SPRFMO

3rd Meeting of the Scientific Committee

Port Vila, Vanuatu
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Seabird interactions around fishing vessels and associated data collection protocols

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South Pacific Regional Fisheries Management Organisation

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Purpose

The Conservation and Management Measure for minimising bycatch of seabirds in the SPRFMO Convention Area (CMM 2.04) encourages Members and CNCPs to record data on seabird observations and all interactions with seabirds and report this information to the Scientific Committee in their National Reports. Discussions at SC-02 on seabird risk from fisheries highlighted the need for standard protocols for data collection to better inform our understanding of the risk that SPRFMO fisheries may pose. This paper provides a comparative assessment of bird observation data collected in the SPRFMO area (compared to longer term data sets collected in New Zealand) and provides recommended protocols for future data collection of seabird attendance at fishing vessels. We also provide recommended protocols for observations of seabird warp strikes or impacts with monitoring cables in trawl fisheries should seabird attendance observations indicate sufficient risk. Collection of this data will allow meaningful comparisons across fisheries within the SPRFMO area and elsewhere, to better develop our understanding of the risks posed to seabirds.

Bird abundance and bycatch risk

As seabird bycatch events are typically rare and not always directly observable, additional observations of seabirds attending fishing vessels provide a valuable source of data for assessing the overlap between seabird species and fisheries. They account for both the distribution of the birds and how attracted they are to fishing vessels, providing a measure of the interaction rate between seabirds and fisheries. This information can be used to inform seabird risk assessments (Richard et al 2011). Example outputs from seabird counts made by the New Zealand observer programme can be explored at http://data.dragonfly.co.nz/seabird-counts/.

Pierre & Debski (2014a; SC-02-13) summarised studies demonstrating that observed seabird bycatch in trawl and longline fisheries is likely to underestimate the true number of fishing related seabird mortalities. Cryptic mortality extrapolation multipliers are particularly high in trawl fisheries, where birds being struck by trawl warps (warp strikes) are the primary source of cryptic mortality. In New Zealand the use of monitoring cables (e.g. net sonde cables) was banned due to incidence of seabird bycatch on these cables (Bull 2007) however the use of these cables is still permitted in the SPRFMO

region and will provide and additional source on uncertainty and risk. The relationship between seabird abundance and warp strikes has been quantified in one experiment and one monitoring study, both conducted in New Zealand waters. The experimental dataset comprised a total of 1581 observation periods made of a defined area astern 18 trawl vessels (Middleton and Abraham 2007). While significant, the relationship between warp strikes and abundance was somewhat noisy. Monitoring of seabird strikes on trawl warps over a five-year period has also produced a dataset allowing the exploration of the relationship between seabird abundance and trawl warp strikes (Abraham 2010). The dataset involved 2456 hours of observations of defined areas, conducted astern trawlers from 2004/05 to 2008/09. These studies show that while the relationship is not necessarily simple or linear, seabird abundances in defined areas astern trawlers do relate statistically to warp strike rates, and therefore seabird mortalities.

Seabird abundance counts

We analysed seabird abundance count data collected from a pelagic trawl vessel operating in the SPRFMO area in comparison to a range of domestic New Zealand trawl fisheries. The data collection protocols used in the SPRFMO area were similar to those used in New Zealand (see Appendix 1), allowing for direct comparison between fisheries. We sought to compare data across seabird taxa shared between New Zealand and the eastern SPRFMO areas. We report these in three groups: *Diomedea spp.* (great albatrosses), *Thalassarche spp.* (smaller albatrosses) and white-chinned petrel (*Procellaria aequinoctialis*).

The New Zealand data used consisted of seabird sightings from all abundance counts conducted (n = 13,664) across ten trawl fisheries during the period of 30 January 2004 – 14 September 2012. The great albatross species recorded in the New Zealand data set were *D. antipodensis, D. epomophora,* and *D. sanfordi*. The *Thalassarche* species recorded were *T. bulleri, T. carteri, T. cauta, T. chrysostoma, T. eremite, T. impavida, T. melanophris,* and *T. salvini*.

