MIT2006/02 Mitigating Seabird Interactions with Trawl Nets

Draft methodology for trials

Contents

1. Background

The Department of Conservation has commissioned a research program to investigate mitigation of incidental seabird capture in trawl nets.

Specific objectives of this project are:

1. To characterise the nature and extent of interactions between seabirds attracted to trawl vessels and trawl nets;
2. To identify ways in which these interactions can be avoided or reduced;
3. To trial methods that show the potential to reduce these interactions.

Project Outputs

This project has a series of required outputs, four of which have been completed:

1. A report which describes and analyses data and information relating to the capture of seabirds in trawl nets;
2. Presentation of this report and its findings to a Conservation Services Programme/National Plan of Action (Seabirds) Technical Working Group;
3. Convening a workshop, involving relevant experts, to identify possible methods to reduce the capture of seabirds in trawl nets;
4. A report from the workshop which identifies possible methods to reduce the capture of seabirds in trawl nets; selects one or more methods suitable for at-sea trials; and leads to the development of detailed proposals for conducting these trials.

This paper includes the detailed framework for the next two outputs:

5. **Prepare a proposal, or proposals, for at-sea trials of methods identified at the workshop;**
6. **Conduct trials.**

The workshop (Output 3) agreed to conduct additional data gathering, and to carry out two specific trials.

Data gathering – Fleet Characterisation

The workshop identified a number of factors, based on previous work, which may, or are known to, contribute to seabird mortality in nets. The incidence or severity of these factors varies considerably between vessels, depending on the characteristics of the vessel itself and its management.

It was agreed to carry out a survey to characterize the fleet to gather further information on vessel configuration or practices which may contribute to seabird mortality.

Sea trials

Two trials were agreed, testing methods to reduce the quantity of netting on the surface, and so reduce the risk of seabirds being entangled or injured:

1. **Turning the vessel while hauling in order to "close up" the net;**
2. **Tying the net while shooting.**

2. Fleet characterization study

Overview

A study will be carried out to characterize the deepwater trawl fleet (vessels larger than 28m). Information gathered will enable risk factors to be correlated with specific vessels or types of vessel, which in turn will enable targeted mitigation strategies.

This study will take two parts

1. Characterisation of the vessels – determine physical characteristics of the vessels that affect their risk profile;
2. Interviews with vessel Captains – determine vessel practices that affect their risk profile.

Factors that may affect risk of seabird capture

Vessel type and design

1. Fresh fish or processing vessel – the latter produce offal which must be fishmealed or discarded;
2. Vessel processing method – filleting, H&G, surimi etc, which affect processing rates and offal quantity;
3. Availability and capacity of a fishmeal plant for disposal of offal;
4. Availability of a net roller, which enables faster hauling;
5. Deck space, which affects hauling time and ability to mend nets on board.

Net type or design

1. Midwater or bottom trawl – midwater nets have larger mesh, cover more surface area and take longer to shoot than bottom trawls;
2. Net size and mesh size.

Operational practices

1. Doors up turns – turns made with the net on the surface;
2. Removal of stickers – removal of meshed fish from the net before shooting;
3. Mending the net in the water, especially midwater trawls;
4. Amount of offal discharged during normal fishing operations;
5. Offal control practices:
    a. Accidental spillage to open scuppers, sumps, cutter pumps;
    b. Discharging offal on shooting and hauling;
    c. Ability of vessel to hold offal during these periods.

Environmental factors

1. Fisheries targeted - SQU, HOKI, SBW, SCI, ORH, JMA, other;
2. Proximity to large bird numbers –rookeries, bird migration routes;
3. Effect of weather.

2.1 Part 1 - Vessel characterisation

Data collected

The first part of the study will collate information on the vessels themselves, with an emphasis on the characteristics that may create risks of bird capture.

This part will be carried out by a review of all vessels in the deepwater fleet (vessels over 28m overall length).

The fleet can be divided into six distinct categories:

- Fresher
- H&G – Ukraine
- H&G – Korea
- Fillet and H&G – domestic
- Surimi – Japan
- Fillet – Poland

Each vessel will be characterized under the following headings:

Item	**Options/measure**	
Vessel size	Length in meters	
Target fisheries	Hoki spawn Hoki year-round Squid trawl Southern blue whiting	Deepwater (ORH and OEO) Other middle depth Jack mackerel (pelagic)
Trawl method(s) and size (ground rope length; headline height)	Midwater trawl Bottom trawl	
Deck layout	Net roller available (for mid-water trawls)	
Processing plant	None (fresher only) Fillet	H&G Surimi
Processing capacity	Input, greenweight tonnes/day	
Offal disposal	Fishmeal plant Fishmeal capacity (tonnes, as % of daily offal production) Mincing during heavy processing Options for holding offal during critical fishing phases	
Mitigation devices	Tori line Baffler Warp deflector	
Offal management systems	Fishmeal plant Batch discharge of offal Mincing offal	

Data collected will be tabulated in a spreadsheet to serve as a reference document, and will be analysed to identify vessel characteristics which affect risk profile.

