 <p data-bbox="231 533 470 571">Agreement on the Conservation of Albatrosses and Petrels</p>	<p data-bbox="574 241 1385 324">Twelfth Meeting of the Seabird Bycatch Working Group</p> <p data-bbox="909 347 1385 385"><i>Lima, Peru, 5 – 7 August 2024</i></p> <p data-bbox="518 459 1369 604">Guidelines for the safe seabird rescue, handling, and recovery onboard purse seine fisheries</p> <p data-bbox="542 672 1348 757"><i>Cristián G. Suazo, Esteban Frere, Yann Rouxel & Oliver Yates</i></p>
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SUMMARY

Extensive knowledge exists regarding the causes and outcomes of seabird bycatch across various fisheries, whether small-scale or industrial. Furthermore, ongoing studies are examining the impact of new netting techniques, such as purse seine and gillnet fishing, on non-target species, shedding light on their effects. However, addressing sub-lethal entanglements in fishing gear and enabling seabird rescue onboard remains limited. Thus, this document emphasizes purse seine fisheries to assess how *ad hoc* actions and tools can aid in implementing best practices among crew members, including the safe rescue and handling of seabirds. The document provides recommendations for safe handling techniques and the utilization of appropriate tools for rescuing trapped or entangled seabirds, as well as mitigating seabird strikes on deck caused by light attraction or adverse weather conditions. Lastly, it underscores the importance of integrating these actions onboard, particularly in response to health contingencies like the ongoing high pathogenicity avian influenza panzootic.

1. INTRODUCTION

Many seabird species face ongoing threats including pollution (e.g., oil, plastics), overexploitation by fisheries, and incidental bycatch in various fishing operations. Recent efforts to address interactions between seabirds and fisheries have primarily focused on identifying instances of bycatch and assessing the effectiveness of mitigation measures to reduce this impact.

However, there is also a significant lack of guidelines for efficiently rescuing and handling non-target species, such as seabirds, especially when they become entangled in fishing gear. Improper handling of seabirds during bycatch events can lead to injuries for both the birds and crew members.

'This paper is presented for consideration by ACAP and may contain unpublished data, analyses, and/or conclusions subject to change. Data in this paper shall not be cited or used for purposes other than the work of the ACAP Secretariat, ACAP Meeting of the Parties, ACAP Advisory Committee or their subsidiary Working Groups without the permission of the original data holders.'

As a result, consolidated guidelines for initial response protocols by crew members aboard fleets, as well as for management and compliance authorities overseeing fisheries, are currently unavailable. In the purse seine fishery context, ATF-Chile has diagnosed and evaluated potential mitigation measures related to gear structures in the Humboldt Current System (Suazo et al. 2016, 2017). However, these field experiences have highlighted the absence of processes for rescuing and handling seabirds entangled or trapped in this type of fishing gear.

Therefore, these guidelines aim to outline procedures and steps as complementary measures to reduce the impact of fisheries on seabirds, particularly in purse seine fisheries, while also offering applicability to other types of netting fisheries such as trawl and gillnets.

2. WHAT IS PURSE SEINE FISHING AND HOW DOES IT WORK?

Purse seine fishing involves encircling and capturing a school of pelagic fish of varying sizes, such as tuna, sardines, and other target species like squids. The fishing gear consists of a wall of netting equipped with an upper line of buoys or floats and a lower line of weights (Fig. 1).

In the lower section of the net, a system of metal rings (known as keys) is connected by steel cables, allowing the net to be closed to prevent fish from escaping through the bottom. The dimensions of purse seine gear vary in length and depth, depending on whether it is small-scale or industrial, and the mesh size is tailored to the target species.

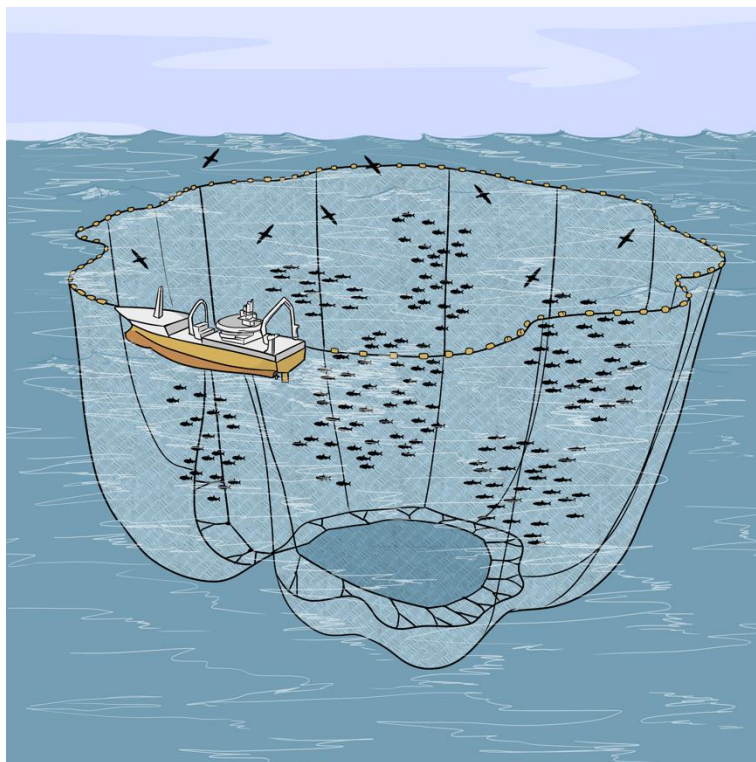


Figure 1. Overview of infrastructure for purse seine fishing at an industrial scale (© ATF-Chile).

