made (Table 1). This resulted in 22 video files with a total duration of about 37 hrs 51 minutes. In 11 (79 percent) of the shots the camera was hung inside the trawl to give the clearest possible picture of the catch, the grid and escape hatch. During two shots (14 percent) the camera was deployed on top of the net to ensure the hood was deploying properly and to observe any fish escapement. All files were reviewed first at double speed to see if there were any easily detected events. Such events were logged and the file then run through at normal or slow speed to verify any observations. A major difficulty with video and bottom trawling is the sediment cloud raised from the sea floor which can completely obscure the field of view. Sediment clouds of varying duration and density were present in all the video files examined. The camera supplied by AFMA is a robust but old unit. The LED white light illuminator, while adequate for most of the day shots, tended to produce a fairly narrow spot at night. The addition of a second LED light would have been a significant benefit particularly when the water was turbid, however, this would have reduced battery duration. Underwater video technology has been continuously improving and remains the most promising technology for assessing SED and fishing gear performance.

Figure 7. Protruding Motnet SED wrapped around the net drum.

Table 1. Seal Trial 1 - SED and camera use log.

Shot	SED	SED In Net	Camera Position	Hood Open/Closed	Comments
01	Motnet	No		Open	
02	Motnet	Yes	Inside	Open	
03	Motnet	Yes	Inside	Open	Motnet SED removed
04	Guarn. Soft	Yes	Inside	Open	
05	Guarn. Soft	No		Open	
06	Guarn. Soft	Yes	Inside	Closed	1 Large skate over grid, 1 dead sub-adult male Australian Fur Seal behind grid.
07	Guarn. Soft	Yes	On top	Closed	
08	Guarn. Soft	Yes	On top	Closed	SED grid Removed end shot
09	Guarn. Soft	Yes	Inside	Closed	
10	Guarn. Soft	No		Closed	Skipper shot away soon as net cleared
11	Guarn. Soft	Yes	Inside	Closed	
12	Guarn. Soft	No		Closed	Chafed wires ex battery shorted against housing, battery dead.
13	Guarn. Soft	Yes	Inside	Closed	Camera now every alt. shot
14	Guarn. Soft	No		Closed	Skipper wants 2 quick shots in succession.
15	Guarn. Soft	No		Closed	
16	Guarn. Soft	Yes	Inside	Closed	
17	Motnet	Yes	Inside	Open	3 floats needed on top bar
18	Guarn. Soft	Yes	Inside	Closed	No grid
19	Motnet	Yes	Inside	Open	Extra flotation on

Sea Trial 2

This trial took place during 22 February to 28 February 2009 on the Western Alliance departing from, and returning to Hobart, Tasmania. The SED used during this trial was the Bennett SED which was sewn into the spare net. The Bennett SED was used during 6 of the 19 shots observed during this trip during which the under water video camera was used 5 times (Table 2). The number of shots in which the Bennett SED was deployed was somewhat restricted during this trial for a few reasons. First, the light housing flooded early in the trip (Shot 7) which prevent the SED being trialled during any further night shots. Second, the headline of the net containing the Bennett SED broke during an early morning shot and had to be repaired during that day. As it was not a chartered vessel, commercial fishing continued using the net without the SED. Another reason was that continual modification was being made to the positioning of the SED based on the footage from the previous shot, and often that meant that the alternate net (without the SED) had to be deployed.

The Bennett SED

The Bennett SED was semi rigid, but flexible enough to wind onto the net drum. This made it easy for the crew to handle. The addition of the underwater camera and light unit added extra weight and required some care while deploying and retrieving, however without the camera, the SED was easily would easily be deployed, and required very little extra effort.

