Methodology to Assess Fisheries for Risk to Seabirds

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LIST OF ACRONYMS AND DEFINITIONS

ACAP	Agreement on Conservation of Albatrosses and Petrels
BSL	Bird-scaring lines. These may include tori lines or any of several similar systems using lines and streamers to frighten birds away from an area where hooks are being set.
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
ETP species	Endangered, Threatened, and Protected species. Also seen in some reports or publications as "PET." It is not exactly equivalent to US Endangered Species Act terminology.
FMP	Fishery Management Plan
MSC	Marine Stewardship Council, a fishery sustainability certifier.
NPOA	National Plan of Action (for seabirds)
Sustainable	Because this document is oriented towards seabirds, "sustainable" would refer to maintaining seabird populations in the long run.

INTRODUCTION

Marine fisheries worldwide pose a risk to seabirds, some more than others, some almost not at all. At present, there is great interest in encouraging fisheries to become sustainable in the general sense, and this of course requires consideration of seabirds and the effect of fisheries on seabirds. The seabirds are an integral component of fisheries, because they either are a part of each fishery's food chain or they may be affected directly by the act of harvesting as bycatch. The objective of sustainability of a fishery, with regard to seabirds, therefore requires that a fishery not cause mortality or injury to seabirds that would cause a decline in their populations in the long run, and would allow healthy populations.

The methodology described in this document provides a mechanism for evaluation of fisheries as to their effects on seabirds[1]. The main objective of the evaluation process is to identify fisheries that pose a risk to seabirds, to allow development of strategies to reduce that risk, with the ultimate objective of conservation of seabirds. The strategies to be developed will depend on many factors, such as the national and international legal environments, type and size of the fishery, markets for the seafood, certification system for the fishery, and many others.

The methodology in this document describes the considerations and steps required to evaluate a fishery for risk to seabirds. Because not all fisheries pose a risk to seabirds, a filtering mechanism is described by which fisheries can be identified that require more detailed evaluation. Finally, the methodology describes an in-depth analysis of fisheries which are suggested to have risk to seabirds, along with recommendations on how the fisheries can be improved with regards to seabird conservation. To aid in the evaluation, guidance is provided on the risk posed by various gear types and sets, as well as other factors.