Data analysed from the SPRFMO area were sightings from all abundance counts conducted (n = 17) aboard one pelagic trawl fishing vessel during the period of 5 – 27 May 2014. *Diomedea* were not identified to species level and *Thalassarche* species were *T. bulleri, T. chrysostoma, T. melanophris,* and *T. salvini*.

The seabird abundance data collected in 2014 provides a very informative insight to the range of species that interact with pelagic trawl fisheries in the SPRFMO area. Figure 1 provides a comparison of average counts of these seabird taxa made in the SPRFMO area to those counts made in a range of domestic New Zealand trawl fisheries. The average number of white-chinned petrel counted in the SPRFMO area exceeded those of any New Zealand fishery, with the squid trawl fishery being the most similar. Counts of the two albatross groups (*Thalassarche spp*. and *Diomedea spp*.) were similar between the SPRFMO area and several New Zealand fisheries, including squid, hoki, hake and ling trawl fisheries. These New Zealand trawl fisheries with similar seabird attendance to the SPRFMO counts are known to pose considerable risk to both *Thalassarche* albatross and white-chinned petrel (Richard & Abraham 2013).

The only pelagic New Zealand trawl fishery represented in Figure 1 is the jack mackerel trawl fishery (MACT). The MACT fishery is one of the New Zealand trawl fisheries that pose least risk to seabirds (Richard & Abraham 2013). The SPRFMO counts were also made on a pelagic trawl vessel targeting jack mackerel, but it is clear that although the SPRFMO and MACT fisheries may be operationally similar, the SPRFMO fishery is operating in an environment of much higher seabird attendance.

Whether this is due to spatial differences in seabird assemblages between the areas where these fisheries operate, or the attraction of seabirds due to fisheries waste availability (Debski & Pierre 2014b; SC-02-12) is not clear and requires further investigation.