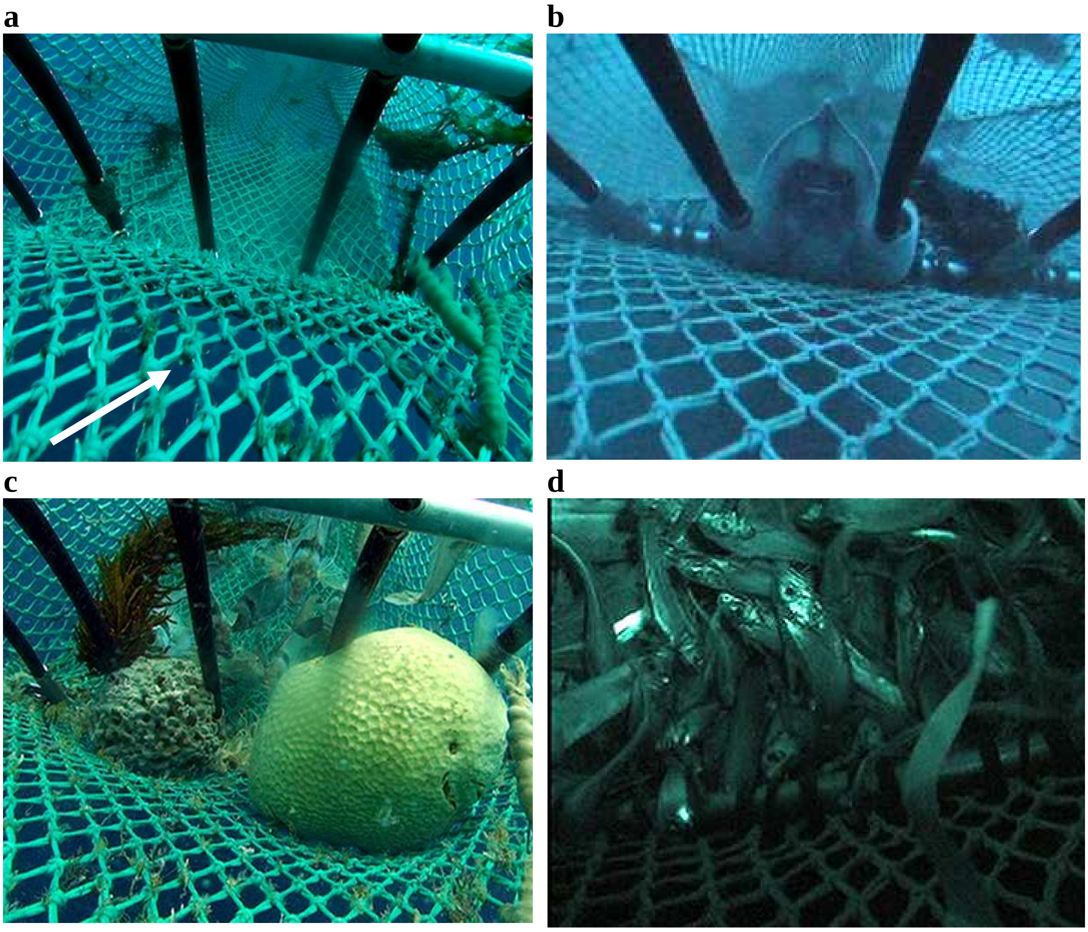

Figure 8. Images of the Bennett SED from the underwater video taken during 2nd sea trial showing: a) the SED sitting with the floor of the net ballooning up; b) a skate caught on the bottom of the SED; c) sponge accumulating at the base of the SED rather than going out through the escape hatch; and d) blue grenadier and other fish clogging up the SED.

Without floatation, the Bennett SED laid down at a flat attitude, possibly caused by the weight of the SED and camera unit. This undoubtedly affected the flow of water through the net, and may had assisted fish to easily, at times effortlessly, swim or settle on middle sections of the net. The addition of bubble floats helped to steepen the attitude of the SED, however the mesh on the floor of the net in front of the hatch stayed loose, ballooning up in front of the lower sections of the SED as marked by the arrow in Figure 8a. This appeared to reduce the flow in the bottom section of the net, and reduced the chance of large objects being funnelled into the hatch. Increasing the attitude by 2.5 meshes again resulted in a better net opening, but the mesh in front of the SED still appeared slack and ballooned upwards.

Large skates hitting the SED often failed to either pass through the SED, or be directed down towards and through the escape hatch. Rather, they became straddled across two of the vertical bars of the SED (Figure 8b), sometimes creating a blockage. Likewise, sponge (Figure 8c) and Australian burrfish sometimes formed blockages, as could a variety of other species (Figure 8d). In these cases, large quantities of commercial species were lost through the escape hatch. This was particularly evident in the video imagery during the first shot using the SED where blue grenadier and blue-eye trevalla (among other species) can be seen exiting through the escape hatch. Accordingly, modifications were made at-sea in an attempt to increase the performance of the SED.

The escape hatch was essentially a slit across the floor of the net with an escape "sock" sewn onto it. Unlike the two SEDs trialled on the first trip, there was no external structure that forced the escape hatch open, and consequently, the hatch remained closed during the trial unless forced open by a large object, which appeared to usually only occur during hauling. Even when sponge and sharks hit the base of the SED while hauling, they rarely passed through the escape hatch, which may have been held tightly closed by the pressure of the net.

It is clear that significantly more work needs to be done in setting the Bennett SED up correctly for SETF wetboats to improve flow of water and fish through the SED, and to more efficiently direct seals, skates and sponge to the escape hatch.

