SERAWG-03-05

3rd Meeting of the Stock and Ecological Risks Assessment (SERAWG3)
08-11 March 2021
(online)

Killer whales of the Crozet Archipelago and adjacent waters: photo-identification, population status and distribution in 2020

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Relates to agenda item: 4. Patagonian Toothfish Working paper ☒ Info paper ☐

Delegation of French Territory

Abstract

This paper updates the SIOFA Scientific Committee on the occurrence of whale depredation in toothfish fisheries in the SIOFA Area (SC-05-21, SC-04-INFO-06, SERAWG-02-INFO-13). It also highlights the need to collect consistent data on these interactions to increase the accuracy of fish stock assessments, to understand their impacts on whale populations and to develop mitigation solutions.

Three forms of killer whales (*Orcinus orca*) occur around the subantarctic islands of the southern Indian Ocean (42-53°S; 34-74°E). The form encountered in both inshore and offshore waters, described as generalist in its feeding preferences (seals, whales, penguins and fish as prey) and known to depredate toothfish from longliners has been opportunistically photo-identified around the Crozet archipelago since the 1960s.Together with photo-identification data collected in the Prince Edward/Marion EEZ, Kerguelen EEZ and international waters, this papers provides up to date information on the abundance and distribution of the Crozet killer whales. Photographs taken during 2,109 encounters since 1964 were analysed, allowing for 299 individuals to be identified. Most encounters with available data were from the Crozet EEZ and occurred after 2003 when photo-identification was implemented in the fishery observer program. Among the 188 individuals recorded in the Crozet EEZ since 2003, 13 (7%) were also photographed in adjacent international waters.

The frequently encountered subset of the Crozet killer whale population was composed of 23 social units (maternal groups), 19 of which included individuals alive in 2020. However, detailed analysis of data collected between 2005 and 2020 shows that the number of confirmed deaths (n = 51) exceeds the number of recorded births (n = 46), resulting in a 5% decrease of the population size over this period.

Factors contributing to mortalities, which extent is abnormally high for juveniles and reproductive females, are unclear, but may involve lethal interactions with IUU fisheries. When paired with the fact that the Crozet killer whales already underwent a severe mortality episode in the 1990s, these findings raise strong concerns about the future of the population and stress the necessity of conservation actions while maintaining an intensive monitoring effort.

Recommendations *(proposals and working papers only)*

1. Considering this paper and SC-05-21, SC-04-INFO-06, SERAWG-02-INFO-13, it is recommended that the SC:
- Note that up to date information on the abundance and distribution of the Crozet killer whales
- Note that among the 188 individuals recorded in the Crozet EEZ since 2003, 13 (7%) were also photographed in adjacent international waters.
- Note a 5% decrease of the population size between 2005 and 2020.
- Note mortality rates being abnormally high for juveniles and reproductive females, suggesting additive mortality being potentially caused by negative interactions with IUU fishing vessels. This is supported by the fact that these killer whales are known to be heavily involved in depredation from legal toothfish longliners, and as individuals may respond indifferently to the presence of IUU vessels, may subsequently be exposed to lethal retaliation practices. Evidence of killer whales being shot was found on one individual showing a wound likely caused by a bullet in 2019.

- Note that taking this depredation into account, the 5th SC recommended the MoP:
- *"request CCPs adopt a protocol for documenting all interactions with marine mammals for all longliner vessels operating in the SIOFA Area.*
- *encourage CCPs to adopt operational actions to mitigate such interactions and report on the results of those actions at SC6."*

2. Recommend to the Meeting of the Parties adopt a protocol for documenting all interactions with marine mammals for all vessels operating in the SIOFA Area.

3. Recommend to the Meeting of the Parties that operational actions to mitigate such interactions while maintaining an intensive monitoring effort are urgently required.

4. Recommend to the Meeting of the Parties to increase monitoring efforts mitigating IUU fishing activities by adopting specific programs such as the one described in the Sentinel Program (PAEWG-02-07).

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Killer whales of the Crozet Archipelago and adjacent waters

Photo-identification catalogue, population status and distribution in 2020

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2021

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Citation

Tixier, P., Gasco, N., Towers, J.R., & Guinet, C. (2021). Killer whales of the Crozet Archipelago and adjacent waters: photo-identification catalogue, population status and distribution in 2020. Centre d'Etudes Biologiques de Chizé, Centre National de la Recherche Scientifique, France, 167 p.