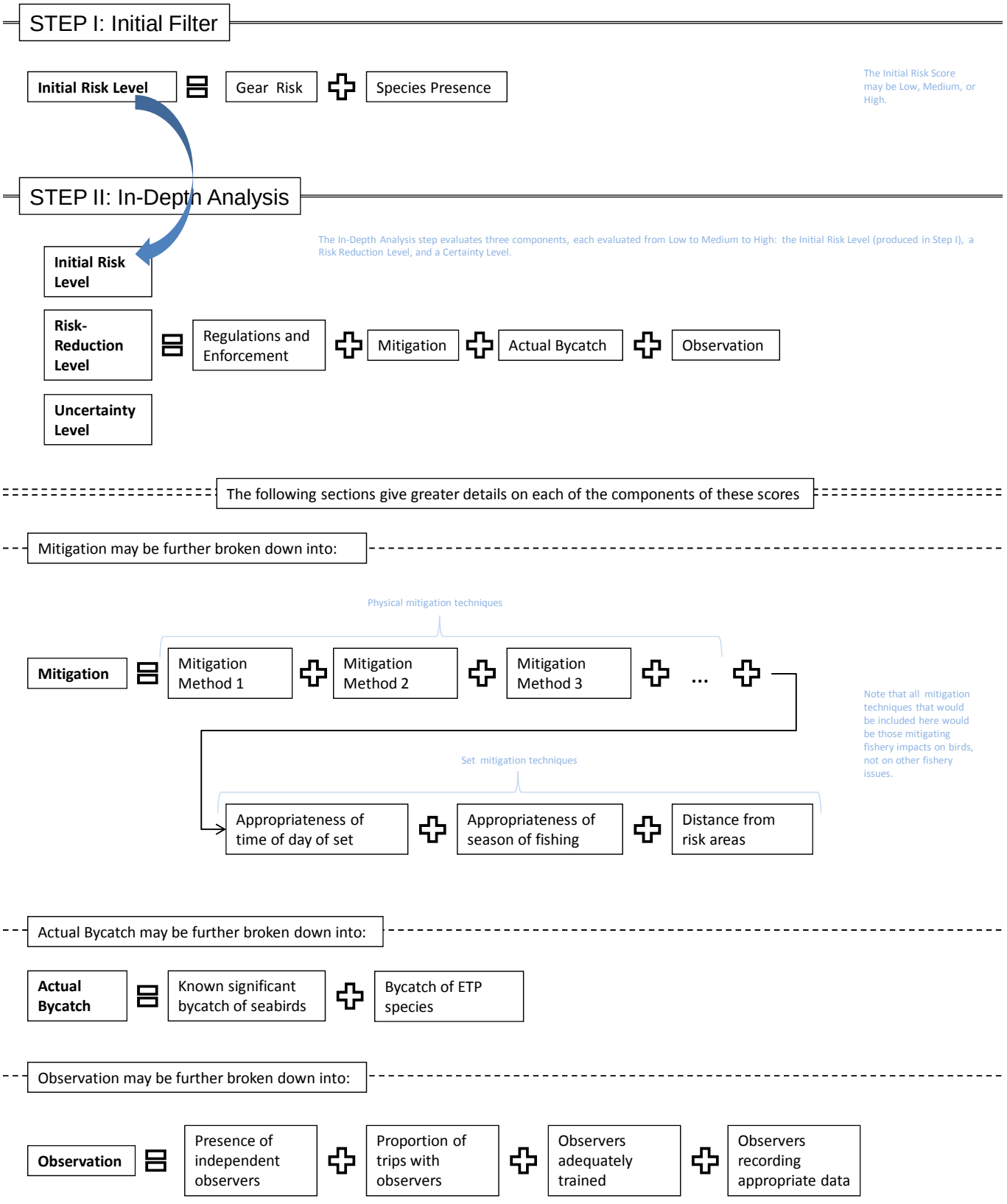
FACTORS TO BE CONSIDERED

The conceptual framework for the factors that must be considered is diagrammed in the figure on the following page. Some factors may reduce likelihood that a fishery is unsustainable with regard to seabirds (for example, use of mitigation methods), whereas others increase that likelihood (for example, the presence of threatened species). The diagram also indicates the division of the evaluation process into two steps, Step I, a filtering process to identify high risk fisheries from those that pose little or no risk to seabirds, and Step II, an in-depth analysis of the higher-risk fisheries.

There are seven sets of factors in a fishery that affect the likelihood that the fishery will be unsustainable with regard to seabirds. Some of these increase the likelihood a fishery will have significant bycatch of seabirds, while others reduce it. The seven factors can be divided into three categories: those that increase risk, those that decrease risk, and uncertainty about the knowledge on the fishery.

[1] Whenever evaluation or risk are referred to in this system, they are relative to seabird bycatch, not to any other bycatch or aspect of the fishery.

Fisheries Seabird Risk Evaluation System



The seven factors are divided into three categories:

Increase risk

- Gear type(s) used in the fishery. The gear and set used in a fishery combine to produce an inherent level of risk.
- Presence of seabirds. The presence of birds, especially Endangered, Threatened, or Protected species (ETP species), increases the risk to birds posed by a fishery. Obviously, if no birds occurred in the area of a fishery, no birds would be placed at risk by the fishery.

Decrease risk

- Mitigation used, including gear and set mitigation. The risk posed by use of a particular gear type can be improved (reduced) by having effective mitigation methods used, either physical methods (bird-scaring lines, for example) or modifying set characteristics (night setting, for example). Mitigation methods may of course be used in combination, and using more than one generally will reduce the overall risk posed by the particular gear, reducing the likelihood of unsustainability.
- Regulations and enforcement. Does the country of origin of the fishery have appropriate legal framework to protect seabirds? This might include national regulations, participation in international agreements such as Agreement on Conservation of Albatrosses and Petrels (ACAP) or seabird National Plan of Action (NPOA). Are regulations enforced?
- Low actual bycatch of seabirds. This is the presence of bycatch of *any* species, whether ETP species or not. Risk to seabirds is increased by the actual bycatch of ETP species, even when the numbers of these are low.
- Observation. The amount of observer coverage (what proportion of boats and sets are covered by observers), the quality of observation data (are observers capable of identifying bycatch species), or gaps in the data (do observers record the right data) all are components of observation information that can affect risk to seabirds. Poor quality observation usually results in high levels of Uncertainty.

Uncertainty of knowledge of the fishery:

- Uncertainty itself is composed of several intertwined components, *inadequateness of information available*, *uncertainty of results*, and *missing information*. Greater certainty about what is going on in a fishery, especially about what is going on with regard to seabirds, can usually be advantageous for reducing bycatch. Conversely, not knowing about seabird bycatch means that no efforts can be made to mitigate the bycatch, or to address the issue of sustainability of the seabirds affected by the fishery. Uncertainty often derives from having poor quality data from observation.

The interaction of these factors can be complex, and requires that the evaluator have an understanding of seabird biology, of fisheries, and of their operation.