Seal Exclusion

Seals were seen on deployment or hauling during 13 of the 19 shots conducted. It is likely that seals were present during more shots, however these were hard to observe during the night. A total of six Australian fur seals were caught during this trip, two of them with the net containing the Bennett SED. On one of those occasions, the escape hatch was sewn up because the underwater camera was not going to be deployed. On the second occasion, the escape hatch was open and the camera deployed. In the imagery from that shot, an Australian fur seal can be seen inside the net at the SED approximately 1 hour into the shot. It does not find the escape hatch, and remains swimming strong enough to not get forced against the SED. The seal swims back past the camera and its fins can be seen shortly after. During hauling, a seal was seen falling out through the escape hatch while the net was being lifted over the stern. The status of this seal at the time of escape can not be obtained from the small amount of time it took to move past the video camera and out through the escape hatch.

Table 2. Seal Trial 2 - SED and camera use log.

Shot	SED In Net	Camera Position	Comments
01	Yes	Roof, forward of SED	Net remained flat, apparently due to weight of SED and camera
02	No		
03	Yes	Roof, forward of SED	Three bubble floats attached to SED
04	No		
05	Yes	Yes On top bar of SED	Three more bubble floats attached to SED
06	No		
07	No	Headline	Light housing flooded – restricting future camera shots to daylight.
08	No		
09	No		
10	Yes		Hatch sewn up to reduce loss of catch. 1 adult Australian fur seal trapped in front of SED.
11	Yes	On horizontal cross bar of SED	Seal seen at the SED did not escape through hatch. Seal in net while hauling, fell through hatch while hauling.
12	No		Headline broke during early morning shot in the net containing the SED
13	No		
14	No		
15	No		
16	No		
17	No		
18	Yes	On horizontal cross bar of SED	Angle of SED increased by 2.5 meshes.
19	No		

PERFORMANCE REPORTING

1. Progress against the objectives of the Activity.

Project Objectives	**Objectives Completed (please discuss)**	**Objectives Not Completed**
Development of 2 SED designs to suit SETF wet boat trawl vessels	Three different SEDs were identified/designed for trial on SETF wet boat trawl vessels.	
SED construction and vessel preparation	The three SEDs were constructed and vessels selected for trials	
SED trials and modification	All three SEDs were trialled at sea during two cruises and modifications were made to enable better performance in the net.	
Reporting of Results	Results are reported in this document.	
Extension of project	The project has had considerable extension activities applied during 2008 back to SETFIA members and this will continue during 2009.	

2. Outcomes

Expected Outcomes	**Actual Outcomes Achieved (please discuss)**	**Outcomes Not Completed**
Development of an appropriate SED design for SETF wet boats	Three different SEDs were designed for wetboats. One of the essential characteristics required was that they were easily manageable by the vessels crew and could be stowed on net drums. One of the SED designs, whilst more typically used for seal exclusion on larger vessels did not meet this requirement. The other two SEDS met this requirement but of these, the soft SED was unlikely to be effective at excluding seals.	There remains considerable work to do before a SED suitable for roll-out to the wetboat fleet is developed. This initial work has been critical for industry but much more fine-tuning and modification is required.
Evaluation of the potential pros and cons of their uptake on the broader fleet	Performance of the Bennett SED was most encouraging, however, its configuration in the net requires further experimentation. In particular, the shape, size and location of the escape hatch did not allow easy escape of large sponge, skates or seals. Further, the build up of	

	fish on the SED, followed by the subsequent mass funnelling of the catch out of the escape hatch is an issue for the profitability of the trawling operation. The ease of use of this SED also supports continued trials.	
Extension of the results to the broader trawl industry.	There has been an ongoing process of extension of this project to the broader industry through presentations at regular SETFIA meetings and as an item of the quarterly Industry Liaison Officer's report. This will continue during 2009 as will continued industry trials of the modified SEDs initiated through this project.	Extension of the results and support for ongoing trials and modifications will continue during 2009.

CONCLUSION

- Three different SED designs were trialled during two field trips on wetboats in the SEF on which underwater video imagery was captured.
- Of the three SED designs trialled, the Bennett SED showed most promise as it was easy for the crew to handle, stowed neatly onto the net drum and maintained a rigid shape during towing.
- Each SED suffered from the problem of skates getting stuck on the vertical bars, and on at least two of these occasions, this resulted in the loss of large quantities of commercial species through the escape hatch.
- Only one seal was observed to enter the net and exit through the SEDs escape hatch.
- The configuration of the Bennett SED in the net requires further experimentation to get the correct water flow, improve posture and to more easily allow unwanted catch such as seals and large skates through the escape hatch.
- Industry members are keen to continue these trials.