2.2 Part 2 – Captain interviews

The Captains of at least one vessel from each of the six fleet types will be interviewed during port calls during August and September. Where necessary, companies chartering foreign vessels will be asked to provide the assistance of an interpreter.

The purpose of these interviews is to determine current vessel operational practices, how those practices affect the risk of incidental seabird capture, and to establish current best practice for mitigating seabird captures in trawl nets.

Contents of questionnaire

The questionnaire will include detailed questions under the following major headings:

1. Amount of time the net is on the surface, and why this varies;
2. General fishing operations and net handling, and practices which affect the time the net creates a risk of Bycatch;
3. Offal discharge practices, and how these can be managed at critical phases of the trawl;
4. Net characteristics, and Captain's observations on where, when and perception of why birds get caught;
5. Environmental factors;
6. Other issues affecting risk of seabird captures, and Captain's suggestions on mitigation.

The detailed questionnaire is provided in Appendix 1

Analysis and outcomes of Captain Interviews

Data collected during the interviews will be collated by vessel type, and related to the information from the vessel characterisation study.

This information will be used to determine:

1. Current operational practices, and how these affect risk of seabird capture;
2. Current best practice (including how current recommended mitigation measures are applied);
3. Captains' observations on:
    a. Methods that can or could be used to avoid or minimise bird captures in trawl nets;
    b. Whether any proposed seabird capture mitigation practices could result in marine mammal captures.

See appendix 1

3. Seabird capture mitigation trials

A number of mitigation methods have already been implemented to target specific identified risk factors. These have primarily focused on factors that cause deaths of large birds (albatrosses and mollymawks) from warp strikes.

The workshop focused on a further set of risks that primarily affect smaller diving and swimming birds, that is petrels and shearwaters. These feed on fish or fish waste drifting over the net during shooting and hauling, or fish in the net or net meshes (stickers). These birds often swim through or dive through the open meshes into the net, then get caught and drown when they can't get out.

It has been suggested that if the bulk of the netting on the surface was reduced during hauling and shooting, birds would be less likely to swim into the netting and get caught. If the bulk of netting can be reduced during shooting, the net may also sink faster, reducing the time it is available for bird interactions.

Two possible methods were identified to reduce the bulk of netting on the surface, and hence reduce the risk to birds. These are:

1. Turning the vessel during hauling to "close up" the net
2. Net binding when shooting.

While net binding has been tried in the Falkland Islands, neither of these methods has been thoroughly tested anywhere in the world, so there is little information available on their implementation, on the practical implications or on their effectiveness.

Consequently, the trials proposed below are preliminary trials. The primary objective of the trials will be to determine if and how these methods can be applied. Information will also be gathered on effects on seabird behaviour.

These trials are proposed to be carried out on trawlers using midwater (pelagic) trawls. These trawls are much larger than bottom trawls, with much larger meshes, so the amount of netting floating on the surface is greater and the risk of birds getting entangled in the netting is greater.

3.1 Trial 1 – Closing Net by Turning the Vessel During Hauling

Background

The mesh in trawl nets spread out on the surface after the trawl doors are on the vessel, and while the net itself is being hauled aboard. While the net is on the surface, birds swim around, or dive on, the net to feed.

Turning the vessel while hauling can "close up" the net, reducing the amount of netting on the surface. Closing up the net also reduces mesh opening, so it is suggested that adopting this as standard practice could reduce the chance of birds swimming or diving into the net and becoming trapped.

However, there are practical issues associated with this method:

1. On busy fishing grounds, or in bad weather, it may be difficult for vessels to continue turning safely. Risks include collision with other vessels or injury to crew on a rolling deck. The Captain will need the discretion to do a continuous turn or a series of turns from side to side;
2. Some vessels use a net drum to stow the midwater trawl. This has the advantage of doubling hauling speed, but it is important that the net is fed onto the net drum correctly to prevent subsequent problems when shooting. It will be necessary to establish whether hauling the net up one side of the stern ramp can be done without causing problems when stowing or shooting the net, or causing safety issues on the deck.

It will also be essential to establish that this method doesn't increase risks to marine mammals.

Method

1. Trials will be carried out on two distinct and contrasting vessel types:
    a. A domestic fresh fish trawler; this vessel is reasonably typical of those vessels which haul the net onto a net roller;
    b. A foreign factory trawler – it is proposed to use a foreign charter vessel typical of those which don't have a net roller;
2. The trials will be of approximately the following duration:
    a. Fresh fish trawler, Cook Strait: 3-4 fishing days, with 2-3 shots per day, totaling up to 10 to 12 shots;
    b. Factory trawler, West Coast: 6-8 sea days (including transit to and from grounds), with 2-3 shots per fishing day, totaling up to 12 to 16 shots;
3. The Captain will be asked to haul alternate tows as follows:
    a. Hauling as per normal practice (the vessel typically steams in a straight line while hauling);
    b. Turning while hauling; the Captain will turn the vessel sufficient to pull the net to one side of the stern ramp, which should close up the meshes. It will be left to the Captain's discretion as to whether the vessel does a continuous turn or turns from side to side (S-turns).