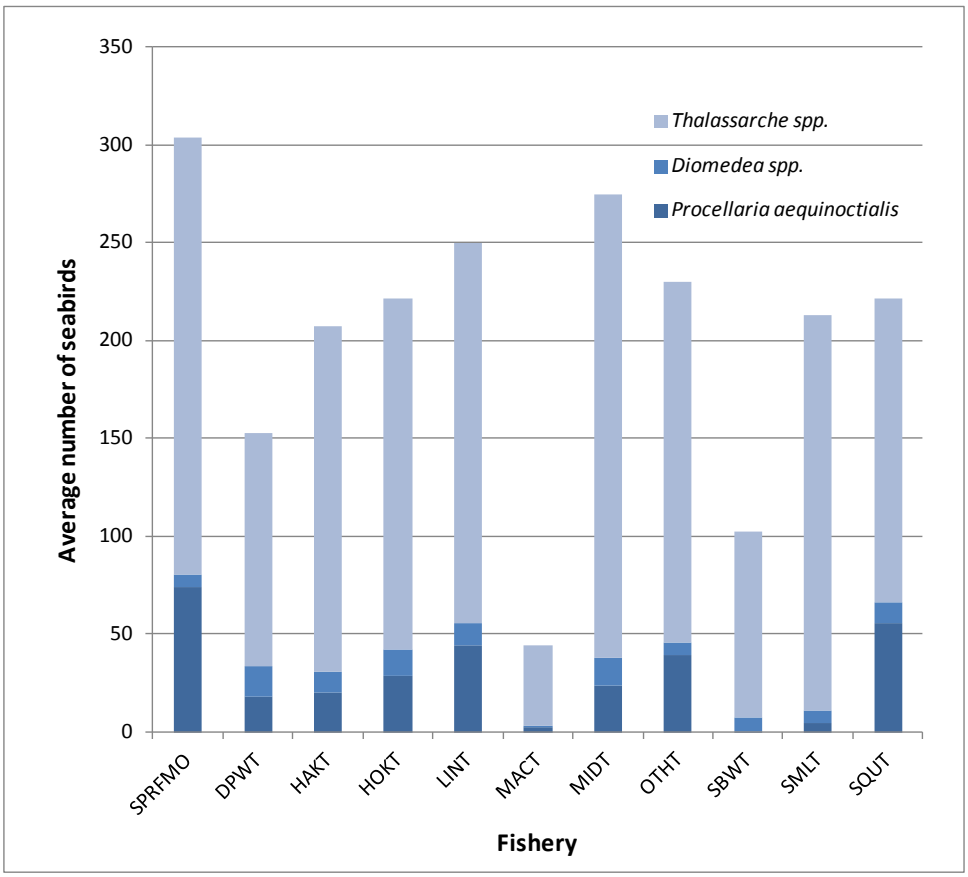

Figure 1. Average counts of seabirds attending fishing vessels, comparing counts made in the SPRFMO region in 2014 to longer term average counts from a range of New Zealand domestic trawl fisheries (SMLT: Trawl vessels less than 28-m long,HOKT: Large trawl vessels (>28m) targeting hoki, HAKT: Large trawl vessels (>28m) targeting hake, LINT: Large trawl vessels (>28m) targeting ling, SBWT: Large trawl vessels (>28m) targeting southern blue whiting, SQUT: Large trawl vessels (>28m) targeting squid, DPWT: Large deepwater trawl vessels (>28m) targeting (oreo species, orange roughy, cardinal fish, and patagonian toothfish), MACT: Large trawl vessels (>28m) targeting blue and Jack mackerel, MIDT: Large trawl vessels (>28m) targeting middle-depth species (barracouta, bluenose, alfonsino, warehou, gemfish, ghost shark, spiny dogfish, rubyfish, frostfish, and sea perch), OTHT: Large trawl vessels (>28m) targeting other species, or with missing target).

When high densities of seabirds are in attendance around a trawl vessel there is increased risk of collision with trawl warps or monitoring cables (e.g. net sonde cables), many of which are not readily observable, or cryptic (Debski & Pierre 2014a; SC-02-13).

Data collection protocols

As we have demonstrated, the collection of seabird abundance data from fishing vessels allows for easy but meaningful comparisons between fisheries and areas. In accordance with CMM 2.04 we encourage the collection of further data on seabird attendance at fishing vessels throughout the

SPRFMO area, and across different fishery types, using standard protocols. We provide recommended protocols for seabird counts in Appendix 1.

When seabirds, particularly albatross and larger petrels, are in close attendance to trawl fisheries, there is risk of cryptic mortality through warp strikes or impacts with monitoring cables. To investigate this risk further, dedicated observations can be made. In Appendix 2 we propose recommended protocols for conducting such observations based on the review by Pierre et al (2015).

Recommendations

This paper **recommends that the Scientific Committee**:

- encourage Members and CNCPs to collect data on bird attendance at fishing vessels using the protocols provided in Appendix 1;
- where potential risk of seabird warp strikes is identified, encourage Members and CNCPs to collect data on warp / monitoring cable strikes using the protocols provided in Appendix 2;
- request Members and CNCPs to report results from seabird counts and warp / monitoring cable strike observations to the SC.

References

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Appendix 1 – Seabird abundance data collection protocol for SPRFMO fisheries

Protocol for seabird abundance counts

Purpose

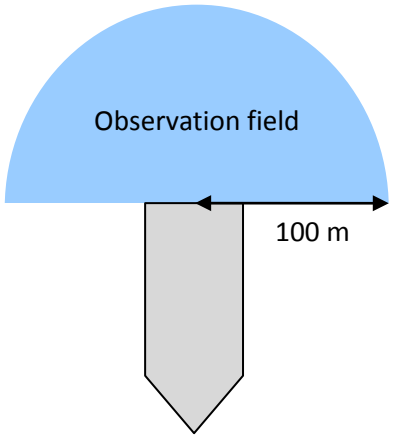
A basic understanding of the variety and abundance of seabird species present around a vessel during fishing activity can inform estimates of the bycatch risk posed by that fishing vessel. This protocol for seabird abundance counts at-sea has been developed following an international review of existing protocols and will enable the collection of directly comparable data across fisheries. A model data collection form is also provided.

Count Frequency

A minimum of one count per day should be undertaken during fishing activity. Where time allows it is recommended that further counts are undertaken during as many fishing events as possible.