Table of Contents

Abstract

Three forms of killer whales (*Orcinus orca*) occur around the subantarctic islands of the southern Indian Ocean (42-53°S; 34-74°E). The form encountered in both inshore and offshore waters, described as generalist in its feeding preferences (seals, whales, penguins and fish as prey) and known to depredate toothfish from longliners has been opportunistically photo-identified around the Crozet archipelago since the 1960s. Together with photo-identification data collected in the Prince Edward/Marion EEZ, Kerguelen EEZ and international waters, this report provides up to date information on the abundance and distribution of the Crozet killer whales. In total, 124,313 photographs taken during 2,109 encounters since 1964 were analysed, allowing for 299 individuals to be identified. Most encounters with available data were from the Crozet EEZ (1,432 from longliners, 602 from Île de la Possession) and occurred after 2003 when photo-identification was implemented in the fishery observer program. Among the 188 individuals recorded in the Crozet EEZ since 2003, 22 (12%) were also photographed in the Kerguelen EEZ, 13 (7%) in the Prince Edward/Marion EEZ and 13 (7%) in adjacent international waters. The frequently encountered subset of the Crozet killer whale population was composed of 23 social units (maternal groups), 19 of which included individuals alive in 2020. These social units ranged in size from 1 to 11 individuals with a mean (± *SD*) of 4 ± 3 per unit. As of June 2020 when the latest photographs included in the study were taken, abundance of this subset was 89-94 individuals. However, detailed analysis of data collected between 2005 and 2020 shows that the number of confirmed deaths (n = 51) exceeds the number of recorded births (n = 46), resulting in a 5% decrease of the population size over this period. These deaths were distributed across the population with the majority occurring in the most common sex and age classes - adult females and juveniles. Factors contributing to mortalities are unclear, but may include lethal interactions with illegal fisheries. When paired with the fact that the Crozet killer whales already underwent a severe mortality episode in the 1990s, these findings raise strong concerns about the future of the population and stress the necessity of conservation actions while maintaining an intensive monitoring effort.

Résumé

Trois types d'orques (*Orcinus orca*) ont été documentés autour des îles subantarctiques du sud de l'Océan Indien (42-53°S; 34-74°E). Le type fréquentant les eaux côtières et hauturières, décrit comme généraliste (proies incluant pinnipèdes, baleines, manchots et poissons) et connu pour interagir avec les palangriers à la légine (comportement de déprédation), est suivi par photo-identification autour de l'archipel de Crozet depuis les années 60. A partir de ce suivi, élargi aux ZEE de Prince Edward / Marion et de Kerguelen, et aux eaux internationales adjacentes, ce rapport présente les données d'abondance et de distribution des orques de Crozet mises à jour en 2020. L'analyse de 124 313 images prises au cours de 2 109 observations depuis 1964 a permis d'identifier un total de 299 individus. La majorité de ces observations a eu lieu dans la ZEE de Crozet (1 432 depuis les palangriers, 602 depuis l'Île de la Possession), et ce, après 2003, année où le programme de photo-identification des orques par les contrôleurs de pêche a été initié sur les palangriers. Parmi les 188 individus répertoriés dans la ZEE de Crozet depuis 2003, 22 (12%) ont aussi été photographiés dans la ZEE de Kerguelen, 13 (7%) dans la ZEE de Prince Edward / Marion et 13 (7%) dans les eaux internationales. Dix-neuf des 23 unités sociales (unités maternelles) fréquemment observées à Crozet incluaient des individus confirmés vivants en 2020, avec une taille d'unité variant de 1 à 11 individus pour une moyenne de 4 ± 3 individus par unité. En Juin 2020, date à laquelle les dernières photos utilisées pour cette étude ont été prises, l'abondance de ce sous-ensemble était de 89-94 individus. L'analyse détaillée des données de photo-identification collectées entre 2005 et 2020 indique un nombre d'individus confirmés morts (n = 51) supérieur au nombre de naissances (n = 46), et donc un déclin de 5% de la taille de la population, au cours de cette période. Les causes de cette mortalité, dont les niveaux apparaissent anormalement élevés chez les juvéniles et les femelles reproductrices, restent à déterminer mais pourraient inclure des interactions létales avec les pêcheries illégales. Combinés au fait que les orques de Crozet ont déjà subi une forte surmortalité dans les années 90, ces résultats mettent en lumière une situation préoccupante quant au devenir de la population et appuient la nécessité de mesures de conservation tout en maintenant un important effort de suivi.