Monitoring

The project observer will make observations or measurements each tow of the following:

1. The degree of helm required to close up the netting;
2. The estimated width of netting at the midpoints of each of the following sections of the net, at the point when that section of the net starts to come aboard the vessel:
    a. Head of the net (the rope section) – this part of the net is usually comprised of ropes 4 to 40m in length, rather than meshes;
    b. Large mesh section, typically containing 800 to 2000mm mesh;
    c. Medium mesh section, typically containing 120 to 600mm mesh.

    Figure 1 (page 18) shows a typical midwater trawl net, with the measuring points specified in this section.
3. The time required to haul the net on board, from the time the wing end weights are stowed, to the time the codend is completely on board;
4. The number of seabirds (categorised into albatrosses, petrels or shearwaters) on, or immediately adjacent to the net; this count will be made intervals during the haul;
5. General subjective observations; the project observer will be requested to observe and report on the following:
    a. Effectiveness of this technique in closing up the net and reducing risk to birds;
    b. Effect on safety of vessel and crew, and on gear handling;
    c. Effect on bird behaviour.

See appendix 2

3.2 Trial 2 – Binding the net during shooting

Background

When the net is shot away, birds often swim into or dive into the meshes to feed on fish remains in the net or fish waste drifting behind the vessel.

It has been suggested that if the net meshes remain closed up when the net is shot, birds will be less likely to get trapped in the net. This can be achieved by tying the net at intervals with some form of tie that releases when the doors spread the net open.

It is likely this will also result in the net sinking faster (as there will be less surface area causing drag) which will reduce the time the net is available for birds to dive on.

Limited trials have been carried out on this method in the Falkland Islands, where one or two plies from a three ply sisal rope with a breaking strain of 110kg were used. Results suggest this method could successfully reduce bird mortality. The following picture shows a trawl net bound with sisal rope.

An alternative method of net binding is to use a stronger rope wrapped around the net and tied with one or two overhand hitches, forming a slip not.

It is proposed to try both methods to see which is the most practical.

Method

1. Trials will be carried out on the same vessels as for the previous trials;
2. Because net binding is not an established technique, the trial will primarily focus on developing one or more workable methods; this will take some experimentation. It is proposed to carry out the different treatments as follows:
    a. The first tow will be shot in the normal way, to observe how the net deploys and how birds behave around the net;
    b. The next three tows will trial the sisal rope knot method;
    c. The next three tows will trial the polyester rope slip knot method;

d. On subsequent tows, the three methods (no tie; sisal; polyester) will be alternated;

In each case, the amount of netting on the surface, and the sink rate, will be measured.

3. The trials will be of approximately the following duration:
    c. Fresh fish trawler, Cook Strait: 3-4 fishing days, with 2-3 shots per day, totaling up to 10 to 12 shots;
    d. Factory trawler, West Coast: 6-8 sea days (including transit to and from grounds), with 2-3 shots per fishing day, totaling up to 12 to 16 shots;

Monitoring

The project observer will make observations on each tow as follows:

1. Visual observations on the behaviour of the net;
2. Measuring the sink rate of the net (the time the net takes to sink 2m below the surface);
3. Recording the number of seabirds active on or near to the net;
4. Observing the practicality of the method, and its effects on vessel operations and safety.

See appendix 2

Appendix 1. Seabird Net Interactions Questionnaire

Vessel: _____ **Company: _____ Date: _____**

Person interviewed: _____ **Position: _____**

Processing Type: Fillet / H&G / Whole **Offal Control:** F-Meal / Batch / Mince / Other

Trawl Type: Midwater: Length:_____ Opening: _____ Ground rope length: _____

or bottom trawl: Length: _____ Opening: _____ Ground rope length: _____

	When	Why/why not	Notes
1) Amount of time the net is on the surface			
a) Gear breakdowns happen how often when hauling and shooting (%)?			
b) What is the main type of gear failure that causes the net to remain on the surface – sweeps/bridles, winches, crew mistakes, monitor twist, other?			
c) Do you haul the gear to the surface during tows but not land the gear/trawl on deck?			
d) What other problems/issues occur, and how often, that could cause the net to be left on the surface during hauling and shooting?			

	When	Why/why not	Notes
2) General Fishing Operations			
a) How long does it take to shoot: • Midwater net? • Bottom trawl net?			
b) Haul: • Midwater net? • Bottom trawl net?			
c) How long does the mesh sit on the surface: • Shooting? • Hauling?			
d) Do you ever repair the net (MW / BT) in the water when hauling or shooting?			
e) Could repairing the net be done less often while the gear/net is on the surface? Could you only repair net the net on shooting instead of hauling?			
f) Once the gear is shot, do you turn the vessel, and for what reasons, with the trawl on the surface?			
g) Do you bring the gear to the surface during the tow (i.e. doors up turn)?			
h) When you turn during the tow what depth do you haul the net to?			
i) How do you haul the net aboard? (net rollers, fleet the net, use sweep line winches); how many times do you fleet the net?			

	When	Why/why not	Notes
j) j). does the position of the net monitor slow down shooting the net (e.g. because of the time required to fit it, or because it flips over?			
k) Would you buy a net monitor that was more stable and doesn't flip over?			