Observer Location

A standard observation location should be selected at the beginning of the trip. Where possible this should be at a high point with an unobstructed view of the area 100 m astern of the vessel.



Count Method

The counts are intended to record 'snapshots' of bird abundance around the vessel at a given point, including both birds in flight and on the water. Therefore it is important that adequate time is taken to assess all birds within the observation field. Depending on sea states this may also mean ensuring seabirds are not obscured by swell.

Note: One form should be completed per count

Observation Steps

1. Fill out Section 1- Summary Data. Provide either a valid 'linking ID' (this will vary by jurisdiction) or the vessel effort details. Ensure that positional data is recorded as Latitude / Longitude to at least 0.1 degree resolution in decimal format. All times should be recorded in UTC.

2. A 'snapshot' count should be undertaken of all seabirds in the observation field and recorded in Section 2 – Seabird Abundance Data.

    i. Each seabird should be identified to the finest possible taxonomic level and the corresponding FAO species code used. Each taxon should have a separate line.

    ii. If a bird or group of birds cannot be identified to species level, the most appropriate generic code should be used.

    iii. If there is no corresponding FAP code for the species or species group, record this in the Comments field.

    iv. If it is possible to differentiate juveniles from adults, age group should be indentified on the form using the following coding:

Age group	Code
Total	T
Adult	A
Juvenile	J

    v. The Comments field in Section 2 should be used for anything of note about the birds observed. This may include any markings, banding of birds, tracking equipment or presence of fishing gear.

3. Fill out Section 3 - Observation Period.

    i. Record the vessel activity at the time of observation, as categorised below:

Vessel activity
Trawl - set
Trawl - tow
Trawl - haul
Longline/setnet - set
Longline/setnet - soak
Longline/setnet - haul
Purse seine - set
Purse seine - pursing
Purse seine - brailing

ii. For each count 'eye height' should be recorded. This is defined as the vertical distance between the observer's eye and the surface of the water (m).

iii. Presence of other vessels should be marked 'Yes' if any vessels are visible by the naked eye.

iv. Wind force should be recorded using the Beaufort scale.

v. The observers position on the vessel should be noted by the following categories:

Position	Code
Port	P
Starboard	S
Stern	R
Other	O

vi. Use of visual aids should be recorded:

Visual aids	Code
Binoculars	B
Other	O
None	N

vii. Any biological discharge from the vessel should be recorded by the observers as Yes **(Y)**, No **(N)** or unobserved **(U)**

viii. The observer should indicate **(Y/N)** whether weather conditions allow them to see up to 100m.

NOTE: every field should be filled with a value

4. Section 4 - Comments should be used to record any unusual events or conditions during the count. These may include gear failures that occurred during the count, noteworthy weather events, or reasons why a count was interrupted.

Seabird Abundance Count Form

1. General information

Linking ID		Observer name(s)		Vessel	
Date		Organization		Position	
Time		Jurisdiction		Event number	

2. Seabird abundance data

FAO species code	Number	Age group	Comments

3. Observer period data

Vessel activity		Eye height (m)		Other vessels		Wind force	
Observer position		Visual aid		Discharge		Visibility ? 100 m	

4. Comments (e.g. decreased viewing angle, changes to observation transect width, noise disturbances)

Seabird abundance form - codes

Vessel activity
Trawl - set
Trawl - tow
Trawl - haul
Longline/setnet - set
Longline/setnet - soak
Longline/setnet - haul
Purse seine - set
Purse seine - pursing
Purse seine - brailing

Observer position	
P	= Port
S	= Starboard
R	= Stern
O	= Other

Visual aid	
B	= Binoculars
O	= Other
N	= None

Age group of birds	
T	= Total birds
A	= Adult birds
J	= Juvenile birds

Other	
Y	= Yes
N	= No
U	= Unknown

Beaufort Scale of Wind Force

Beaufort Number	Description	Mean wind speed (knots)	Probable wave height* (m)
0	Calm	< 1	
1	Light air	1 - 3	0.1 (0.1)
2	Light breeze	4 - 6	0.2 (0.3)
3	Gentle breeze	7 - 10	0.6 (1.0)
4	Moderate breeze	11 - 16	1.0 (1.5)
5	Fresh breeze	17 - 21	2.0 (2.5)
6	Strong breeze	22 - 27	3.0 (4.0)
7	Near gale	28 - 33	4.0 (5.5)
8	Gale	34 - 40	5.5 (7.5)
9	Strong gale	41 - 47	7.0 (10.5)
10	Storm	48 - 55	9.0 (12.5)
11	Violent storm	56 - 63	11.5 (16.0)
12	Hurricane	> 64	14 (-)