In the majority of purse seine operations, a motor-driven skiff lifts and deploys the net, released from the stern of the purse seine boat (Fig. 2). This auxiliary vessel attaches one end of the purse seine, holding it in place while the purse seiner circles to secure the other end, bringing both vessels close to the buoyline for closure. The purse seine is then closed by hauling the wire line with a winch, shaping the net into a cup-like form.

Subsequently, the retrieval of the purse seine gear involves bringing the net onboard using hydraulic engines such as a powerblock (Fig. 2). Crew members also arrange buoys, netting gear, and weights on deck for the next set. As the amount of net material in the water decreases, the bunt section of the net is drawn in, transitioning to the net break (where the line of buoys is lifted with a winch and pulleys). At this stage, a hydraulic pump or a grab net is used to transfer the catch onboard (Fig. 2).

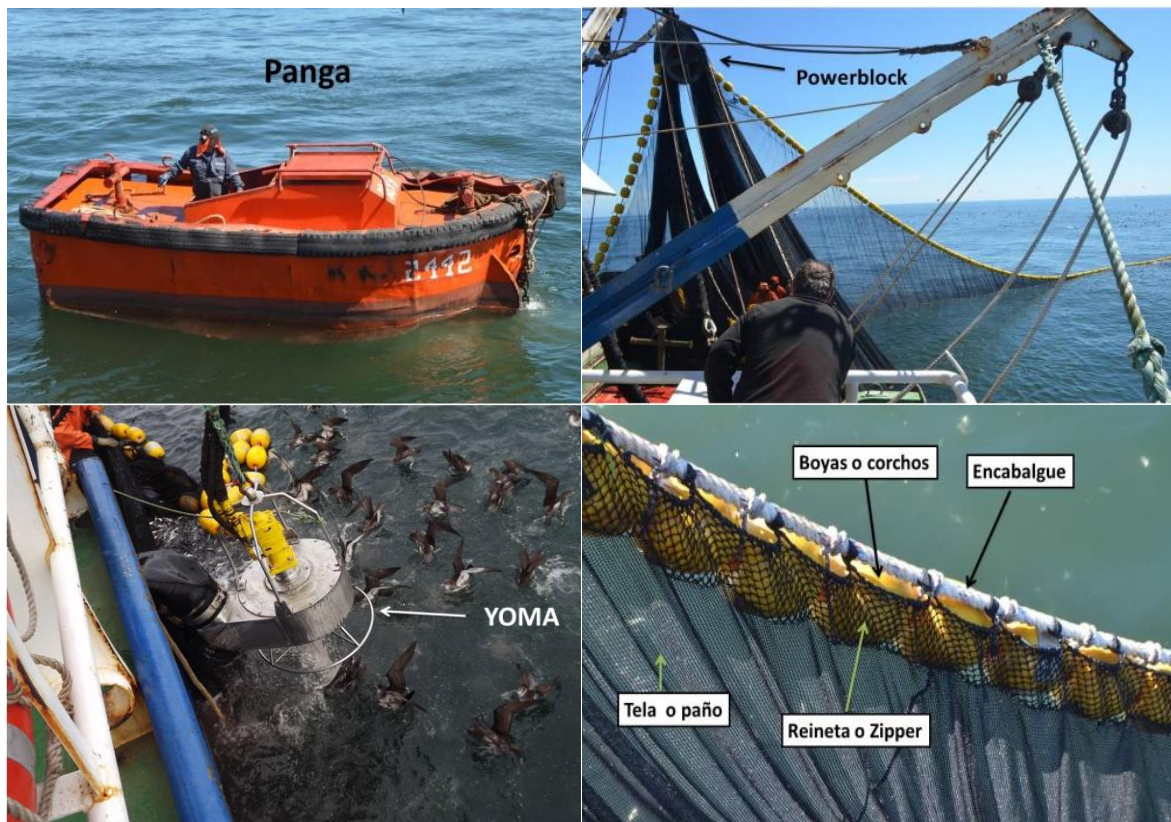






Figure 2. Overview of equipment and stages in a small-scale purse seine fishing operation. Top-left: Skiff (Panga); top-right: Use of powerblock for retrieving nets on board; bottom-left: Hydraulic pump (Yoma) for transferring catch from the codend; bottom-right: Sections of the buoy mounting system and fishing net connectors (Zippers) during the hauling phase (© ATF-Chile).

3. IDENTIFYING SEABIRD BYCATCH FOR SAFE RESCUE IN PURSE SEINE FISHERIES

3.1. Phases of purse seine fishing and hotspots for seabird bycatch

In each purse seine fishing set, hotspots for seabird bycatch can be identified during both the setting and hauling phases of the gear. In this process, seabird bycatch is primarily influenced by the structural features of the fishing gear (Table 1).

Table 1. Phases of the purse-seine fishing and hotspots for seabird bycatch.