Introduction

Three distinct forms of killer whales (*Orcinus orca*) occur around the subantarctic islands of the southern Indian Ocean (Crozet islands, Prince Edward/Marion islands and Kerguelen islands – 42-53°S; 34-74°E). The most frequently encountered form occurs in both inshore and offshore waters. It is indistinguishable from and closely related to some other populations found in the southern hemisphere, including killer whales of the Bremer Canyon (Australia) and Type-A killer whales of the Antarctic Peninsula (de Bruyn *et al*., 2013; Foote *et al*., 2019). These killer whales are generalist in their feeding preferences with a diet including marine mammals, seabirds and fish, and are also involved in depredation (removal of fish caught on fishing gear) of the toothfish longline fishery in the southern Indian Ocean (Guinet *et al*., 2015). The second form is referred to as the subantarctic or Type-D killer whale and is normally encountered in deep offshore waters (Pitman *et al*., 2011). The natural diet of Type-D killer whales is unknown, but this form will depredate toothfish from longlines around Crozet, Kerguelen and Prince Edward/Marion islands (Tixier et al., 2016; P. Tixier; unpubl. data). The third and most rare form in this region is the Antarctic Type-C killer whale, with only one encounter confirmed in the inshore waters of the Kerguelen islands in 2008 (P. Tixier, unpubl. data).

Most of the knowledge on the ecology of killer whales in the southern Indian Ocean is available for the first form and was mainly obtained from studies conducted in the inshore waters of Île de la Possession (main island of the Crozet archipelago – French Exclusive Economic Zone, hereafter "EEZ") and Marion Island (South African EEZ). In both areas, individuals were documented primarily feeding on Southern elephant seals *Mirounga Leonina*, but also on fur seals *Arctocephalus* spp., king penguins *Aptenodytes patagonicus*, macaroni penguins *Eudyptes chrysolophus* and rockhopper penguins *Eudyptes chrysocome filholi* (Guinet & Jouventin, 1990; Guinet, 1991, 1992; Guinet & Bouvier, 1995; Reisinger *et al*., 2011; 2016; Tixier *et al*., 2019). At Crozet, additional species confirmed as natural prey of killer whales include Southern right whales *Eubalaena australis*, Minke whales *Baleanoptera acutorostrata,* Gentoo penguins *Pygoscelis papua,* cephalopods (unidentified benthic octopus) and Nototheniid fish (Guinet & Jouventin, 1990; Guinet *et al*., 2000, Tixier *et al*., 2019). Among the latter, Patagonian toothfish *Dissostichus eleginoides*, a large demersal fish occurring at depths > 300 m, and which is depredated by killer whales from longlines, was recently suggested as also being also an important natural prey item (in absence of fishing vessels) from isotopic data (Tixier *et al*., 2019). This result was supported by tag data showing active foraging behaviour around seamounts at depths where toothfish occurs (Richard et al., 2020). Similar data from individuals tagged at Marion Island suggest that toothfish is also a natural prey item for killer whales in the South African EEZ (Reisinger *et al*., 2015).

At Crozet, these killer whales (hereafter the "Crozet killer whales") have been monitored by photo-identification since the 1960s, with photographs opportunistically taken until 1987, and both dedicated and opportunistic photo-identification effort ever since. This effort was initially conducted only from Île de la Possession until expanded to fishing vessels in 1998, two years after the longline fishery for toothfish began in the EEZ. Since 2003, killer whale photo-identification has been implemented as a dedicated task for fishery observers aboard the seven licensed toothfish longliners of the fleet. Together, these long-term photo-identification data have allowed for the distribution and demographic trends of the population to be assessed for decades. The Crozet killer whales have undergone a sharp decline in abundance over the past 30 years, with a 60% decrease in the number of unique individuals observed from Île de la Possession just for the 1988 – 2000 period (Poncelet *et al*., 2010). A marked decrease in the survival of adults known to interact with the fishery was detected in the late 1990s. This was attributed to intentionally lethal use of firearms and explosives by fishers from an illegal, unreported and unregulated (IUU) fishery operating in the Crozet EEZ during that period (Guinet *et al*., 2015; Tixier *et al*., 2017). Although IUU activities have been greatly reduced since 2002, the population showed no sign of recovery over the following decade. While the calving rate of females has appeared equivalent to that reported in other populations, the survival rate of adult Crozet killer whales has remained abnormally and inexplicably low (Tixier *et al*., 2015; 2017).