*This table is intended as a rough guide for the open sea. Figures in parentheses indicate the probable maximum wave heights. In coastal areas, greater heights will be experienced.

Appendix 2 – Seabird warp/ monitoring cable strike data collection protocol for SPRFMO trawl fisheries

Protocol for seabird warp / monitoring cable strike observations

Purpose

When seabirds, particularly albatross and larger petrels, are in close attendance to trawl fisheries, there is risk of mortality through warp/ monitoring cable strikes. Detecting such cryptic, or normally unobserved, mortality requires specialised data collection. To investigate this risk further, dedicated observations can be made through implementation of these protocols, which were developed following a review of cryptic mortality of seabirds in trawl fisheries.

Choosing which warp / monitoring cable to observe

Only one warp / monitoring cable will be observed during a recording period. Observers should position themselves at a safe point near the stern of the vessel where:

- the warp / monitoring cable can be clearly seen for its entire length from the point it is outboard of the vessel to the point it ends, or enters the water; and
- any biological discharge occurring can be observed.

The warp / monitoring cable with the highest interaction rate should be selected to sample over the entire tow. This would generally be on the same side of the vessel from which most of the offal/discards are discharged, even if there is no discharge at the time of the sampling observations or if discharge is noted from both sides of the vessel. Availability of a safe observation position must be an overriding factor in determining the side of the vessel observed.

Observation Steps

1) Confirm with the skipper that it is safe, in his/her opinion, to carry out the observations.
2) Fill out Section 1 of the form. Record the start time, date and time zone of the tow using 24 hour format.
3) The observation sequence is as follows:
    a) Sample period 1 begins 15 minutes after the start of the tow
    b) Sample period 2 begins 20 minutes after the end of sample 1
    c) Repeat until end of tow
4) For each sample:
    a) Two minutes before the sample period is set to begin, record a bird abundance estimate on the observation form
    b) Record start time of observation using 24 hour format
    c) Observe the chosen warp for 15 minutes and count bird strikes (defined below) for each category of bird and strike.

d) Record end time of observation using 24 hour format

5) Record bird strikes, noting seabird categorisation below, on the observation work sheet.

6) Complete Section 3 of the form for that sample period (see "instructions for completing sampling form").

7) Observe the haul and record net interactions according to the haul observation protocol described below.

8) Photograph and record details of all birds captured by the fishing gear and mitigation device.

9) Record any pertinent comments in Section 4 of the form.

Sampling periods

Observers should undertake 15-minute sampling periods during each tow where trawling occurs in daylight. As many sampling periods as possible should be carried out per tow. The 20 minute break between sampling periods ensures that one observation is not affected by the period before it.

Sampling periods of 15 minutes each will be used to characterise strikes on the warp / monitoring cable. These are to be carried out during the fishing phase of the tow (i.e. when the net is in the water and cables are no longer being paid out). It is very important to record the correct start and stop time of the observation and the tow.

If conditions change significantly during an observation period; e.g., the wind conditions change considerably, or if the offal discharge rate changes significantly, terminate your observation at that point and note on the form the environmental conditions that prevailed during the observation period. Record the reason for early termination of the sample period under section 4 of the form. Begin a new sampling period later in the tow if possible, or on the next tow.

Start a new form for observations on a new tow.

Instructions for completing the sampling form

The text in bullet points and italics refers to elements to record on the form.