Phase	Milestones during fishing	Hotspots of seabird bycatch
SET	<p>Start the set (Skiff released from stern and net in water)</p> 	<p>At this stage, penguins that are feeding on the shoal are trapped.</p>  <p>Bycatch mainly in the ceiling of the net.</p>
	<p>The purse seine boat moves on, enclosing the shoal (continuous setting) until it meets up with the Skiff holding the other end of the cork line.</p> 	

Closing of the fence to allow the cables to be collected with the support of the anchor and thus to close off the bottom of the net.



The hauling phase begins. After closing the bottom of the net by picking up the cables and steel rings with the winch, the tacking phase begins by picking up the net with the help of the powerblok (passing the buoys or corks through the powerblok).



At this stage of haul, seabirds are trapped in the net: entanglement in the buoy line.







At this stage of hauling, seabirds remain trapped in the net: the netting: "reineta" or zipper.



The haul continues and the skiffer stabilises the purse seine boat



HAUL

		<p>At this stage of netting, seabirds are trapped in the net: folds.</p> 
	<p>Beginning of the net break (when the outer area of the net and buoys or bunt is lifted). At this stage, seabirds are trapped in the bunt without the option of getting out on their own.</p> 	<p>At this stage, seabirds are trapped in the bunt of the net, with no option to leave on their own.</p> 
	<p>Start hauling of the net (this is done to pick up cloth by helping what passes through the powerblok, but also with ropes and winch).</p> 	

The hydraulic pump (yoma) for catch pumping begins.



The catch is pumped through and passes to the dryer (separates the water from the catch), to send the catch to the hold of the vessel.



After the yoma has been used, the net is completed on board in the stern area, and the net is left in order until a new set is made.










3.2. Seabird species associated with purse seine fisheries



Seabird species linked to industrial and small-scale purse seine bycatch events have primarily been identified as diving species such as shearwaters, pelicans, boobies, penguins, and cormorants (Suazo et al. 2014).

However, bycatch events have also been recorded among surface-feeding species such as gulls and albatrosses. Details of recurrent species, bycatch focal points in fishing gear, and identification specifics are presented in Table 2.

Table 2. Most frequent seabird species susceptible to bycatch in purse seine fisheries.

Seabird species (ACAP listed species)	Hotspots of seabird bycatch	
Sooty shearwater negra <i>Ardenna grisea</i>	Zipper, buoyline, folds in netting material, ceiling of the net, bunt	
Pink-footed shearwater <i>Ardenna creatopus</i> (ACAP species)	Zipper, buoy line, folds in netting material, ceiling of the net, bunt	
Black-browed albatross <i>Thalassarche melanophris</i> (ACAP species)	Bunt	

<p>Peruvian Pelican <i>Pelecanus thagus</i></p>	<p>Buoy line, folds in netting material, ceiling of the net, bunt</p>	
<p>Peruvian booby <i>Sula variegata</i></p>	<p>Zipper, buoy line, ceiling of the net</p>	
<p>Humboldt penguin <i>Spheniscus humboldti</i></p>	<p>Bunt</p>	
<p>Magallanic penguin <i>Spheniscus magallanicus</i></p>	<p>Bunt</p>	

<p>Red-legged cormorant <i>Phalacrocorax gaimardi</i></p>	<p>Zipper, ceiling of the net, bunt</p>	
<p>Guanay cormorant <i>Phalacrocorax bougainvillii</i></p>	<p>Zipper, ceiling of the net, bunt</p>	

4. CURRENT STATUS IN THE HANDLING OF BYCAUGHT SEABIRDS

Through ATF-Chile's *in situ* diagnosis of seabird bycatch events in purse seine fishing since 2013, occurrences of birds trapped in the bunt during net breaking, entanglement in the mesh frame, and entanglement in the buoylines have been documented. During these incidents, purse seine crews undertake manual and tool-assisted maneuvers to rescue and release birds.

However, in most cases, procedures for bird extraction and handling are inadequate, posing a risk of physical harm to released birds. Manual extraction typically involves gripping birds by their outstretched wings, potentially causing limb dislocation or fractures.

Alternatively, crews commonly use tools like "bicheros" which are wooden sticks with steel hooks at one end (see Fig. 3). These tools are typically used in fishing operations to bring non-target fish aboard from the bunt. This practice of using hooks for extracting trapped seabird species often results in injuries such as cuts.



Figure 3. Detail of the bichero, a hook used for extracting seabirds caught in the bunt in small-scale purse seine fishing in Chile (© ATF-Chile).

4.1. Recommended rescue procedures for handling seabirds onboard

Rescuing a bird under stressful conditions can be dangerous both for the birds and the people performing the rescue and handling. Therefore, it is recommended to consider the following procedures and safety measures, especially when dealing with seabirds entangled in nets or trapped in the bunt due to net breaks that prevent their escape.