In the diagram on the previous page the seven factors are divided into two steps, as mentioned above. The two factors that are evaluated for Step I can indicate whether or not an in-depth analysis is required. If it is, the remaining five factors (the four Fisk Reduction factors + Uncertainty) are evaluated in Step II.

STEPS TO EVALUATION OF A FISHERY

To evaluate a fishery for its potential risk to seabirds requires information. Although much public information exists on almost all fisheries, that information is not always available from one source, and may vary significantly in quality from fishery to fishery. Fisheries that have applied to the Marine Stewardship Council (MSC) for certification and have reached at least Stage 5 of the process or are certified have detailed reports made public that contain most of the required information for evaluation with regard to seabirds. Therefore, fisheries in the MSC process at these stages are relatively easy to evaluate. Fisheries that are early in the MSC process or that are not in the process at all, may have less available or at least less readily available information that is useful to the evaluation of the fishery with regard to seabirds.

For all fisheries that are to be evaluated with regard to seabirds, there are two steps to the evaluation. The first of these, Step I, is a filter by which the reviewer can determine whether the fishery warrants more in-depth evaluation of its effect on seabirds, or if the effect on seabirds is likely to be sufficiently low as to not require significant additional effort in evaluation. Step I produces an Initial Risk Level, based on the gear type in use and the presence of ETP seabirds or large concentrations of seabirds in the fishery area (factors that increase risk; see page 11).

If the reviewer deems the fishery's effects on seabirds to require a detailed evaluation based on the Initial Risk Level, he may proceed to Step II, In-Depth Analysis. Step II requires more detailed information, to evaluate the factors that can decrease risk and uncertainty (see page 11).

The in-depth evaluation considers the fishery's status with regards to all seven of the risk factors, the two that increase risk and which form the Initial Risk Level, the four that reduce risk (mitigation methods, regulations and enforcement, actual bycatch of seabirds, and observation), and Uncertainty. The in-depth evaluation produces a second level ranking, the Risk Reduction Level, and an Uncertainty Level. The final result of Step II is a short (2-5 page) summary of these factors as they pertain to the fishery, recommendations on how to address any weaknesses, and a final, subjective level ranking taking the Initial Risk Level, Risk Reduction Level, and Certainty Level into account to produce a ranking of Low Risk, Medium Risk, or High Risk.

Details on each of these steps is given, below.

STEP I: INITIAL FILTER

Filter Methodology

An important need when reviewing fisheries for their effects on the conservation of seabirds is to be able to identify which fisheries require in-depth evaluation, because they may pose a significant risk to seabirds, and to identify those which require less intense scrutiny, because they likely pose a low risk to the birds. This filter methodology was designed to fill that need. It is designed to give a "level" (a ranking) indicating a fishery's need for further evaluation, determined from basic, summarized information available about the fishery. An evaluator may then select fisheries that receive high risk levels for further, in-depth evaluation in Step II, to determine if the fishery may actually does pose a high risk, or if mitigation methods or other factors suggest that the risk has been lowered.

The filter system is designed to give a general idea of the relative risk a fishery poses based on general principles of the risks posed by different types of fisheries and the presence of ETP species or large concentrations of any seabirds (breeding colonies, for example) in the fishery area. The level rankings produced by the system are designed to be repeatable with some reliability. Note that these levels are generally not *in themselves* an adequate evaluation of the risk to seabirds in a fishery, but are to be used to identify which fisheries will require a further, in-depth analysis.

The Initial Risk Level is composed of two components, Gear Risk and Species Presence. Each of these is treated separately.

Gear Risk

The Gear Risk Score is evaluated from Low Risk to High risk. Different gear types receive scores based on risk from published sources (see Appendix). If a fishery uses more than one gear type, the evaluator may assign the Gear Risk Score as he judges, Low, Medium, or High, with higher scores indicating greater risk. The gear types and scores they receive are:

Risk Level	Gear Types
High Risk Gear	Longline (pelagic, semi-pelagic, or demersal) Gillnet (drift or set) Trammel net
Medium Risk Gear	Trawl (midwater, pelagic, demersal, beam; single or twin-rigged) Seine (purse or Danish)
Low Risk Gear	Trap, Korean trap, pot, fish wheel Harpoon Troll, jig Handline, pole and line Tongs, hand-collection, hand raking, sieving Dredge Culture, farming

Each of these gear types affects seabirds in a different way, and they may affect different types of seabird groups (divers vs. surface foragers) or communities in different ways. Following are brief descriptions of the effects on seabirds by each of these.

- *Longlines* may be up to many kilometers long, usually in the form of a single, main line with many hooks attached to it by branch lines. Longlines may be set near the surface, subsurface, or on the bottom. Seabirds are caught by the longline hooks and dragged under the surface and drowned. Most frequently, seabirds are caught during the setting procedure, when the baited hooks are near the surface. The birds attempt to steal the bait, but are hooked and drowned. Seabirds may be caught at killed any time that longline hooks are near the surface, most frequently when setting, but also on hauling the line, or if the line is brought to the surface or remains near the surface.