Section 1. Fishing event descriptors

- *At the beginning of the sampling set of observations, record details of the trip, tow and observer. Note that a new form must be started for each new tow observed.*
- *Record the date, start time and time zone for the tow. Record times in 24 hour format.*
- *Side observed (P/S) – Record which warp is observed during the tow. P = Port, S = Starboard. Note that the same side should be observed for the whole tow.*
- *Observer initials – Initials of the observer making the observations on this form.*

Section 2. Fifteen-minute warp/mitigation device strike observations and bird abundance

- *Record the time at the start and end of each 15-minute sampling period in 24 h clock times, e.g., 09:30 - 09:45 or 15:00 - 15:15.*

Seabird abundance:

The objective of the abundance estimate is to provide order-of-magnitude level of information about the numbers and species group of birds behind the vessel during the sampling period. This is done by counting the number of birds in the sample area just before the 15 minute observation of warp strikes. Estimate the total number of birds of each species group on the water **and** in the air and record this information separately. Separate the bird groupings in this estimation.

The area in which bird abundance is to be assessed is a 25m radius around the stern of the vessel (Figure 1).

- *Fill in the form by writing the number of birds for each sample period under the bird categories (defined below).*

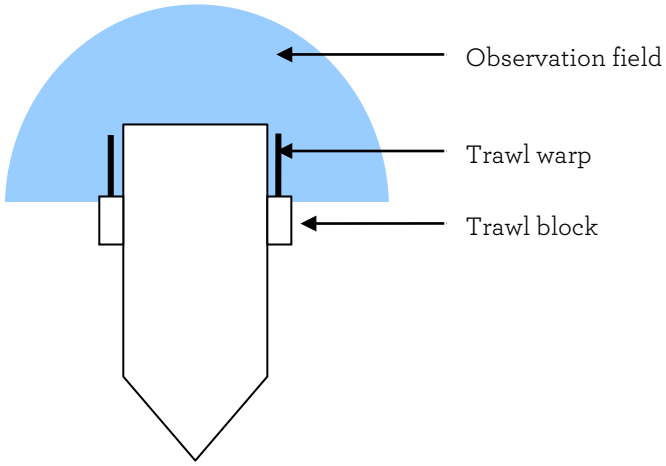


Figure 1. Diagram of a vessel with the warp entry point shown. The 25m radius in which seabird abundance is estimated is highlighted (not to scale).

Number of heavy contacts

- *Record the total number of heavy contacts and the type of contact for each bird category during the 15 minute observation period (see below for definitions of Heavy Contacts, and birds).*

<u>Defining heavy contacts between birds and the trawl warp or mitigation device:</u>

A heavy contact is one in which a bird:

1 has its path of movement deviated when it comes into contact with the trawl warp / monitoring cable; *and*

2 the part of the body contacted is above the 'wrist' joint of the bird (i.e. on the upper part of the wing and or on the head or body).

This can occur on the water or in the air. Birds on the water may be dragged under the water by a heavy contact. Heavy contacts occur either when the bird, through active movement, comes into contact with the warp / monitoring cable or mitigation device, or when the warp/ monitoring cable or mitigation device moves to contact the bird (e.g. whilst the bird is sitting on the water).

Light Contacts are NOT included in this category are when birds may have contacted the warps / monitoring cable or mitigation device but are not moved out of their flight path or position on the water. Light contacts are recorded separately.

Bird size categories:

Birds of different species will be seen in contact with trawl warps/ monitoring cable. Differences in size and behaviour between species result in variation in vulnerability to striking the warp/ monitoring cable or mitigation device. Seabirds have been grouped into 5 categories based on behaviour and size in order to maximise the information coming out of each observation period. These categories were based on bird assemblages around New Zealand domestic trawlers and may need to be adapted to include other groups of species in other fisheries.

L Alb Large albatross: royal and wandering albatross; *Diomedea spp.*

S Alb Small albatross and giant petrels: other albatross; *Thalassarche spp.* and *Phoebetria spp.* plus *Macronectes spp.*

P Shearwaters and other petrels apart from giant petrels and cape pigeons: other Procellariidae.

CP Cape pigeons: *Daption capense*.

O Other species.