4.2. Recommended procedures for handling entangled seabirds in purse seine fisheries

When seabirds are entangled in the buoyline system and connectors with the netting material, it is recommended to handle them manually without using tools. The handler should untangle the trapped bird as the net is being brought on board, coordinating with the crew member in charge of the powerblock operation to slow down the net retrieval speed. Below are sequential images illustrating a successful rescue and handling from this section of the net on a purse seine vessel (Fig. 4)

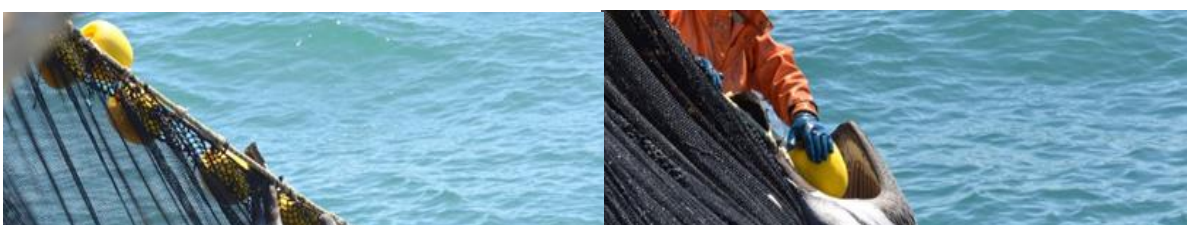


Figure 4. Phases of bird rescue and handling during entanglement events in purse seine hauling. Top-left: Pelican in the buoyline; top-right: crew member in position for bird extraction; bottom-left: handling the bird by immobilizing the beak without compromising its grip on the wings; bottom-right: bird safely aboard without wing damage (© ATF-Chile).

4.3. Recommended handling procedures for seabirds trapped in the bunt

During the hauling phase, the net break involves lifting the buoyline before using the yoma to pump the catch onboard. Birds are often trapped in this section of the bunt as the buoyline is lifted from the water level (Fig. 5).

To extract birds safely, it is recommended to use alternative tools such as handle-nets (Fig. 5). These tools are commonly used on some vessels where they have been shown to safely handle birds without causing cuts or fractures (Suazo et al. 2019).



Figure 5. Phases of seabird rescue and handling during bunt trapping events. Top-left: Net break at the end of the purse seine hauling phase. Top-right: Shearwater trapped in the bunt during net break. Bottom-left: Use of a handle net as an alternative rescue tool onboard purse seine fishing. Bottom-right: Recommended use of handle nets for extracting birds from the bunt (© ATF-Chile).

Additionally, during the onboard handling of birds, it is recommended to use safety equipment such as thick latex or leather gloves, face masks, rubber boots, waterproof suits, overalls, and towels (Soto-Azat et al. 2017, Hall, 2008). Finally, the procedures for handling birds onboard will depend on the species of seabird caught in the bunt, as described in this protocol (see section below).

5. RECOMMENDATIONS FOR SAFE HANDLING OF SEABIRDS IN FISHERIES

As there are different types and sizes of seabird species in purse seine fisheries and other fisheries in general, recommendations for proper onboard handling of seabirds across taxonomic groups are presented here.

5.1. Penguins

They should be brought onboard using a handle net (also known as chinguillo). Penguins, due to their robust bills, should be handled with leather gloves to protect the handlers from potential injuries. It is important to remember that penguins are strong birds and require a firm grip.

Specifically, penguins should be handled by grasping the bird at the base of the head, immobilizing it with the palm of the hand, and firmly holding the lower jaw with the fingers (Hall, 2008; see Fig. 6).

If needed, it is advisable to cover the bird with a towel to wrap around its body, then lift it from the ventral side, supporting it under the arm with the flippers pressed against the handler's body (Fowler & Fowler, 2001; AZA Penguin Taxon Advisory Group, 2014; Fig. 6).

Penguins should never be lifted by their flippers, as this can dislocate the bird's shoulder joint (Soto-Azat et al. 2017). Once securely held, the next step is to place the penguin in an appropriate container for recovery or release at sea.

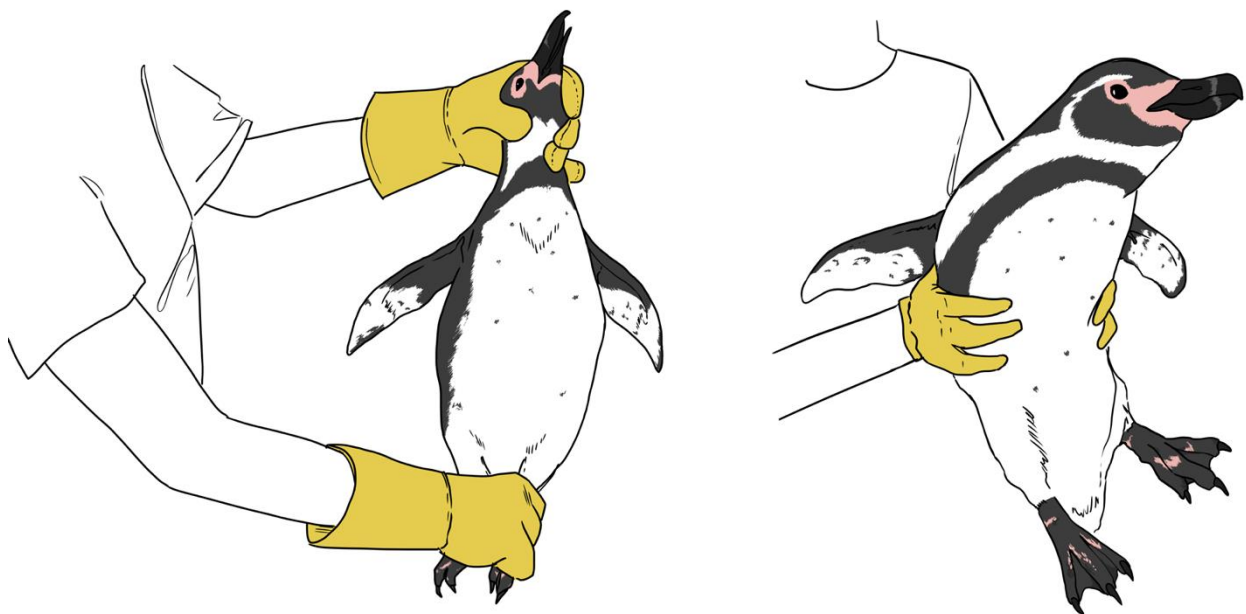


Figure 6. Sequence of the recommended method for proper handling of penguins onboard (© C.G. Suazo).