3) Offal discharge when the net is on the surface (offal attracts birds to the net area)			
a) Stickers removed prior to shooting			
• Does your crew remove all stickers from the trawl?			
• Are there times, and for what reasons, crew don't remove stickers?			
• How long does it take your crew to remove all or most of the stickers?			
b) Offal discharge			
• If you had to hold offal from doors up until net on deck, how much time is that?			
• If you had to hold offal from the time the net was pulled from the deck until the doors were under the water surface, how much time is that?			
• Can you hold all offal and whole fish discards when shooting and hauling?			

	When	Why/why not	Notes
• What procedures do you have in place to facilitate this (tanks, bins conveyors)?			
• Apart from the main offal discharge chute or main mincer pump, what other scuppers, sumps or pumps, discharge offal?			
• If mincing all offal, can you turn off discharge pumps for this time?			
4) Net Type, quantity and size of netting and netting surface area			
a) Net construction			
• What is the dimensions, length, opening, ground rope?			
• What are the mesh sizes in the trawl?			
• Do you use MW and BT net? What % of time, in what fisheries, do you use each type?			
b) Seabird captures in mesh			
• What size mesh are the birds mainly caught in?			
• Do you see bird captures on hauling and shooting (%)?			
• What % of birds are released alive (shooting and hauling)?			

	When	Why/why not	Notes
• Does the crew work to release birds quickly?			
• Which net type causes more risk to seabirds?			
c) Volume of netting/mesh on the surface			
• What part of the net or mesh size balloons out on the surface?			
• How much netting is on the surface (quantity) when shooting and hauling?			
• When hauling, could you turn the vessel to close up the mesh? How?			
• How long does it take for the mesh to sink from the surface when shooting?			
5) Environmental factors			
a) Fisheries close to breeding/migration routes			
• What times of the year do you have major issues with diving birds?			
• Do diving birds (petrels and shearwaters) attack to the net in different areas of the mesh?			
• Do you feel that if fishing alone the risk is higher than when fishing in a fleet situation?			

	When	Why/why not	Notes
• Does high wind or rough sea change the numbers/types and ways birds get caught in the net?			

6) Other			
• Do you think large birds (albatrosses) get caught up in the net only when offal is discharged?			
• Do larger birds (albatrosses) keep clear from the net, while diving birds are attracted to it? Hauling or shooting?			
• How much navigation space is required to complete a 180° turn (e.g. ¼ NM, ½ NM?			
• Could you tie 4 or 5 rope lashings around the trawl to hold the mesh together when shooting? How long would this take?			
• What do you think could be done/improved on deck or with shooting and hauling to reduce seabird captures?			
• How could you reduce the time, or amount of times, the net is on the surface?			

Appendix 2. Seabird Observation Protocol: Reducing the Quantity of Netting on the Surface

A review of seabird captures in trawl nets has shown that many birds, especially petrels and shearwaters, are captured during shooting or hauling by becoming tangled in the meshes and drowning.

One suggested approach to reduce this source of mortality is to reduce the quantity of netting on the surface during shooting and hauling. Different methods have been proposed to for shooting and hauling phases:

1. Hauling: if the vessel is turned while the net is hauled, the netting is pulled to one side of the stern ramp which "closes up" the net in the water;
2. Shooting: the net is bound at intervals with rope that breaks or slips once the mouth of the net is spread open, so its quantity is reduced until the net is shot away and under water.

This project will trial both these methods, to measure their practicality and effectiveness. The trials will also need to determine whether there is any increased risk of capturing marine mammals when these procedures are used.

Part 1: Closing Net by Turning the Vessel During Hauling

During this part of the trial, you will ask the Captain to turn the vessel while the body of the net is being hauled aboard, in order to close up the net.

Because this approach has not been trialed before, an important object is to determine how to manoeuvre the vessel to close up the net, while not creating hazards to the vessel or the crew.

You will need to discuss the objective of the trial with the Captain, work with him to determine what amount of turn is required to close up the net, and what type of turn (continuous or side-to-side) is most appropriate given weather and presence of other vessels on the grounds.

It is important that safety of the vessel or crew is not compromised at any time.

Methodology

Data will be collected, during daytime tows only, by:

1. Visually monitoring the behavior of the net, and taking video recordings of selected hauls;
2. Estimating the quantity of net on the surface;
3. Monitoring the number of seabirds on or around the net.

You will also make observations on the practicality of this method on vessel operation, and any effects on safety or vessel operations.

Observation procedure

Remember the deck can be one of the most dangerous places on the vessel. You should consider your safety before beginning observations. It is good practice to inform the bridge whenever you are going to be working on the deck.

Chose a location on the deck or the aft gantry that is safe and gives you a good view of the net during hauling.

Observations should be carried out on all tows if possible.

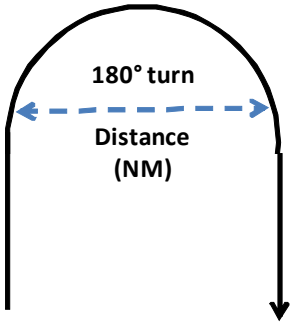
Observations will be recorded on the form below. The form provides for some numerical estimates, but general observations on the effectiveness and effects of turning the vessel while hauling are also important.