It should be emphasised that in other fisheries for which suitable mechanical solutions to TEP species bycatch reduction have been achieved (e.g. Turtle Excluder Devices in the Northern Prawn Fishery, Sealion Excluder Devices in the NZ squid fishery or Seal Excluder Devices for factory boats in the SESSF blue grenadier winter fishery), it has taken many years, large human resources and often millions of dollars to achieve the desired outcome. This one year ($100,000) NHT project represents the first step to achieving this goal in the SESSF wet boat trawl sector. It is a long process. That we have come up with at least one design that skippers and crews are interested in continuing to investigate is an important is an important achievement. SETFIA is committed to continuing this work and would like to use the unexpended funds from this project to continue the trials and extension.

DIRECTIONS FOR THE FUTURE

- Concentrate further design variations on a more flexible version of the Motnet SED or a top-opening Bennett SED
- Continuing review and redesign SED features such as hoods and placement of SEDs in the nets to maximise escapement of seals and minimise catch loss.
- Develop monitoring programmes to assess the true impact of the wet boat fleet on local pinniped populations and potential interaction mitigation methods.

REFERENCES

ABARE (2007). Australian Fisheries Statistics 2006, Australian Bureau of Agricultural and Resource Economics Canberra, June.

Arnould, J.P.Y. and Hindell, M.A. (2001). Dive behaviour, foraging locations, and maternal-attendance patterns of Australian fur seals (*Arctocephalus pusillus doriferus). Canadian Journal of Zoology* **79**: 35–48.

Goldsworthy, S.D., Bulman, C., He, X., Larcombe, J. and Littnan, C. (2003). Trophic interactions between marine mammals and Australian fisheries: an ecosystem approach: In: Marine Mammals: Fisheries, Tourism and Management Issues. Gales, N., Hindell, M. and Kirkwood, R (eds), CSIRO Publishing: Collingwood, Victoria. pp. 62–99.

Kirkwood, R., Gales, R., Terauds, A., Arnould, J.P.Y., Pemberton, P., Shaughnessy, P.D., Mitchell, A.T. and Gibbens, J. (2005). Pup production and population estimates of the Australian fur seal. *Marine Mammal Science 21 (2): 260-282.*

Knuckey, 1. A. and Stewardson, C. L. (2008). An industry-based program to monitor seal interactions in the Commonwealth Trawl sector of the Southern and Eastern Scalefish and Shark Fishery. Final Report to Fisheries Research and Development Corporation (FRDC). Report No. 2005/049. 61 pp.

Knuckey, I.A., Eayrs, S. and Bosschietter, B. (2002). Options for reducing incidental catch of seals on wet-boats in the SETF: a preliminary report. Marine and Freshwater Resources Institute. Final report to the Australian Fisheries Management Authority (AFMA). ARF Project R01/0887. 59 p.

Stephenson, P. C. and Wells, S. (2006). Evaluation of the effectiveness of reducing dolphin catches with pingers and exclusion grids in the Pilbara trawl fishery. Final report to Fisheries Research and Development Corporation on Project No. 2004/068. Fisheries Research Report No. 173, Department of Fisheries, Western Australia, 44p.

Stephenson, P. C., Wells, S. & King, J.A. 2006. Evaluation of exclusion grids to reduce the catch of dolphins, turtles, sharks and rays in Pilbara trawl fishery. DBIF Funded Project. Fisheries Research Report No. 171, Department of Fisheries Western Australia, 24 pp.Stewardson, C.L. and Knuckey, I.A. (2005a). South East Trawl Fishery: Seal Bycatch - Guidelines for reporting and data collection. Bureau of Rural Sciences, Canberra. DVD/Video production. Andrew Marriot Productions, Images Online Pty Ltd., Canberra. NHT Project 44144. ISBN 1 921192 02 X (for the video). ISBN 1 921192 03 8 (for the DVD).

Stewardson, C.L. and Knuckey, I.A. (2005b). South East Trawl Fishery: Seal Bycatch - Guidelines for reporting and data collection. Bureau of Rural Sciences, Canberra 20p.

Tilzey, R.D.J., Goldsworthy, S.D., Cawthorn, M., Calvert, N., Hamer, D.J., Russell, S., Shaughnessy, P.D., Wise, B. and Stewardson, C.L. (2006). Assessment of seal–fishery interactions in the winter blue grenadier fishery off west Tasmania and the development of fishing practices and Seal Exclusion Devices to mitigate seal bycatch by factory trawlers. Final Report to FRDC. Project no. 2001/008, Canberra, 69 pp.