5.2. Shearwaters

They should be brought onboard using a handle net. The birds should be handled with light leather gloves to prevent injury from pecks. Shearwaters have sharp, hooked bills that can cause lacerations or significant discomfort to handlers. Handling involves grasping the birds by their bills with one hand, ensuring not to cover their nostrils to prevent suffocation (see Fig. 7). With the other hand, it is recommended to lift the bird, place it on your lap, and gently press on its wings to prevent them from spreading (see Fig. 7). If necessary, covering the bird with a towel to wrap its body is advisable.

Once securely held, the next step is to place the bird in an appropriate container for recovery or release at sea.

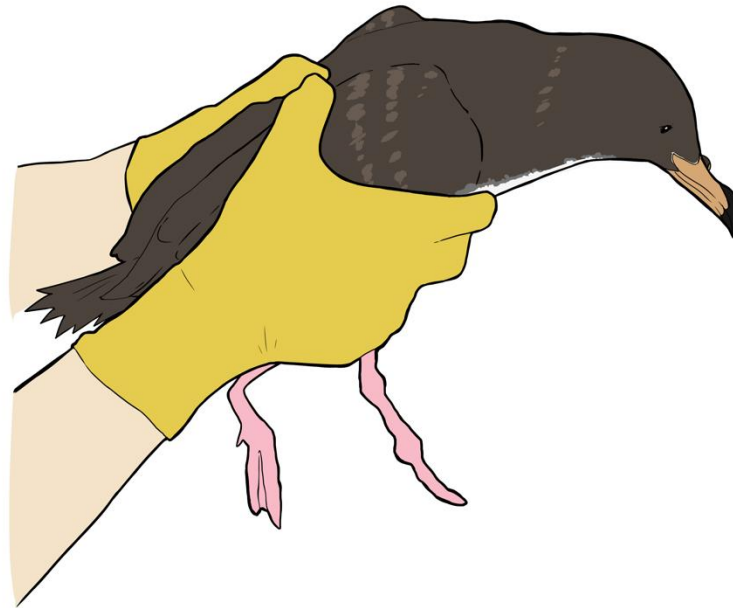


Figura 7. Sequence in recommended method for proper handling of shearwaters onboard (© C.G. Suazo).

5.3. Pelicans

They should be brought onboard using a handle net. Birds should be handled with leather gloves due to their sharp bills. It is also recommended to wear goggles or keep the birds away from the handler's face to prevent pecking and potential eye damage.

The bird's bill should be carefully held with one hand to prevent movement while allowing it to breathe with its beak half open, as these birds do not have nostrils (see Fig. 8). Grip the bill from the middle to the tip, leaving the base of the upper jaw to the middle of the bill slightly open.

With the other hand, lift the bird from its ventral side, wrapping handler's arm around it and placing it between your armpit and waist, gently squeezing the wings to prevent them from spreading (Fig. 8). It may also be helpful to wrap a towel around the bird's body and cover its eyes.



Figure 8. Recommended method for the proper handling of pelicans onboard (© C.G. Suazo).

5.4. Albatrosses

They must be brought onboard using a handle net. Individuals should be handled with leather gloves, as they have robust and sharp bills that can cause injury to handlers.

Always aim to keep the birds at waist height to prevent eye damage, and wearing goggles is recommended. The bird should be held by the bill without covering the nostrils with the hands (see Fig. 9).

Simultaneously, with the other hand, carefully tuck the wings against the bird's body and gently lift it close to the handler's body. Always avoid spreading the wings. Alternatively, wrap a towel around the bird's body to cover its eyes (Fig. 9).