Trial tows

Experimental tows should be alternated with normal tows, that is every second tow (where practical) should involve the vessel turning to close up the net. At all times, the Captain will have the sole discretion as to whether the trial tow should proceed.

Completing the form

1. Complete one sheet for each tow;
2. Information on vessel and tow – for each tow, fill in the information at the top of the form:
    a. Date and vessel name;
    b. Turning/not turning – whether this is a standard tow or the vessel turns while hauling;
    c. Wind speed and swell height;
    d. Time – record the time the wing-end weights removed and hauling recommences, then the time the last of the codend is brought aboard, and calculate the total hauling time;
    e. Heading change – enter the rudder angle the Captain applies to close up the net;
    f. Continuous or S-turns (side to side) – record which method the Captain uses to keep the net closed up;
    g. During turning, the amount of seaway required to complete a 180°turn;



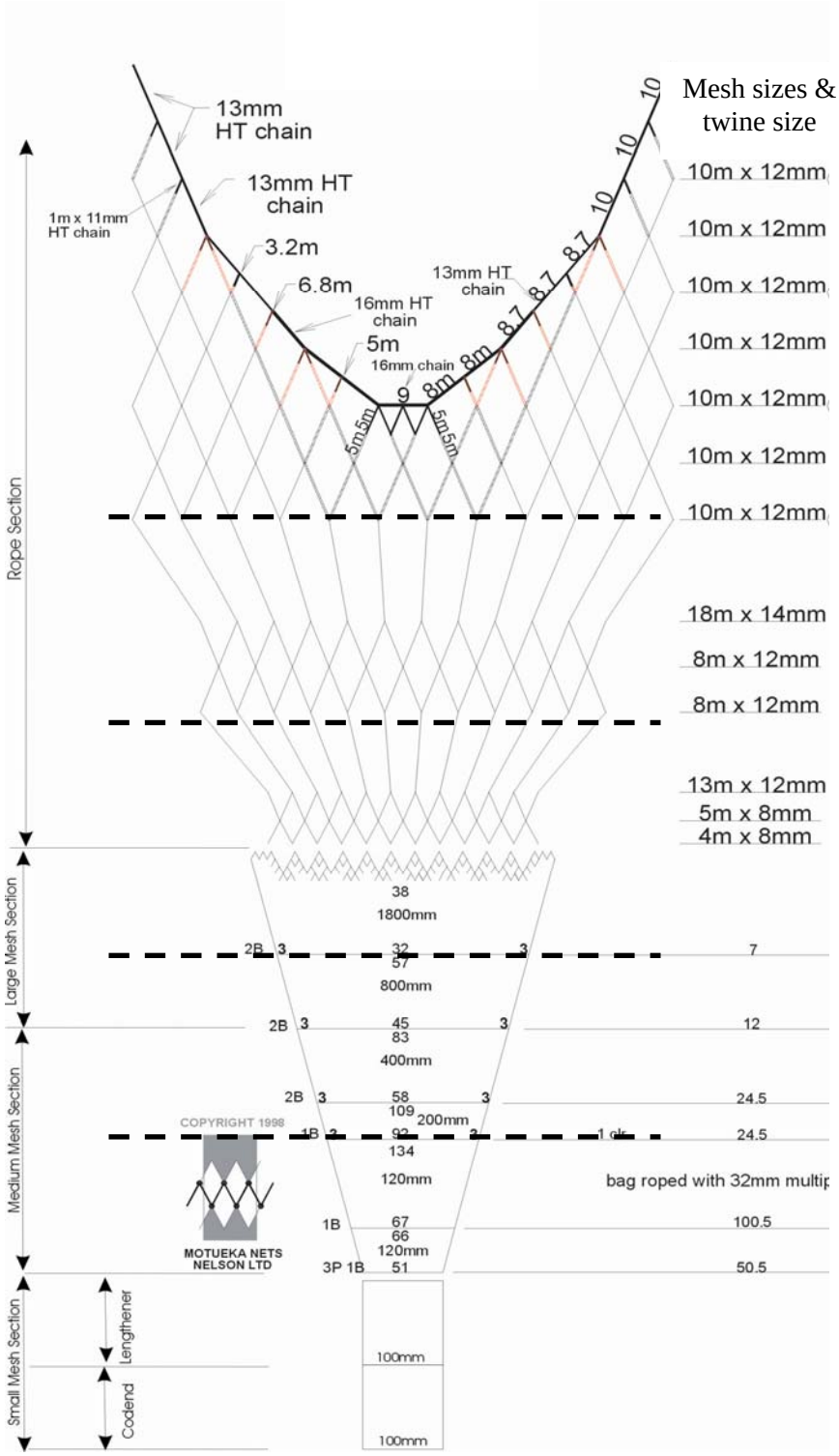
3. Offal and waste fish discharge – discharging fish or fish waste during the haul will have an effect on bird behaviour; tick the appropriate box for discharge from sump/scupper or processing waste (offal);
4. Width of net: The purpose of this observation is to measure how much the net closes up when the vessel turns, and if all or only parts of the net close up. The net is divided into four sections. At the point when each section starts to come aboard the vessel, estimate the width of that and following sections of the net at their midpoint. These sections are:
    a. Head section – this is the rope section immediately behind the ground rope;
    b. Large mesh – this is the large mesh section;
    c. Medium mesh – this is the section immediately in front of the lengthener;
5. Estimated number of seabirds – at the same points as item 3 above, estimate the number of birds attending the net or on the water within 5m of the net, by type of activity; bobbing means birds swimming or feeding on the water, diving means birds diving under the water surface.
6. Captures – record any birds that are caught in the net; if any birds are caught, the vessel will still need to record this in the Non-fish Incidental Bycatch form at the end of the voyage;
7. General observations – record your observations in relation to the questions on the back of the form.