Among factors potentially contributing to low survival rates, the additive mortality event in the population in the 1990s has likely impacted the fitness of surviving individuals through a profound alteration of their social organisation (Busson *et al*., 2019). Specifically, while the Crozet killer whales were initially described as organized into highly stable social units of maternally related individuals led

by the eldest female (Guinet, 1991), individuals surviving this event have responded to the loss of relatives by opportunistically associating with a greater number of other units, likely to maintain a functional group size that maximized their foraging success. However, these associations were loose and the lack of long-lasting bonds within the affected population resulted in survival rates remaining low for years following the mortality event (Busson *et al*., 2019).

The photo-identification catalogue of the Crozet killer whale population was last updated in 2014 from photographs taken only within the EEZ, both from Île de la Possession and fishing vessels (Tixier *et al.* 2014). However, additional photographs of killer whales taken in waters adjacent to the Crozet EEZ since 2006 have allowed us to extend our dataset. These photographs come from toothfish longliners experiencing depredation in the Kerguelen EEZ, the Prince Edward/Marion EEZ and in international waters to the northwest and south of the Crozet EEZ. Preliminary analysis indicated that killer whales encountered in these adjacent waters included a combination of new individuals and individuals previously identified at Crozet (Roche *et al*., 2007; Gasco *et al*., 2019), thus suggesting some level of movement and spatial connectivity across the region. Such movements were also highlighted when identification images of the same individuals were found in both the previous Crozet catalogue (Tixier *et al*., 2014) and the catalogue developed from killer whale encounters along the coast of Marion Island (Reisinger & de Bruyn 2014, Jordaan *et al.,* 2019). However, these individuals only represented a small subset of the total whales found in each of the two areas. The combination of both frequently and infrequently encountered individuals at Crozet and Marion suggests that social units have variable patterns of fidelity to different regions and raises the question of whether or not discrete population clusters occur. To date, the overall population structure of killer whales found in Crozet, Prince Edward/Marion and Kerguelen waters remains unclear.

In this report, we present a photo-identification catalogue including information on the number of individuals, composition of social units and distribution maps for killer whales encountered around the Crozet islands and adjacent waters. For the subset of individuals frequently encountered at Crozet, we provide a detailed population status update for 2020.

Methods

Photo-identification data collection

Killer whale photo-identification data were collected and made available for the study from 1964 to June 2020. At Crozet, photographs of killer whales were taken both opportunistically by fieldworkers on Île de la Possession and fishery observers on toothfish longliners. Dedicated photo-identification effort was conducted by researchers during field trips on Île de la Possession from 1987-1990, 1998, 2000, 2009, 2011 and 2012 as well as on toothfish longliners from 2008-2011, 2017, 2018 and 2020). Among fieldworkers on Île de la Possession, the person dedicated to monitoring birds and marine mammals year-round (contractor of the French Polar Institute – IPEV Program 109; supervised by the CEBC-CNRS) took photographs when observing killer whales from the shore using personal camera equipment, but also gathered any photographs taken by other people on the island. Fishery observers on toothfish longliners were provided with Canon DSLRs and 100-400 mm telephoto lenses by the French Southern and Antarctic Lands (Terres Australes et Antarctiques Francaises – TAAF; Réserve Nationale Naturelle des Terres Australes – RNN TAF) since 2009. They took identification photographs of killer whales during depredation events when longlines were being hauled to the surface. There are seven legal fishing vessels operating year-round within the Crozet EEZ, but each will spend from two weeks to three months per year in the area and tend to concentrate their effort from October to April.