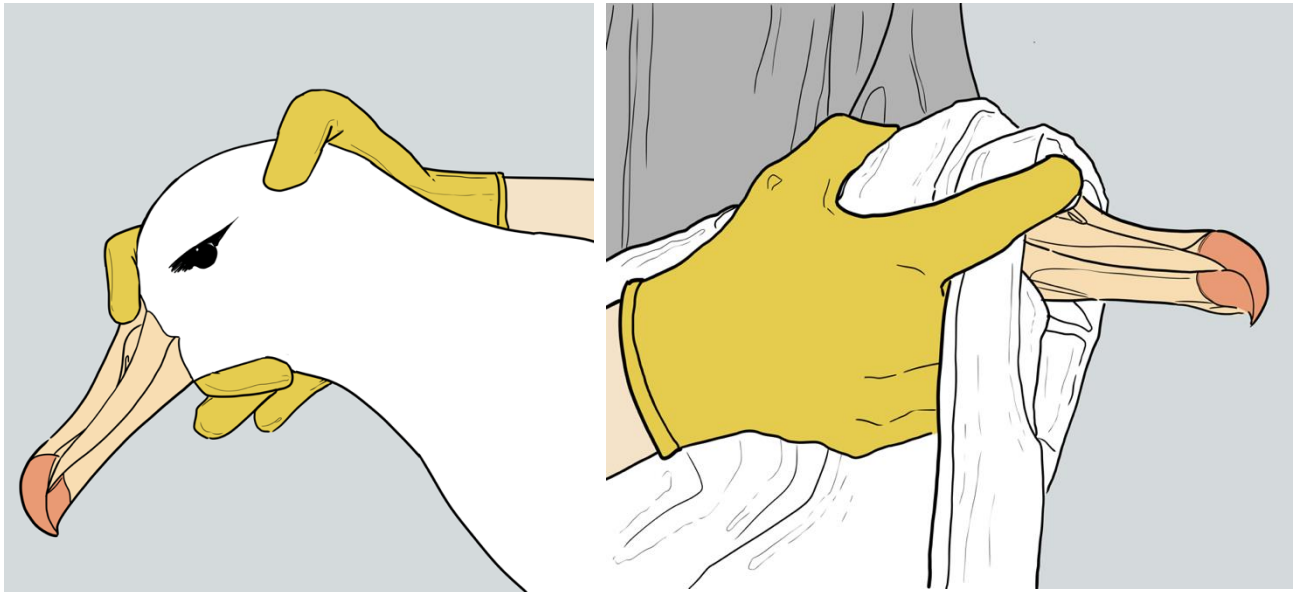


Figure 9. Sequence of the recommended method for the proper handling of albatrosses onboard (© C.G. Suazo).

5.5. Cormorants

They must be brought aboard using a chinguillo. Similar to boobies, cormorants are also mouth breathers. Therefore, it is important not to obstruct their breathing during handling.

When handling these birds, it is advisable to move quickly because they breathe rapidly (Hall, 2008). Handling should be performed with light gloves, securing the head with the fingers under the lower jaw and the thumb holding the top of the head (Hall, 2008; see Fig. 11).

Then, with the other hand, ensure that the wings are folded against the bird's body, gently lift the individual from the ventral area, and bring it under the handler's arm (Fig. 11).



Figure 11. Recommended method for the proper handling of cormorants onboard (© C.G. Suazo).

5.6. When handling a seabird, remember the following:

1. Use the safety equipment mentioned above.
2. Use towels to wrap larger species; this helps in handling the birds and ensures that the wings are folded against the bird's body and tucked over the head to cover the eyes, thereby reducing stress. Towels will also be useful in the case of oiled birds, as they can help absorb some of the oil.
3. Avoid picking up birds from injured areas.
4. Avoid picking up birds by their wings, flippers, or feet.
5. Avoid pecking or biting.
6. When handling birds, they are likely to defecate, so consider wearing appropriate clothing (such as a waterproof suit that is easy to clean).
7. If wings are damaged (broken), immobilize these limbs by securing them against the bird's body before placing it in containers for rest or transfer. This prevents the bird from stepping on or spreading its wings against the container during transport.
8. During handling, keep bills away from the face, especially the handler's eyes, and maintain birds at waist level.

6. EQUIPMENT FOR THE RESTING, RECOVERY, AND REHABILITATION OF SEABIRDS

6.1. Containers on deck for seabirds

The designated area for handling and placing specimens into containers must ensure safety for both the handler and the specimens, protecting them from elements like wind, rain, and oils.

Therefore, the recommended tools and procedures for managing birds onboard include:

1. Placing injured seabirds in containers designated for transport to authorized rehabilitation centers on land.
2. Depositing seabirds in containers along with healthy specimens requiring rest before their release back into the sea, prior to returning to port (see Fig. 13).
3. Assisting in the completion of bird identification sheets by crew members or observers.
4. Assisting in obtaining morphometric measurements of seabirds (e.g., through observers or the ACAP seabird bycatch guide).

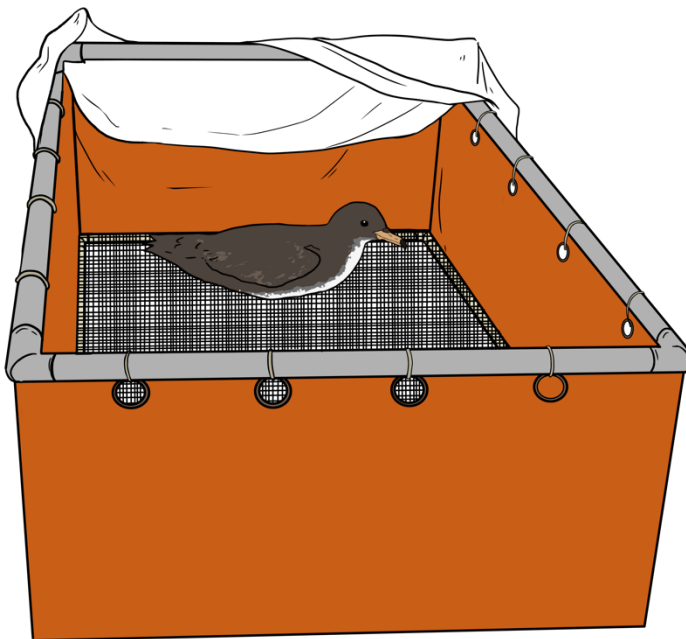


Figure 13. Container for seabird recovery onboard (© C.G. Suazo)

The presence of seabirds aboard purse seine fishing vessels can result from interactions with fishing infrastructure or from bird strikes onto the deck. In the case of interactions with the purse seine net during hauling, seabirds can become wet from contact and rubbing against the target catch, which disrupts their plumage architecture (Suazo et al. 2023).