- *Gillnets and trammel nets* are held vertically in the water, and may be set near the surface or at the sea floor. Diving seabirds may be entangled in the nets and drown. In trammel nets, the seabirds may be trapped between the coarse nets and the middle net, as well as being caught in the middle net.
- *Trawls* are nets that are towed through the water. They are not high risk to seabirds; few birds are actually caught in the nets. Some birds may be killed during towing of the net as a result of striking the warps (the heavy cables that pull the net and extend from the boat into the water to the net below). During towing the warps become very tight and rigid, and enter the water at an angle. Seabirds following the boat in its wake may strike the warps and suffer injury, or upon striking the warp may be trapped between the moving cable and the water, and dragged beneath the surface. Some birds may also be killed when the net is near the surface, either being set or being hauled. They are more likely killed on hauling the net, when they try to obtain the fish being brought aboard the boat, and become entangled.
- *Seines* are similar to trawls, but are not usually towed. Instead they are set by a boat sailing around a shoal of fish while playing out the net. Once the shoal is surrounded, the seine is drawn in and hauled on board with its catch. As with trawls, seabirds may become entangled in the net, more likely when hauling, when the fish-laden net is near the surface or is being brought on board.
- *Dredges* are similar to trawls, in that a large dredge is towed, in this case along the sea floor. Although they may have cables similar to the trawl warps, they generally do not cause much seabird mortality, because the dredge moves much more slowly than a trawl.
- *Traps, Korean traps, and pots* are enclosed cages with one-way entrances, and most often are used for catching crustaceans. These usually do not cause seabird mortality, although when set in water sufficiently shallow for diving birds some birds may enter the traps and be drowned.
- *Fish wheels* are set in flowing-water estuaries, usually to catch returning salmon. Because they are set in shallow water and have small net areas, they only rarely cause mortality to birds.
- *Harpoon, handline, pole and line, tongs, hand collection, hand raking, and sieving* are all manual fishing methods. As such, they cause almost no seabird mortality.
- *Trolls and jigs* are methods by which a baited or artificial lure with a hook is towed through the water. In many cases, the hooks are attended by humans. Most boats using this method have relatively few hooks.
- *Culture and farming* encompass a large range of methods. Most involve static systems, anchored in one place. Diving seabirds may rarely be killed by becoming tangled in enclosure netting or culture support nets.

Species Presence

As with the Gear Risk Level, the Species Presence is evaluated as Low, Medium, or High. Higher rank indicates greater presence of ETP seabirds or seabird concentrations, that is, it suggests higher risk. The greater the number of ETP species present in a fishery, the greater the potential risk. However, it is necessary to also take into account not only the presence of ETP species, but also their abundance. For example, a threatened species that is present but only at the margin of its range where it is less abundant would not face as high of a risk as one where the

fishery is at the core of its range. In addition, it is necessary to consider non-ETP species which may occur in high numbers in a fishery area. This may occur because a breeding colony or an important foraging concentration site occurs in the area of the fishery.

Risk Level	Species Presence
High Risk	Fishery is in core of range of three or more ETP species OR Fishery is in area of concentration of a two or more non-ETP species
Medium Risk	Fishery is in range of one or two ETP species OR Fishery is in area of concentration of a non-ETP species
Low Risk	None, one, or two ETP species present and only at margin of their ranges AND Fishery area has no concentrations of non-ETP species

As with the Gear Risk, the reviewer may assign levels of Low, Medium, or High risk, depending on his judgment of the likely risk and number of species or concentrations present.

Determining Initial Risk Level

This system is intended to be conservative. For example, many fisheries have presence of many ETP species, thereby pushing their Species Presence Level into the "High Risk" category. *The objective of this system, however, is to identify fisheries that require a more in-depth evaluation of the risk they pose to seabirds.* Therefore, the system should identify for greater evaluation all fisheries with any potential for significant risk.

To determine the Initial Risk Level for a fishery, look up the appropriate cell in the table below for the two categories Gear Risk (rows) and Species Presence, (columns). If the corresponding cell is red, the fishery would generally be considered "High Risk" and a more in-depth evaluation would be needed, leading to Step II. If the corresponding cell is green, however, an in-depth analysis is probably not needed, and Step II can be skipped.