Although photographs were primarily taken from passive platforms (as opposed to active platforms like small boats that allow photographers to position themselves relative to the whales), effort was made to follow existing photo-identification protocols as much as possible. These protocols were developed in the 1970s in the coastal waters of the north-eastern Pacific (British Columbia, Canada) by Bigg *et al*. (1976). They rely on obtaining photographs of the dorsal fin and the saddle patch of killer whales with an angle being as perpendicular as possible to individuals when they come to the surface to breath. The natural shapes and markings visible on these two morphological features were used to

distinguish individuals and determine identifications. Eye patches, which vary in shape across individuals and represent a stable feature over time were also photographed and used for the identification of individuals following the same approach as in Towers et al. (2019) for Bigg's killer whales in the north-eastern Pacific. Fieldworkers and fishery observers were all trained in photo-identification protocols and DSLR camera use prior to departing to Crozet, by both the Muséum National d'Histoire Naturelle de Paris (MNHN – in charge of the fishery observer scientific program) since 2003 and by the CEBC-CNRS since 1987 (when the photo-identification monitoring program was initiated on Île de la Possession by Christophe Guinet).

Photographs of killer whales from waters adjacent to the Crozet EEZ were for the most part taken by fishery observers on toothfish longliners. Exceptions included photographs taken at Kerguelen from the small boat operating in the Golfe du Morbihan and from the trawler used for fish stock assessment campaigns (POKER program). Photographs from fishery observers in the Kerguelen EEZ and in the international waters northwest of Crozet were taken from the same toothfish longliners as the ones operating at Crozet. In the Prince Edward/Marion South African EEZ and on the Ob and Lena Bank in international waters, photographs were taken by fishery observers with personal equipment or cameras provided by the CEBC and the MNHN and were accessed through a collaboration with CAPFISH (observers programme coordinated by Chris Heinecken).

Photo-identification data processing

All photographs received were processed through a frame-by-frame analysis using a custom-made Excel application (Gasco et al., 2016). Non-usable photographs (no killer whale visible in the image or quality too poor for identification) were separated from usable photographs. For the latter, information on the date/time, platform, vessel, location, coordinates, photographer, image quality, ID of the individual as well as angle and the degree of visibility of its features (dorsal fin, saddle patch and eye patch) were entered in the data base. The quality of images ranged from poor (quality index of 0) to high (quality index of 2) and was based on sharpness, lighting, distance of subject and its angle. The ID of individuals was represented by an alpha-numeric code starting with 2 letters referring to the area where the animal was first photographed (CR for the Crozet EEZ, KE for the Kerguelen EEZ, PE for the Prince Edward/Marion EEZ, OB for the Ob and Lena Bank, and IN for all adjacent international waters). Numbers following this two-letter code were related to the order in which individuals were first identified.

Data from the photo-identification analysis were classified into encounters. For photographs taken from fishing vessels, the duration of an encounter was defined as the time spent hauling one longline set (a main line bearing baited hooks with an anchor, surface line and buoy at each end) during which individual killer whales where photographed while depredating. As longline sets can be several km long and are deployed in a straight line, coordinates used for each encounter were from the middle of each set. These coordinates, along with the date/time of depredated longline sets, were retrieved from the PECHEKER database for French longliners (Martin & Pruvost, 2007) and were provided by CAPFISH for the other longliners. Encounters from all other platforms (the shore or non-fishing vessels) were defined as starting and ending when individuals were first and last photographed, respectively, either because whales moved out of sight or photographers had to stop their effort.

Information associated with each individual killer whale was entered in a separate data set and included its dates of first and last encounter, its level of marking, and if known, its age, sex, mother and social unit (see below for details on age, sex, mother-offspring and social unit designations). The level of marking was based on the distinctiveness of individuals and was an index ranging from 0 for poorly marked whales (no visible notches or generic fin shape – identification reliant on high quality images) to 2 for highly distinctive individuals (large notches or peculiar fin shape – identification usually possible with low quality images).

Defining sex, age and social units

The sex of subadult and adult males was determined based on the large size and shape of their dorsal fins. Among remaining killer whales, individuals were confirmed as adult females when photographed with an associated calf, or when photographed > 5 years without the dorsal fin growing beyond the size of an adult female. Mother-calf associations were confirmed by the two individuals repeatedly photographed surfacing side-by-side over multiple encounters. Additional sex determination was made possible by photographs or field observations of the posterior ventral region of individuals as well as from genetic analyses performed on biopsy samples collected in 2011 at Crozet. For all other individuals, sex was undetermined.