On the other hand, strikes onto the deck can also occur due to adverse weather and sea conditions, as well as attraction to lights during dusk and nighttime fishing operations, which can even happen during transit between fishing zones (ATF-Chile, unpublished data).

The occurrence of seabirds onboard is not exclusive to fisheries, as it has also been documented in fishing operations and tourist cruises in high latitude waters, such as the Southern Atlantic (Coleman et al. 2022).

From these different events, it is advisable to have spare quick-drying pet mats available, preferably equipped with a ventilation stretcher (PVC profiles and anchovy mesh) at the bottom of the recovery container to promote drying of the bird and minimize any impact trauma inside the container (Fig. 14).

6.2. Transporting injured seabirds to rehabilitation centers



Figure 14. Options for drying birds inside the recovery container onboard. Left: Pet drying mat; Right: stretcher for drying on the floor of the seabird container.

A pilot initiative for seabird recovery stations and tools for safe handling of seabirds was implemented in the purse seine for jack mackerel (*Trachurus murphyi*) fleet based in south-central Chile. This initiative was installed to identify suitable locations for seabird recovery containers on deck but also for the identification of the minimum safety gear required for crew members.

For the implementation of seabird rescue and recovery stations onboard, it is necessary to identify secure locations within the infrastructure of each vessel, as well as maintain a permanent list of protective equipment kept in stock. Crew members recommended potential locations for deploying recovery containers including storerooms as suitable locations for the

installation and anchoring of containers due to the reduced noise, light, oil, and transit of people (Fig. 15).



Figure 15. Detail and dimensions of recommended sites for installation and anchoring of seabird stations on the deck of purse seine vessels targeting jack mackerel, south-central Chile.

In addition, transporting seabirds is a complex task that must be approached with caution. As wild animals subjected to stressful conditions, birds should be transported in containers that provide adequate ventilation and shade (Fig. 16).

The number of individuals per container should be managed to ensure proper ventilation and the ability to dry effectively. Container size will vary depending on the species being transported, with each bird needing enough space to stand upright without being able to spread its wings (Fig. 16).

When placing birds into containers, avoid sudden movements. Ensure that containers are lined with impact-reducing materials and have a rubber floor. Folded towels should be placed on the container floor to absorb moisture and maintain body temperature, thus minimizing the risk of injury or harm to the birds' keel and feet (Hall 2008).

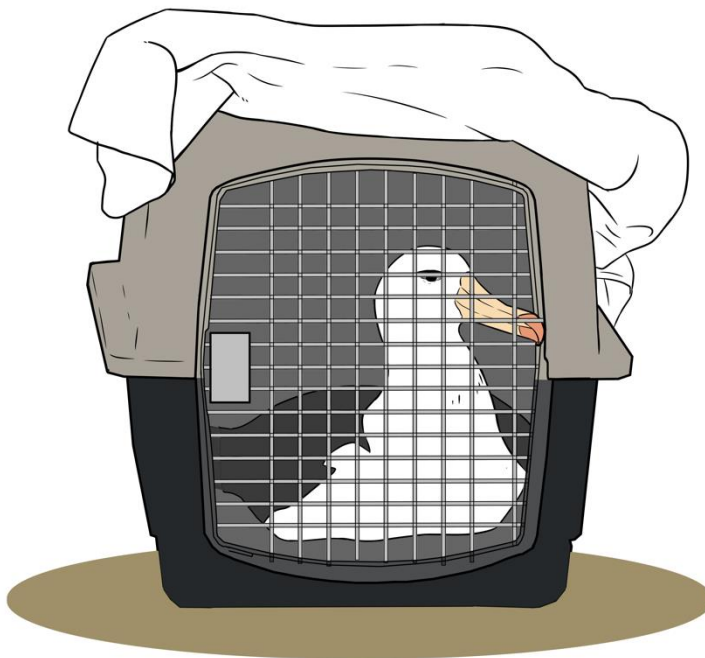


Figure 16. Ventilated and shaded container for transporting seabirds to rehabilitation centres (© C.G. Suazo).

When transporting over long distances, it is important to consider the potential dehydration of the birds, and it is advisable to monitor and hydrate them as recommended by the transport specialist on site. However, for short journeys, it is recommended not to provide birds with liquids or food.

This is due to two reasons: i) Birds typically do not eat or drink in stressful conditions; ii) Liquids or food may spill inside the containers, leading to dirt and humidity. In the event of transferring seabirds, the official body should manage the reception, capture, and transfer of wildlife once the vessel arrived.

7. RECOMMENDATIONS FOR THE PROPER HANDLING AND RELEASE OF HEALTHY SEABIRDS

For the release of birds in good condition, it is crucial to ensure that they meet specific criteria, such as the absence of external injuries and the quality of their plumage. It is recommended to assess each bird individually, as early evaluation facilitates prompt release and alleviates congestion onboard vessels.