Video recording

Please take a video recording of at least one complete haul of each haul/turn type.

Figure 1. Typical Midwater Net Plan

Dashed lines show initial positions of ties for the net binding trial



Observation form: Closing Net by Turning the Vessel During Hauling

Date: (dd:mm:yyyy) ___ : _____ : _____ Vessel name: _____ Turning/not turning _____

Sump/scupper ☐

Wind speed _____ Swell height (meters) _____ Offal discharge

Factory waste ☐

Time, ground rope on board: _____ : _____ Time, codend on board: _____ : _____ Haul duration: _____ minutes

Helm required to close up net _____ degrees Continuous turn or side to side: _____ Seaway required for 180°turn _____ NM

	Refer Fig. 1	Head (rope mesh)		Large mesh		Medium mesh			
Width of netting, m	**Head section**								
	Large mesh								
	Medium mesh								
		Diving	**Bobbing**	**Diving**	**Bobbing**	**Diving**	**Bobbing**	**Captures**	
								Captured	**Released**
Estimated No. Seabirds within 5m	**Large albatross**								
	Small albatross								
	Cape petrel								
	Other seabirds								

General observations:

1. **Effectiveness of manoeuvre at closing up net:**
    a. Does the manoeuvre effectively close the net up along its length, or just part of its length?
    b. Does the vessel need to keep turning for the entire hauling process to keep the net closed up?

2. **Vessel navigation and safety:**
    a. Can the vessel complete manoeuvre safely given weather or the proximity of other vessels?
    b. Does the manoeuvre create any safety issues on deck?
    c. Does the manoeuvre have any effect on stowing or subsequent shooting of the net?

3. **Seabird behaviour:**
    a. Is there any obvious difference in seabird diving or bobbing behaviour?
    b. Is seabird activity on the net changed, e.g. do birds dive on or swim into the net more or less often?
    c. Does closing the net up create any new risks to seabirds or marine mammals, e.g. is it harder for birds to get out of the net?

Part 2. Binding the Net While Shooting

Purpose

One method which has been suggested to reduce the risk of seabird mortality is to reduce the quantity of netting on the surface by binding the net while shooting. The net is tied at intervals with rope that either breaks or slips undone when the net starts to spread. The purpose of this is to bunch up the net and so reduce the amount of mesh floating on the surface.

A secondary benefit is that the net should sink faster when tied, because water resistance is reduced.

This trial is being carried out to determine methods of net binding and operational practices which will allow nets to be bound during shooting, without preventing the net opening properly when deployed.

Because only limited trials of this method have been carried out before, the primary purpose of this project is to develop methods of binding the net so the quantity of the net is reduced while shooting, but the net opens properly once it is under the surface.

Alternative methods of binding the net

You will test two different methods of binding the net. It will be necessary to refine these methods so they hold the net closed while the net is being fed off the stern of the vessel, but release every time when the net is sinking:

1. Use a rope which will break when the net starts to spread:
    a. Take a 2m length of 3-4mm sisal rope; tie it along one third of its length to a selvedge so it won't slip; then pass the long end around the net and tie the two ends together;
    b. Repeat this at intervals until the front of the lengthener. Initially use four ties on the net in the positions shown in Figure 1, one behind the ground rope, one in the middle of the rope section, the third where this section joins the large mesh section, and the fourth where the large mesh join the medium mesh;
    c. If the net billows out between ties, fit additional ties as required;
    d. It is recommended that you use a single ply from the 3-ply sisal rope for the first shot, then if this fails before the nets is fully deployed, use two or three plies on subsequent shots;
2. Use a rope tied in such a way it will slip when the net starts to spread:
    a. Take a 2m length of 10mm polyester rope; tie one end to a selvedge so it won't slip down the net; then wrap the rope around the net twice and pass it under itself once or twice (to form a slip knot) then pull tight. It is recommended you use one slip knot initially, increasing this to two if it slips too readily;
    b. Repeat this at intervals until the front of the lengthener. Initially use four ties on the net in the positions shown in Figure 1, one behind the ground rope, one 2/3 of the way along the string section, one midway along the large mesh section, and the last half way along the medium mesh;
    c. If the net billows out between ties, apply further ties between these positions as required.

Fixing the ropes around the net that has been fleeted onto the deck can be made easier by passing a rope under the net, then using this to lift the net while each binding is tied; the rope is then slid along to the next binding position.