	Species Presence		
Gear Risk	Low	Medium	High
Low	Fishery is not High Risk; further analysis is probably not needed.		
Medium			Fishery is High Risk.
High		Proceed to Step II (In-Depth Analysis)	

STEP II: IN-DEPTH ANALYSIS

General

The final result of the analysis in Step II is a short narrative report, two to four pages long, giving a summary of the evaluation and describing the details of the fishery with regard to seabird bycatch. For the in-depth analysis, the reviewer must collect information on the four factors that decrease risk. Each of these is evaluated separately, and assigned a score. High scores indicate greater strength of that factor (for example, stronger regulations or more effective mitigation methods) and therefore decreased risk to seabirds.

Risk Reduction Level

The four factors making up the risk reduction are not equally significant to seabird bycatch. Therefore, in the following analysis, the four factors are assigned different scoring weights.

- Regulations and enforcement are assigned a score from 1 to 20 points.
- Mitigation is assigned a score from 1 to 25 points. Effective mitigation is the second-most important factor in knowing how a fishery is affecting seabirds.
- Actual bycatch is assigned a score from 1 to 35 points, with higher scores indicating lower levels of bycatch. Because the actual bycatch that is occurring in a fishery is actually the most important factor in knowing how the fishery is affecting seabirds, it is given greater weight than other factors.
- Observation, or the presence of independent on-board observers, is assigned a score from 1 to 20 points.

The maximum scores for the four factors sum to 100 points. Of course, few fisheries will achieve this score. The minimum possible score is 4 points.

Regulations and Enforcement

The presence and enforcement of regulations on a fishery by its home country can show a commitment by the country to reduce seabird bycatch. Participation by the fishery's home country in international agreements such as ACAP or CCAMLR as well as national regulations indicate this commitment, as do the presence of NPOAs and FMPs covering a fishery. Enforcement, via observation, inspections, tracking of vessels, etc., of the regulations that are cover a fishery can reduce the risk to seabirds of the fishery.

The reviewer gives a score of 1 to 20, with 20 indicating strong regulation with regard to seabird bycatch and enforcement. The level of risk reduction for regulations and enforcement is then determined from the table below. Depending on the range in which the score falls, it may be categorized as Poor, Fair, or Good.

Range of Regulations and Enforcement Score	
1 to 7	Poor
8 to 14	Fair
15 to 20	Good

Mitigation

The use of effective mitigation methods can significantly reduce seabird bycatch. These may include both physical mitigation equipment (bird-scaring lines, for example) or set mitigation techniques (night-setting, for example), and different methods may be used together. The guidance table in the Appendix provides information on which mitigation methods are effective with each gear type, and how effective. Both gear and set mitigation methods are detailed in the Appendix.

The effectiveness of all mitigation methods is highly dependent on many external factors. A method which is highly effective under one set of conditions, or time of day, or in one location may be far less effective when used in a different place or at a different time of day. Different mitigation methods are often used in combination. However, the interactions of different mitigation methods is complex, also depending on many factors such as time of day, seabird community composition, or even direction of the wind. It is usually non-linear; that is, combining two methods that are each very effective when used alone does not usually mean that using the two together is twice as effective. In addition, combining methods does not necessarily have easily predictable effects. Therefore, the effectiveness of mitigation methods is an inexact science, and must rely on informed but subjective evaluation.

The reviewer assigns a score of 1 to 25 points to a fishery, depending on the effectiveness and use of mitigation techniques. If mitigation techniques are being used, but are unknown, the middle score of 13 is given, but if no mitigation method is used or none is known to be used, the score is 1. The level of risk reduction for mitigation is then determined from the table below. Depending on the range in which the score falls, it may be categorized as Poor, Fair, or Good.

Range of Mitigation Score	
1 to 8	Poor
9 to 17	Fair
18 to 25	Good

Actual Bycatch

Greater bycatch of any species, ETP or not, increases risk. This is an important component that prevents a fishery that kills many seabirds of common and non-threatened species from being

listed as low risk. This component requires actual information on bycatch from the fishery being evaluated, or from comparable fisheries (similar fisheries operating in the same or nearby waters).

Fisheries that have bycatch of any seabirds that is less than 10 birds per 1000 sets are generally low risk to seabirds. Moderate levels are 10 to 100 birds per 1000 sets, and high levels are more than 100 birds per 1000 sets. However, even if a fishery has low levels of total seabird bycatch, but some of that bycatch is of ETP species, the fishery may be considered to have "Poor" levels of actual bycatch.

The reviewer assigns a score of 1 to 35 points to a fishery, depending on the level of its actual bycatch of seabirds, with higher scores assigned to fisheries with lower levels of actual bycatch. The level of risk reduction for actual bycatch is then determined from the table below. Depending on the range in which the score falls, it may be categorized as Poor, Fair, or Good.