ACKNOWLEDGEMENTS

SETFIA thanks Dr Ian Knuckey, Mr Martin Cawthorn and Dr Matt Koopman for conducting this project and preparing the final report. We would also like to thank Mr Tony Guarnaccia, Mr Rod Casement and Mr David Guillot for their involvement and commitment to the project. Appreciation to the skipper and crew of the Lady Miriam (Mr Trevor (Bluey) Hunt, Benny Knoll, Aaron Boehmke and Sean Spencer) and the Western Alliance (Neil McCallum, Ash McCallum, Jamie and Johno).

Mr Dave Johnson from Australian Fisheries Management Authority (AFMA), provided a lot of assistance in the development of the project and Mr Michael Gerner and Mr Michael Tudman also from AFMA assisted in the provision of cameras for the first sea Trial. Many thanks to Gail Richey for providing the administrative support for the project.

SETFIA wishes to thank the National Heritage Trust (NHT) National Project 44144 – “National Strategies to Address Marine Wildlife Bycatch Issues in Australian Fisheries” for the provision of funds to conduct the project.

APPENDIX 1

Extension of project results in ILO Reports

Article printed in 2009 February ILO Report

Bycatch reduction projects

NHT National Project 44144 – "National Strategies to Address Marine Wildlife Bycatch Issues in Australian Fisheries" has a focus on developing and implementing nationally coordinated strategies and activities to reduce fisheries bycatch, including seals, sharks, sea birds, turtles, dugong and possibly other species. Two projects were funded under this Project as described below.

Trials of SEDS on SETF wet boat vessels

This project seeks to modify and trial two existing types of seal excluder devices (SEDs) on a typical SETF "wet boat" (small 18-23 m trawler that uses ice/brine with no freezing / processing capacity) to determine their effectiveness and potential for wider use in the fishery.

SETFIA now has three experienced skippers involved in this project, Tony Gurnaccia, Rod Casement and David Guillot. They are investigating the application of different designs of SEDs that may be suitable for wet boat trawlers.

The initial design of a SED to suit these types of vessels was developed by Martin Cawthorne and constructed by Motueka Nets. The initial designs of the Cawthorne SEDs are at Figure 1.

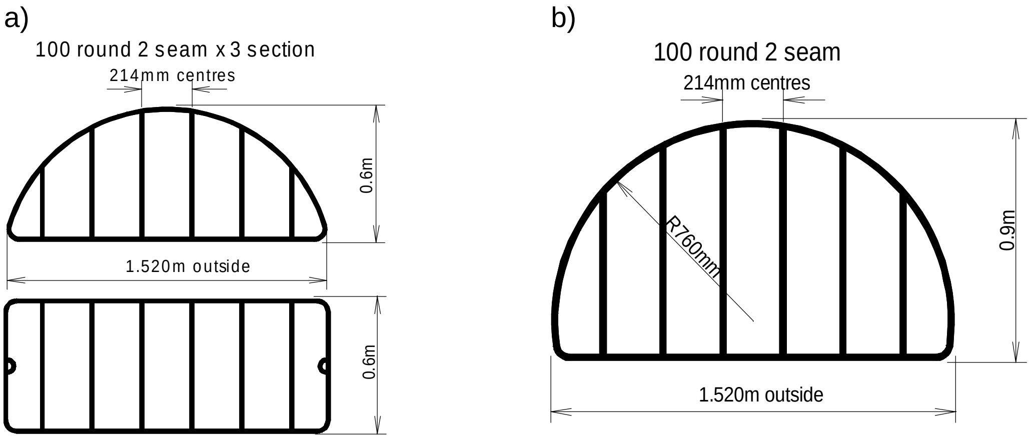

Figure 1. Design of the SED prototypes to be used with mesh hoods on the SESSF wet boats a) three section SED; b) two section SED.

Based on the above, an alternate grid was designed by Tony Gurnaccia and constructed of polypropylene and metal combination wire. The dimensions of the "TG" SED were taken directly off the Motnets SED. The outside ring was fabricated from 2.5cm diameter combination wire with the ends swaged together. The vertical "bars", spaced at 23cm centres were swaged to the outer ring and the spacings maintained with two swaged horizontal bars. The grid structure was then sewn into an extension piece of 90mm mesh netting at the same 45° angle as the Motnets grid. An escape hatch of similar dimensions to the Motnets SED was cut all bars from the apex back to the top bar of the grid and a hood with kite attached. The entire package could then be inserted into the net joining the codend and extension piece with simple "zipper " stitches.