Where a net drum is used, you will need to find the best location to tie the net as it is fed off the drum.

Methodology

1. Trials will be carried out on daylight tows only;
2. Each approach to tying the net will be trialed for several consecutive tows until you are comfortable you have a workable method. It is suggested you observe the following sequence:
    a. Shoot the first tow of the trip in the normal way, so you can observe how the net deploys and how birds behave around the net;
    b. Spend the subsequent three tows trialing the sisal rope method;
    c. Spend the following three tows trialing the polyester rope method;
    d. On subsequent tows, alternate the three methods (no tie; sisal; polyester);
3. Please assist the crew in fixing the ties to the net;
4. Once the net is ready to be shot away, find a safe place on the deck or stern gantry from where to observe the net and associated bird behaviour;
5. Data will be collected by:
    a. Visually monitoring the behavior of the net, and taking video recordings of selected shots;
    b. Estimating the quantity of net on the surface while it is shot away;
    c. Measuring the sink rate of the net; this is determined by tying a 100mm yellow float to the start of the mid-section of the net (that is, where the rope section of the net is attached to the large meshes) using a 2m cord, and recording when the float disappears under the surface;
    d. Monitoring the number of seabirds on or around the net;
    e. Observing the behaviour of birds attending the net;
    f. You will also make observations on the practicality of this method on vessel operation, and any effects on safety or vessel operations.

Materials required

You will need to take the following with you:

1. Data recording forms (as below);
2. Stop watch with split timer;
3. The following ropes:
    a. 100m 100kg sisal rope;
    b. 100m 10mm polyester rope;
4. Three 100mm coloured floats.

Completing the form

Observations will be recorded on the form below. The form provides for some numerical estimates, but general observations on the effectiveness and effects of turning the vessel while hauling are also important.

Complete one sheet for each tow

1. Information on vessel and tow – for each tow, fill in the information at the top of the form:
    a. Date and vessel name;

b. Experiment type – whether this is a standard tow or the net is bound using one of the two binding methods;

c. Wind speed and swell height;

d. Times: record the time when:

   i. The winch brakes are released;

   ii. The wing-end weights enter the water;

   iii. The float disappears under the water;

e. Headline height – request the Captain to measure headline height when the headline of the net is at 50m depth, this is to indicate whether the ties have all released at this depth;

f. Offal and waste fish discharge – discharging fish or fish waste during the haul will have an effect on bird behaviour; tick the appropriate box for discharge from sump/scupper or processing waste (offal).

8. Mark the positions of the ties on the net plan;

9. Estimated number of seabirds – at the point when the wing-end weights enter the water, estimate the number of birds attending the net or on the water within 5m of the net, by type of activity; bobbing means birds swimming or feeding while floating, diving means birds diving from the air;

10. Captures – record any birds that are caught in the net; if any birds are caught, the vessel will still need to record this in the Bird Bycatch form.

Video recording

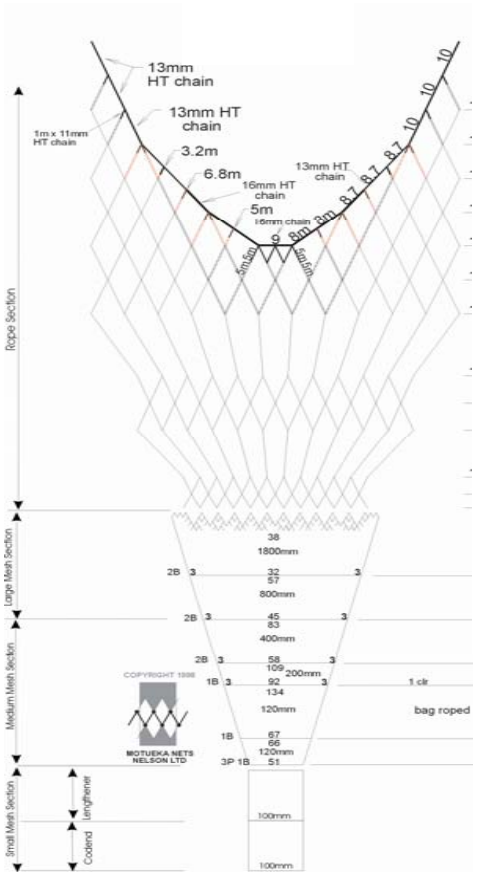
Please take a video recording of at least one complete shot of each type (normal; sisal; polyester).

Observation form: Tying the Net While Shooting

Date: (dd:mm:yyyy)	___ : _____ : _____	Vessel name:	_____	Tied (None, Sisal, PE)	_____
				Sump/scupper	☐
Wind speed	_____	Swell height (meters)	_____	Offal discharge Factory waste	☐
Number of ties	_____	Estimated distance between ties	_____	Headline height when net at 50m	_____
Time, brakes off	_____ : _____	Time, wing-end weights in water	_____ : _____	Time, float under water:	_____ : _____

Number of seabirds on the net when wing-end weights enter the water

		Diving	Bobbing	Captures
Estimated No. Seabirds	**Large albatross**			
	Small albatross			
	Cape petrel			
	Other seabirds			



Mark actual positions of ties on this net plan

General observations:

1. **How effectively does tying the net reduce the quantity of netting on the surface:**
    a. Does tying the net close it up effectively along its length?
    b. Are the meshes fully closed up or do they billow out between the tows?
    c. Do the ties break or slip before the net is below the surface?
    d. Are any ties still tight when the net is brought back aboard the vessel?