Section 3: Environmental factors and offal/fish discharges

- *Swell height (m) - Estimate the average height of the swell during the sampling period in metres.*
- *Swell direction (1-12 h) – Record the direction from which the swell is coming relative to the direction of travel of the vessel. Use a 12 point "clock" scale. The bow of the vessel is defined as the 12h point, therefore a swell coming directly from the stern direction is recorded as 6. Port side is 9, starboard is 3.*

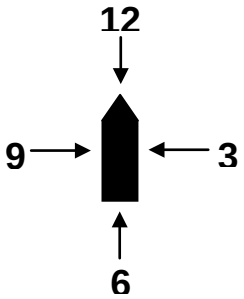


Figure 2. The 12 hour clock scale to be used for swell and wind direction.

- *Wind speed (Beaufort) – Record the wind speed using the Beaufort Scale (below). The information is a rough guide for the open sea. Figures in brackets indicate the probable maximum wave heights. In coastal areas, greater heights will be experienced.*

Beaufort Scale	Description	Mean wind speed (knots)	Wave height (m)
0	Calm	<1	
1	Light air	1 - 3	0.1 (0.1)
2	Light breeze	4 - 6	0.2 (0.3)
3	Gentle breeze	7 - 10	0.6 (1.0)
4	Moderate breeze	11 - 16	1.0 (1.5)
5	Fresh breeze	17 - 21	2.0 (2.5)
6	Strong breeze	22 - 27	3.0 (4.0)
7	Near gale	28 - 33	4.0 (5.5)
8	Gale	34 - 40	5.5 (7.5)
9	Strong gale	41 - 47	7.0 (10.5)
10	Storm	48 - 55	9.0 (12.5)
11	Violent storm	56 - 63	11.5 (16.0)
12	Hurricane	64 and over	14 (-)

- *Wind direction (1-12 h) - Record the direction from which the wind is coming relative to the direction of travel of the vessel. Use a 12 point "clock" scale. See figure 2.*
- *Discharge side - Record whether offal discharge was on the Port (P), Starboard (S), both or Neither (N) sides of the vessel during the observation period.*
- *Discharge rate - Record the rate of offal or discard discharge during each 15-minute sampling period, using four categories (0 = none, 1 = negligible, 2 = intermittent, 3 = continuous). Only one rate should be recorded. If the rate changes significantly, i.e. to the extent that a different discharge rate category would be appropriate, terminate the sample and start a new one later. Note: discharge from all around the vessel should be considered when recording. Diagrams of discharge points should be included in the trip report.*
- *Discharge Type (S/O/D) Multiple types are allowed and should be recorded. Record the type of discharges (S = Sump water, O = offal, meaning heads and guts of processed product, D = whole fish or squid discards). Other material (such as rubbish) on which birds might feed is not included in this category and should not be recorded. If the vessel is discharging any non-fish waste i.e. rubbish, this should be recorded in the comments section of the form.*
- *Mitigation used – record the use of seabird mitigation device deployed in association with the warp being observed (BSL = bird scaring line, BB = bird baffler, O = other – describe in Section 4 Comments).*

Section 4: Haul Observations

In order to better categories net interactions at hauling fill in Section 5 detailing:

1. Time the net is at the surface
2. For each seabird category:
    a. Abundance around the vessel
    b. Number of seabirds landing on the codend
    c. Number of seabirds swimming around the codend
    d. Number of seabirds actively feeding on the net
    e. Number seabirds diving on the net

Section 5. Comments

Record comments in this section, e.g. if you are required to stop your observations for some reason (wind changes, the vessel does a turn, or an incident happens that means the observation period is cut short). Anecdotal information that might help researchers analyse the data you recorded is also helpful as are general comments on the performance of mitigation devices.