Range of Actual Bycatch Score	
1 to 12	Poor
13 to 24	Fair
25 to 35	Good

Observation

Adequate observer coverage is necessary to ensure that seabirds are not being caught. This issue is linked with enforcement of regulations and with certainty of information.

For adequate observation it is necessary not only to have an adequate number of observers on board boats, but those observers must also record information on seabird interactions, and must be sufficiently trained to be able to identify the different seabirds to species.

If the observers in a fishery are collecting the appropriate data and are properly trained for identifying seabirds and collecting information on seabird interactions, then fisheries that have adequate amount of observation (number of trips with on-board observers that record seabird interactions) that they would be able to detect and evaluate seabird bycatch are considered to have adequate coverage. Similar fisheries but with observation which is not sufficient to detect and measure seabird bycatch have lower coverage.

Note that although most fisheries require observers to obtain information about seabird bycatch (or lack of it), some fisheries have an inherently very low risk to seabirds. These may include some aquaculture techniques, harvesting clams or mussels from beaches, or even some deep-sea fishing techniques such as swordfish harpooning. Therefore, although it is desirable to have observers in many fisheries, in some cases it is not necessary. Those fisheries where the evaluator is confident that sufficient information is available to make a determination can be

marked as having a “Low” Information Quality Risk, because there is sufficient information at hand, and there is no need for observers

The reviewer assigns a score of 1 to 20 points to a fishery, depending on the adequacy of observer coverage, with higher scores assigned to fisheries with better coverage. The level of risk reduction for observation is then determined from the table below. Depending on the range in which the score falls, it may be categorized as Poor, Fair, or Good.

Range of Observation Score	
1 to 7	Poor
8 to 14	Fair
15 to 20	Good

Scoring Risk Reduction Level

Once the scores for each of the four risk reduction items have been assigned, sum the four values. The sum can then be compared to the ranges in the table below and assigned a Risk Reduction Level of Poor, Fair, or Good.

Sum of four scores	
1 to 33	Poor
34 to 67	Fair
68 to 100	Good

Uncertainty

Lack of information about a fishery and its effects on seabirds is a source of risk to the birds. Not knowing whether a fishery’s gears, set characteristics, or ecological impacts are affecting seabirds means that potential impacts could be occurring. Uncertainty risk may rise from several, sometimes interrelated causes, such as:

- misidentification of species,
- high variability in results,
- use of comparative data from sources outside the specific fishery,
- gaps in information resulting from a lack of appropriate scientific studies carried out in a way that they apply to the specific fishery.

Many times these factors are related to observer coverage or observer adequacy. That is, low observer coverage often leads to highly variable results, or poor observer training can lead to poor information about the species being caught. Gaps in information, although potentially arising from a low-quality observer program, usually are a result of a lack of appropriate

scientific studies applying to the specific fishery. Because of this interrelatedness, the various forms of information risk are usually very difficult to analyze separately.

Uncertainty may be indicated by lack of specific information on a fishery. For example, if the available information does not have mention of mitigation methods used or actual bycatch data for seabirds, it leads to high uncertainty. If a fishery does not have any on-board observer programs, or if none is known to exist, it leads to high uncertainty. Uncertainty is low when there are more details known about the fishery. If a fishery has a high proportion of its voyages and sets covered by observers, it likely has low uncertainty. Likewise, a fishery with detailed scientific studies of its bycatch issues, bycatch species and numbers has low uncertainty, whereas a fishery which has none of this, but perhaps relies on studies from other, perhaps similar fisheries, would have greater uncertainty.

In a fishery, high knowledge of seabird bycatch (low uncertainty) therefore suggests low risk of making an error in the evaluation of risk to seabirds, whereas little or no knowledge of seabird bycatch (high uncertainty) suggests much higher risk of making such an error.

The reviewer assigns an Uncertainty level of Low, Medium, or High to a fishery, with higher scores assigned to fisheries with greater uncertainty.

Overall Risk Level

Once levels have been assigned for each of the four risk reduction components and for Uncertainty in Step II, the evaluator uses the following three tables to determine the Overall Risk Level to be Low, Medium, or High.

Step 1. Determine which of the three tables to use based on the Uncertainty Level (determined above).

Step 2. Select the cell in the table corresponding to the Initial Risk Level (rows) and Risk Reduction Level (columns).

Step 3. The value in the corresponding cell gives the Overall Risk Level for the fishery.