2. **Vessel navigation and safety:**
    a. Does tying the net create any safety issues on deck?

3. **Seabird behaviour:**
    a. Is there any obvious difference in seabird diving or bobbing behaviour?
    b. Does it change seabird activity on the net, e.g. do birds dive on or swim into the net more or less?
    c. Does closing the net up create any new risks to seabirds around the net, e.g. is it harder for birds to get out of the net?

Appendix 3. Briefing notes for Vessel Operator and Master

Introduction

A review of seabird captures has shown that many birds, especially petrels and shearwaters, are killed during shooting or hauling when they swim or dive into the net and can't escape.

One suggested approach to reduce this source of mortality is to reduce the quantity of netting floating on the surface while hauling and shooting. Two different methods have been proposed to achieve this:

1. **Hauling the net:** turn the vessel while the body of the net is being brought aboard, so the net is bunched up on one side of the stern ramp;
2. **Shooting the net:** bind the net while shooting with a number of rope ties that will either break or slip undone when the net is spread; the ties prevent the meshes billowing out until the net is below the surface, and so reduce the risk of birds becoming entangled in the meshes.

These trials are being carried out to test the effectiveness of these techniques in changing bird behavior and reducing the risk of mortality, and to determine the practicality of using them on a working fishing vessel.

Trials will be run on two trawlers of different types. Your vessel has been chosen as it is typical of a number of boats in the New Zealand fishing fleet.

It is important to stress that these methods are in the early stage of development, and limited trials have so far taken place. Therefore we are asking for your assistance in trying and refining these methods to help find workable ways of reducing bird mortality in the net.

Planned experiments

We wish to run experiments on your vessel to test the practicality of these methods in reducing the quantity of netting on the surface, and in reducing the risk of seabird captures.

A project observer will be on board to carry out the trials. He will be observing the effectiveness of these strategies, their effectiveness at closing up the net, their effect on seabird behaviour, and any practical or safety issues.

During the trial, you should observe normal offal control and warp strike mitigation practices.

If seabirds are captured, you should continue to report these as normal.

Trial 1. Closing the net while hauling

1. You will be asked to test the two different options – hauling as normal, and turning the vessel to close up the net. On alternating tows you will either shoot the net in the normal way, or turn the vessel while shooting the net to reduce the flow of water through the net, and hence to reduce the amount of netting on the surface;
2. There are two options which could achieve this objective – doing a single continuous turn, or turning from side to side (S-turn). You should use the method which you consider is the most effective, taking into account crew safety, collision avoidance, and effect on handling and stowing the net;
3. We appreciate that one or both of these options may not be practical or safe in certain circumstances, for example, in rough weather or where there are a number of other vessels nearby. It is also uncertain how sharply the vessel needs to turn to close up the net. We therefore request that you discuss this experiment with the project observer and agree only on practices which you, as master, consider can be carried out safely.

Trial 2: Binding the net while shooting

The experiment will involve the following:

1. Approximately one third of the tows will shoot the net in the normal fashion, one third will have light sisal rope tied around the net at several positions along its length, and one third will use polyester rope tied in a slip knot around the net at several positions along its length. The first trial tows will use light bindings to minimise the risk of them staying tied when the net starts fishing; if these are too weak, later tows will use stronger ties;
2. The project observer will take video images of the net while it is shot away, and make a series of observations of the behaviour of the net and the behaviour of birds around the net;
3. You will be asked to determine the headline height of the net when it is 50m below the surface 50m to determine if the bindings have broken. It would be useful for you to monitor the headline net monitor to see if it shows when the ties are released and normal headline height achieved;
4. During trials, your vessel should deploy warp strike mitigation devices as normal. During the experiment, the mitigation used should be consistent throughout, i.e. additional mitigation should ***not*** be added during the experiment;
5. It has already been demonstrated that seabird captures, especially of large birds (albatrosses and mollymawks), is increased when offal is discharged during hauling and shooting. We therefore ask that you be particularly diligent in preventing discharge of waste fish or fish waste during shooting and hauling. Please advise the project observer when offal discharge has taken place;
6. If seabirds or other protected species were captured during any tows, you should continue to report these as normal.

Video footage

The project observer will wish to take video footage of the two trials. The consent of the Captain will be sought before any videoing takes place.

Video will only be taken of the net in the water and associated bird activity during the two trials, and of the net binding on the deck.

The Captain will be able to review the video footage before it is taken ashore, and if required has the final say whether this footage, or which parts of it, can be used.

A full copy of the video will be supplied to the vessel operator after the vessel berths.

Safety and operational decisions

The Captain will at all times have the final say on whether specific trials are carried out, and may vary the way these are done as necessary to ensure safe operation of the vessel.