Mitigation Assessment Warp / Monitoring cable Strike Form

1. Fishing event descriptions

Linking ID		Date		Tow start time		Cable angle θ	
Observer trip		Observer tow		Observer initials		Dist. to entry (m)	

See reverse for directions

2. Fifteen-minute warp/ monitoring cable /mitigation device strike observations and bird abundance

Fishing stage	1. At depth / hauling					2. At depth / hauling					3. At depth / hauling					4. At depth / hauling				
15-min observation	Time start		Time end			Time start		Time end			Time start		Time end			Time start		Time end		
Taxa grouping	L Alb	S Alb	P	CP	O	L Alb	S Alb	P	CP	O	L Alb	S Alb	P	CP	O	L Alb	S Alb	P	CP	O
Bird abundance																				
No. light contacts																				
No. heavy contacts:																				
Air																				
Water (deflected)																				
Water (dragged under)																				

3. Environmental factors and mitigation devices

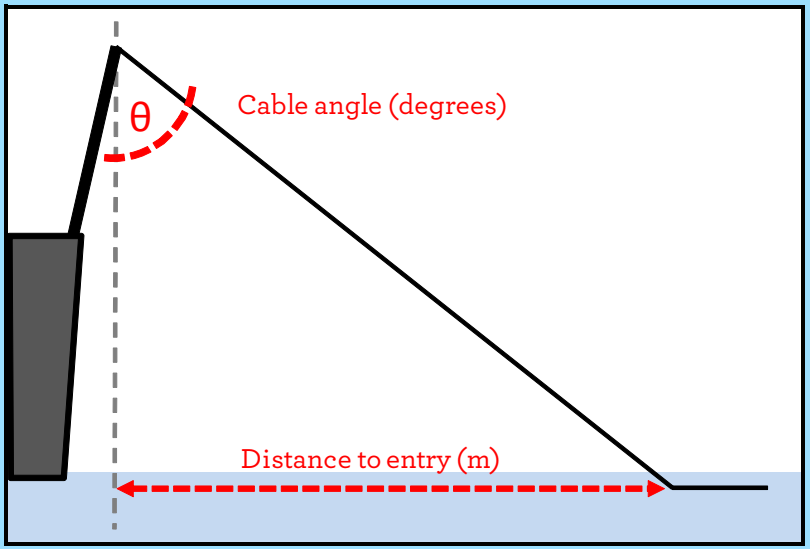
Swell height (m)				
Swell direction (1 - 12 h)				
Wind speed (Beaufort)				
Wind direction (1 - 12 h)				
Discharge location	P / S / R / N	P / S / R / N	P / S / R / N	P / S / R / N
Discharge rate	0 / 1 / 2 / 3	0 / 1 / 2 / 3	0 / 1 / 2 / 3	0 / 1 / 2 / 3
Discharge type	S / O / D	S / O / D	S / O / D	S / O / D
Mitigation used	BSL / BB / O	BSL / BB / O	BSL / BB / O	BSL / BB / O

4. Comments: include any usual factors that may have influenced the number of warp strikes, e.g. gear failure or changes in environmental or fishing factors

Reference Tables and Diagrams

Beaufort Scale of Wind Force			
Beaufort Number	**Description**	**Mean wind speed (knots)**	**Probable wave height* (m)**
0	Calm	< 1	
1	Light air	1 - 3	0.1 (0.1)
2	Light breeze	4 - 6	0.2 (0.3)
3	Gentle breeze	7 - 10	0.6 (1.0)
4	Moderate breeze	11 - 16	1.0 (1.5)
5	Fresh breeze	17 - 21	2.0 (2.5)
6	Strong breeze	22 - 27	3.0 (4.0)
7	Near gale	28 - 33	4.0 (5.5)
8	Gale	34 - 40	5.5 (7.5)
9	Strong gale	41 - 47	7.0 (10.5)
10	Storm	48 - 55	9.0 (12.5)
11	Violent storm	56 - 63	11.5 (16.0)
12	Hurricane	> 64	14 (-)

*This table is intended as a rough guide for the open sea. Figures in parentheses indicate the probable maximum wave heights. In coastal areas, greater heights will be experienced.



Mitigation codes:

BSL	= bird scaring line
BB	= bird baffler
O	= other

Discharge codes:

Discharge side: (one or more)	
P	= Port
S	= Starboard
R	= Stern
N	= Neither / none

Discharge rate: (record one)	
0	= none
1	= negligible
2	= intermittent
3	= continuous

Discharge type: (one or more)	
S	= sump water (deck wash)
O	= offal, i.e. heads and guts
D	= discards of whole fish