The age of individuals was either determined or estimated based on the methodology and life history parameters used for killer whales in the north-eastern Pacific (Towers *et al*., 2019, 2020). Individuals that were first photographed as a calf (< 2 years old), a state being apparent from body size and lack of saddle pigmentation, were assigned birth years equivalent or immediately prior to the year they were first identified. For individuals first identified as juveniles (> 2 years old and < 10 years old), birth years were estimated based on body size when first photographed combined with the last year their assumed mother had been previously photographed without a calf. Females first photographed as physically mature and having had a calf during the study period were considered to be born at least 10 years prior to the birth year of their first calf. This criterium was based on female resident killer whales having been confirmed to give birth as young as 10 years of age in the north-eastern Pacific (Towers *et al*., 2015). Females first photographed as physically mature but not having had a calf for > 15 years were considered as post-reproductive and born > 40 years before the year of first observation based on the mean ages of senescence for killer whales calculated by Olesiuk *et al.* (1990) and Olesiuk *et al.* (2005). Males first photographed as sub-adults and as fully mature were considered to be born > 15 and > 20 years before the year of first observation, respectively. Estimated birth years for juveniles and sub-adults were denoted in the photo-identification catalogues with a ~ symbol, and those for adult males and females with a ≤ symbol (Appendices 1, 2, 3). For all other individuals for which photo-identification data was insufficient and/or not meeting the above criteria, age was considered undetermined.

Confidence in social unit designation greatly depended on the number, frequency and time range of encounters of individuals. For frequently encountered individuals at Crozet (see below for details on this subset), social units of individuals were confirmed by long-term information on maternal relatedness between individuals paired with the consistent association of individuals during encounters over periods of > 5 years. For infrequently encountered individuals at Crozet and in adjacent waters, social unit composition was inferred from associative behaviour of individuals that were photographed surfacing or traveling together.

Population status of the frequently encountered killer whales at Crozet

Previous photo-identification assessments indicated that different social units were encountered with varying levels of frequency within the Crozet EEZ (Tixier, 2012; Tixier *et al*., 2014). These assessments have reported a clear distinction between frequently and infrequently encountered individuals in that some social units were regularly encountered for years over decades and other social units or lone individuals were only encountered during one or a few years. We examined this distinction using a threshold determined from both the number of years and the last year individuals were encountered within the Crozet EEZ over the 2005-2020 period.

The population status of the Crozet killer whales was assessed through abundance estimates of the frequently encountered subset of individuals over the 2005-2020 period. These estimates were calculated from the number of individuals identified, the number of births and the number of deaths recorded within the social units of this subset. Following an approach similar to that used for Bigg's killer whales in the north-eastern Pacific (Towers *et al*., 2019), an individual was declared dead when

not photographed over several months or years during encounters where the other members of its social unit were present. The year of last encounter was assumed to be the year these deaths occurred. For individuals first reported missing from their social units in the last years of the study (> 2017) and for which follow-up photo-identification data were limited, uncertainty about death resulted in an uncertain status. Two abundance estimates were calculated for these recent years, one excluding individuals for which death had yet to be confirmed and another that included them. For all other individuals identified, including infrequently encountered individuals at Crozet, status was considered unknown unless the time period from last encounter exceeded the maximum killer whale life span minus the minimum estimated age of the individual at the date of last encounter.

Photo-identification data presentation in catalogues

The photo-identification catalogues provided in this report include images and associated data for the individuals frequently encountered at Crozet (Appendix 1), individuals infrequently encountered at Crozet (Appendix 2) and individuals only encountered in adjacent waters (never at Crozet – Appendix 3). These 3 clusters were defined from data received for this study. Details about individuals also found in the recent Marion Island catalogue (Jordaan *et al*., 2019) were listed in the discussion and highlighted in appendices. Individuals are represented by the best quality and most up to date photographs of the dorsal fin, saddle patch and eye patches, both for left and right sides when available. Individuals and their associated photographs are displayed on a two-page spread alongside others in their social unit, if confirmed (for frequently encountered whales) or otherwise assumed (for infrequently encountered whales). Social units were designated by the ID of the oldest female of the group (whether still alive or historically used to designate the unit) for the frequently encountered subset, or by the ID of the first identified female for other units with multiple members, or, for lone individuals by the ID of that individual.

Additional information provided alongside names and photographs include the sex of individuals (with symbols ♀ or ♂, when known) as well as maternal relationships inferred from observed associative mother-offspring behaviour (solid lines linking a female to its offspring). For frequently encountered individuals at Crozet (Appendix 1) their birth years (known or expressed with symbols ≤ or ~) are provided and for other individuals (Appendices 2 and 3), the years of first and last encounters (in *italics*) are displayed. In appendix 1, information on whether the individual was biopsied is indicated with the symbol "●" next to the ID.