If Uncertainty is Low:

	Good Reduction	Fair Reduction	Poor Reduction
High IRS	Low	Medium	High
Medium IRS	Low	Low	Medium
Low IRS	Low	Low	Low

If Uncertainty is Medium:

	Good Reduction	Fair Reduction	Poor Reduction
High IRS	Medium	Medium	High
Medium IRS	Low	Medium	Medium
Low IRS	Low	Low	Low

If Uncertainty is High:

	Good Reduction	Fair Reduction	Poor Reduction
High IRS	Medium	High	High
Medium IRS	Medium	Medium	Medium
Low IRS	Low	Low	Low

On the reports produced by the In-Depth Analyses, the Overall Risk Level is indicated by a color-shaded seabird silhouette:

Potentially High Risk to Seabirds | Potentially Moderate Risk to Seabirds | Potentially Low Risk to Seabirds

Examples:

- A fishery using high risk gear type in an area with many ETP species such as a Southern Ocean pelagic longline, would have a high Initial Risk Level. However, the fishery is regulated by CCAMLR, and if it uses effective mitigation techniques such as bird-scaring lines, appropriate offal management, and night setting, has 100% observer coverage, and actually is catching few seabirds, it would have a high Risk Reduction Level of "Good." With Low Uncertainty, resulting from the high amount of observer coverage and adequate science background, such a fishery would be ranked as Low Risk to Seabirds and indicated with a green seabird outline.
- A fishery using a moderately risky gear type such as a demersal trawl in an area with fairly high numbers of seabirds and ETP species, such as fisheries in the Aleutian Islands, would have a Medium Initial Risk Level. As the fishery would be a US fishery, it would

have good regulations, and if it uses appropriate mitigation methods, has good observation, and has low bycatch mortality, the fishery would also receive a “Good” Risk Reduction Level. With low levels of Uncertainty, this fishery would also be ranked as Low Risk to Seabirds.

- A fishery using high risk gear type, such as a pelagic longline, in an area with many ETP species, would have a High Initial Risk Level. If the fishery operates from a country with weak regulations, uses none or ineffective mitigation methods, but has “Fair” observer coverage and therefore “Medium” Uncertainty, has high actual bycatch, its Risk Reduction Level would be “Poor,” and be ranked as a High Risk to Seabirds.
- A fishery using high risk gear type, such as a pelagic longline, in an area with many ETP species, would have a High Initial Risk Level. Even if the fishery is from a country with good regulation and enforcement, effective mitigation methods, low actual bycatch, and moderate observer coverage, that would have a “Good” Risk Reduction level, but with “Medium” Uncertainty, that fishery would still pose a Medium Risk to Seabirds.

APPENDIX: GEAR AND MITIGATION RISK LEVEL GUIDANCE

Gear Risk and Mitigation Factors

The following table provides information on the risk level for particular gear types ("Gear-specific Risk"). Under "Risk Factor" for each of these is given the risk level, in the parentheses following the name of the gear type. The effectiveness of mitigation methods for each type is in the following columns. Sources are listed following the table, and referred to by number.

Category	Gear Type	Mitigation Method	Effectiveness (Reduction of Risk)	Comment	Sources
Gear-specific Risk	Longline, demersal (High Risk)	None	None	With no mitigation methods, demersal longlines pose a high risk.	18
		Bird-scaring lines	Medium to high effectiveness	High reduction when deployed properly in a surface-feeding seabird community, although never 100%. Paired lines tend to be better than single lines. Less effective with diving seabirds.	1, 15, 19, 20
		External line weights	Medium to medium-low effectiveness	Requires 8.5 kg / 40 m of line to be effective. Not as effective as other weighting systems. Less effective with diving seabirds. More effective with weights close to hooks.	2, 15, 19, 20
		Integrated line weights	Medium to medium-high effectiveness	Weighting of 50 g / m. More effective than external weighting systems. Less effective with diving seabirds.	3
		Chilean system	Medium-high to high effectiveness	Most effective of weighting systems.	4, 20
		Underwater setting chute	Medium effectiveness	Can have a significant reduction in bycatch, especially of surface-feeding seabirds. Not as effective for diving seabirds. Not as effective as BSLs.	6, 19, 20

Category	Gear Type	Mitigation Method	Effectiveness (Reduction of Risk)	Comment	Sources
Gear-specific Risk (continued)	Longline, demersal (High Risk) (continued)	Haul mitigation	Low effectiveness	Haul is not usually a significant source of seabird mortality. Use of a moon pool or a Brickle curtain have greatest effect. Disposal of offal on the off-haul side of the boat can also have some effect. Branchline haulers and water cannon seem to reduce risk little.	12
		Offal management	Medium effectiveness	Mealing is most effective, mincing less so. Retention or discharge away from set can be effective.	19, 20
	Longline, semipelagic (High Risk)	None	None	With no mitigation methods, semipelagic longlines pose a high risk.	15
		External line weights	Medium to medium-low effectiveness	Little has been done on semipelagic longlines, but they probably are similar to demersal longlines.	2
	Longline, pelagic (High Risk)	None	None	With no mitigation methods, pelagic longlines pose a high risk.	18
		Bird-scaring lines	Medium to medium-high effectiveness	Two lines are much more effective than one.	7, 15, 19, 20
		Line weights	Medium to medium-low effectiveness	Less effective with diving seabirds.	8
		Side-setting	Medium effectiveness on small boats in a surface-foraging seabird community	Side setting has not been tested on large boats or with diving seabirds. Therefore, its effectiveness is not known for those situations.	9
		Blue-dyed bait	Low effectiveness if squid is bait; not effective if fish is bait	Because many species of birds can become quickly accustomed to blue-dyed bait, this technique will rarely reduce the Gear Risk.	10