During this process, handlers should evaluate whether the bird exhibits the following characteristics and considerations:

1. Accurate species identification.
2. Absence of visible injuries.

3. Assessment of 100% waterproofing of plumage in penguins.
4. Evaluation of 80% waterproofing of plumage in shearwaters, albatrosses, pelicans, and gulls.
5. Verification of permeable plumage in cormorants.
6. Assessment of physical condition, including wing retraction reflexes, full feathers, and species-typical behavior.

7.1. Handling recommendations for the release of seabirds at sea

For the correct handling and subsequent release of seabirds that have been brought onboard, the following recommendations should be applied:

1. Handle seabirds following the procedures described in section 5 of these guidelines (Recommendations for safe handling of seabirds in fisheries).
2. Release the individual downwind, simultaneously letting go of the bill (ACAP Secretariat & National Research Institute of Far Seas Fisheries 2015; Fig. 17). Aim to release from a lower position relative to the water surface (e.g., starboard-bottom side rather than the bow of the vessel).

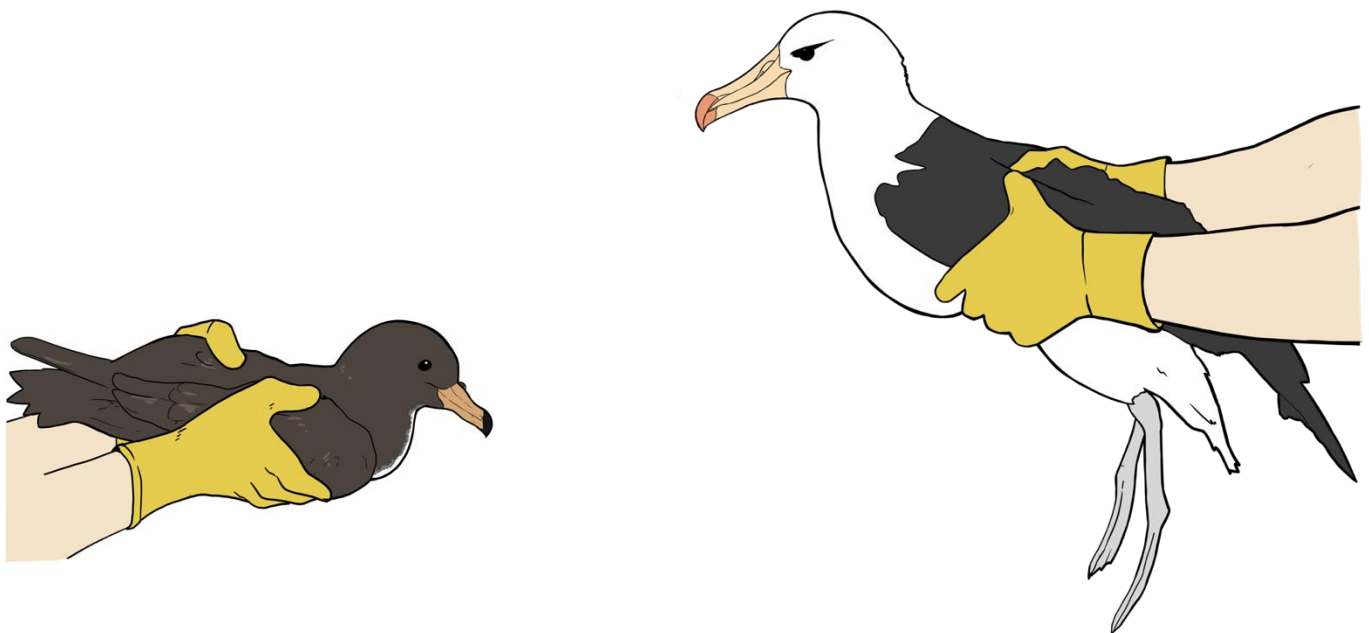


Figure 17. Release of healthy seabirds onboard from the deck. For small seabirds (shearwaters, left) and larger seabirds (albatrosses, right) (© C.G. Suazo).

8. HEALTH CONTINGENCY ONBOARD

The practice of these advances in best practices onboard must respond to the status and validity of zoosanitary emergencies that can compromise the health status of crews. This is the case with the spread of pathogens related to seabirds and marine mammals, such as highly pathogenic avian influenza (HPAI) related to subtype H5N1.

Thus, the implementation of this type of infrastructure, as well as crew training, and practice will be conditioned by current resolutions applied to seabirds birds by every party and their regulations

For instance, Chile recognizes penguins as hydrobiological resources, whose monitoring and regulations are under the responsibility of the National Fisheries Service (Sernapesca; <https://www.sernapesca.cl/influenza-aviar/>).

On the other hand, flying seabirds such as albatrosses, petrels, and shearwaters are subject to zoosanitary monitoring and regulations for handling this type of fauna by the Agricultural and Livestock Service of Chile (SAG; <https://www.sag.gob.cl/ambitos-de-accion/influenza-aviar-ia/normativas>).

These guidelines and local procedures should be aligned with overarching guidelines that integrate preventive recommendations and actions during and after panzootic outbreaks. They should also include recommendations for the identification and monitoring of high pathogenicity avian influenza (HPAI), which currently affects six species listed by ACAP and another eight Procellariiform species (Serafini et al. 2023; ACAP Guidelines for high pathogenicity avian influenza (HPAI) H5N1 panzootic; <https://acap.aq/resources/disease-threats/avian-flu>).

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