Category	Gear Type	Mitigation Method	Effectiveness (Reduction of Risk)	Comment	Sources
Gear-specific Risk (continued)	Longline, pelagic (High Risk) (continued)	Bait conditioning	Low effectiveness	Thawed bait or fish baits with deflated swim bladders at best produce a slight risk reduction.	15
		Bait caster or line shooter	None to low.	Neither bait casters nor line shooters appear to provide significant mitigation, except under special conditions and with highly-skilled use. Therefore, these do not reduce the Gear Risk.	11, 19, 20
		Haul mitigation	Low effectiveness	Haul is not usually a significant source of seabird mortality. Use of a moon pool or a Brickle curtain have greatest effect. Disposal of offal on the off-haul side of the boat can also have some effect. Branchline haulers and water cannon seem to reduce risk little.	12
		Offal management	Medium effectiveness	Mealing is most effective, mincing less so. Retention or discharge away from set can be effective.	19, 20
	Trawl, bottom (Medium Risk)	None	None	With no mitigation methods, trawls pose a medium risk.	17, 18
		Bird-scaring lines	Medium effectiveness	BSLs reduce the risk to about 10% of that with no mitigation.	13
		Warp scarers and bafflers	Medium to low effectiveness, less than for BSLs	Various systems differ in effectiveness depending on conditions. However, in general they seem less effective than BSLs.	13
		Offal management	Medium effectiveness	Offal retention while a trawl is set can be highly effective. Mealing of offal is also highly effective. Discharge of offal away from cables and mincing of offal is also effective but less so.	13, 20

Category	Gear Type	Mitigation Method	Effectiveness (Reduction of Risk)	Comment	Sources
Gear-specific Risk (continued)	Trawl, midwater (Medium Risk)	None	None	With no mitigation methods, trawls pose a medium risk.	17, 18
		Bird-scaring lines	Medium effectiveness	BSLs reduce the risk to about 10% of that with no mitigation.	13
		Warp scarers and bafflers	Medium to low effectiveness, less than for BSLs	Various systems differ in effectiveness depending on conditions. However, in general they seem less effective than BSLs.	13
		Offal management	Medium effectiveness	Offal retention while a trawl is set can be highly effective. Mealing of offal is also highly effective. Discharge of offal away from cables and mincing of offal is also effective but less so.	13, 20
	Gillnet, drift (High Risk)	None	None		17, 18, 19, 20, 21
		Visual alerts	Medium to medium-low effectiveness	Mitigation methods for drift gillnets have been very poorly studied.	19, 20
		Acoustic alerts	Medium-low to low effectiveness	Mitigation methods for drift gillnets have been very poorly studied.	19, 20
		Subsurface setting	Medium to medium-low effectiveness	Mitigation methods for drift gillnets have been very poorly studied.	19, 20
	Gillnet, bottom (Medium Risk)	None	None		17, 18, 21
	Gillnet, midwater (Medium Risk)	None	None	May catch significant numbers of diving seabirds.	17, 18, 21
	Purse seine (Low Risk)	None	None		17, 18

Category	Gear Type	Mitigation Method	Effectiveness (Reduction of Risk)	Comment	Sources
Gear-specific Risk (continued)	Hook and line and troll and jig (Low Risk)	None	None		17, 18
	Dredge (Low Risk)	None	None		18
	Pots and traps (Low Risk)	None	None	Almost pose no risk to seabirds.	17, 18
Set Risk (non-gear specific)	Set, time of day	Night setting	Medium effectiveness	Can be effective, but depends on seabird species, phase of the moon, etc. More effective with deck lights off or facing inward. For gillnets, it is less effective.	19, 20
	Set, season of year	Fishing during seabird's non-breeding season	Medium effectiveness	Closure of fishing areas depending upon seabird breeding season is one way to achieve this. However, in some fisheries there is still high bycatch of seabirds even during the non-breeding season.	19, 20
	Set, distance from risk areas	Fishing far from breeding colonies	Medium effectiveness	Closure of fishing areas depending upon seabird breeding season may be one way to achieve this.	19, 20

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