For each social unit, distribution maps showing the locations of all encounters with members of that unit are provided. Summary tables of the number of encounters in the different study areas (Crozet EEZ, Kerguelen EEZ, Prince Edward/Marion EEZ or international waters) and from the various platforms (fishing vessels, Île de la Possession or others) were inserted either at the end of catalogue (Appendix 1) or on the same page as the identification photographs (Appendices 2 and 3).

Lastly, the date at which each identification photograph used in catalogues was taken, as well as the name of the photographer, were added to a table at the end of each of the three catalogues.

Results & Discussion

All individuals in the Crozet EEZ and adjacent waters: photo-identification data summary

Between 1964 and June 2020, a total of 124,313 photographs usable for killer whale photo-identification were taken during 2,109 encounters, including 104,470 photographs (84% of all photographs) taken during 1,506 encounters (71% of all encounters) from fishing vessels (Table 1). These photographs allowed for a total of 299 individuals to be identified, 225 (75%) of which were documented between 2003 and 2020.

Table 1. Photo-identification data summary: number of encounters with photographs taken, number of usable photographs taken and analysed, and number of individuals identified in the Crozet EEZ (all data since 1964, and for the 2003-2020 period only) and adjacent waters (Kerguelen EEZ, Prince Edward/Marion EEZ, international waters) and for the various data collection platforms (fishing vessels, Île de la Possession or others). Fishing vessels refer to licensed commercial Patagonian toothfish longliners and all photographs of killer whales from these vessels were taken during depredation events (i.e. whales feeding on hooked fish). The 2003-2020 period indicated for the Crozet/Kerguelen EEZs and international waters is the period for which photo-identification has been implemented in the fishery observer program on toothfish longliners operating in these areas. For the Prince Edward/Marion EEZ, photo-identification data were also collected by fishery observers but could only be accessed for this study from the 2006-2019 period.

	Number of encounters	Number of usable photographs taken	Number of individuals identified
Crozet EEZ (1964 - 2020)	**2,034**	**121,141**	**262**
Fishing vessels	1,432	101,704	181
Île de la Possession	602	19,437	153
Crozet EEZ (2003-2020)	**1,855**	**119,780**	**188**
Fishing vessels	1,426	101,690	181
Île de la Possession	429	18,090	78
Kerguelen EEZ (2003-2020)	**20**	**989**	**30**
Fishing vessels	19	583	23
Other	1	406	7
Prince Edward/Marion EEZ (2006-2019)	**39**	**589**	**28**
Fishing vessels	39	589	28
International waters (2003-2020)	**16**	**1,594**	**30**
Fishing vessels	16	1,594	30

Over the 2003-2020 period, most of killer whale encounters and photo-identification effort occurred in the Crozet EEZ, with 119,780 photographs (98% of all photographs - 85% and 15% of which were from fishing vessels and Île de la Possession, respectively) taken during 1,855 encounters (97% of all encounters - 77% and 23% of which from fishing vessels and Île de la Possession, respectively) (Table 1 & Figure 1a).

Out of the 188 individuals identified within the Crozet EEZ between 2003 and 2020, 22 (12%) have also been identified in the Kerguelen EEZ, 13 (7%) in the Prince Edward/Marion EEZ and 13 (7%) in adjacent international waters (Table 2 & Figure 1b).

Among the 22 individuals encountered in both Crozet and Kerguelen EEZs, 16 were from 4 social units frequently encountered at Crozet (CR012, CR016, CR063 and CR138 – Appendix 1) and were all photographed at Kerguelen from a fishing vessel on one encounter or several consecutive encounters over 1-2 days before returning to Crozet (Figure 1b). The remaining individuals (n = 6) were also known from previous occasional encounters at Crozet and included one social unit that made a return trip to Kerguelen (CR171 – Appendix 2) and two lone individuals (CR011 and CR242 – Appendix 2) last encountered at Kerguelen. Only one killer whale encounter from fishing vessels at Kerguelen included individuals that had never been photographed elsewhere before (KE001 in Appendix 3). The other 7 individuals encountered at Kerguelen were photographed while travelling off

the east side of the island from the F/V Austral (trawler) during the 2013 POKER campaign (KE002 to KE008 in Appendix 3) and have never been photographed while interacting with longliners.

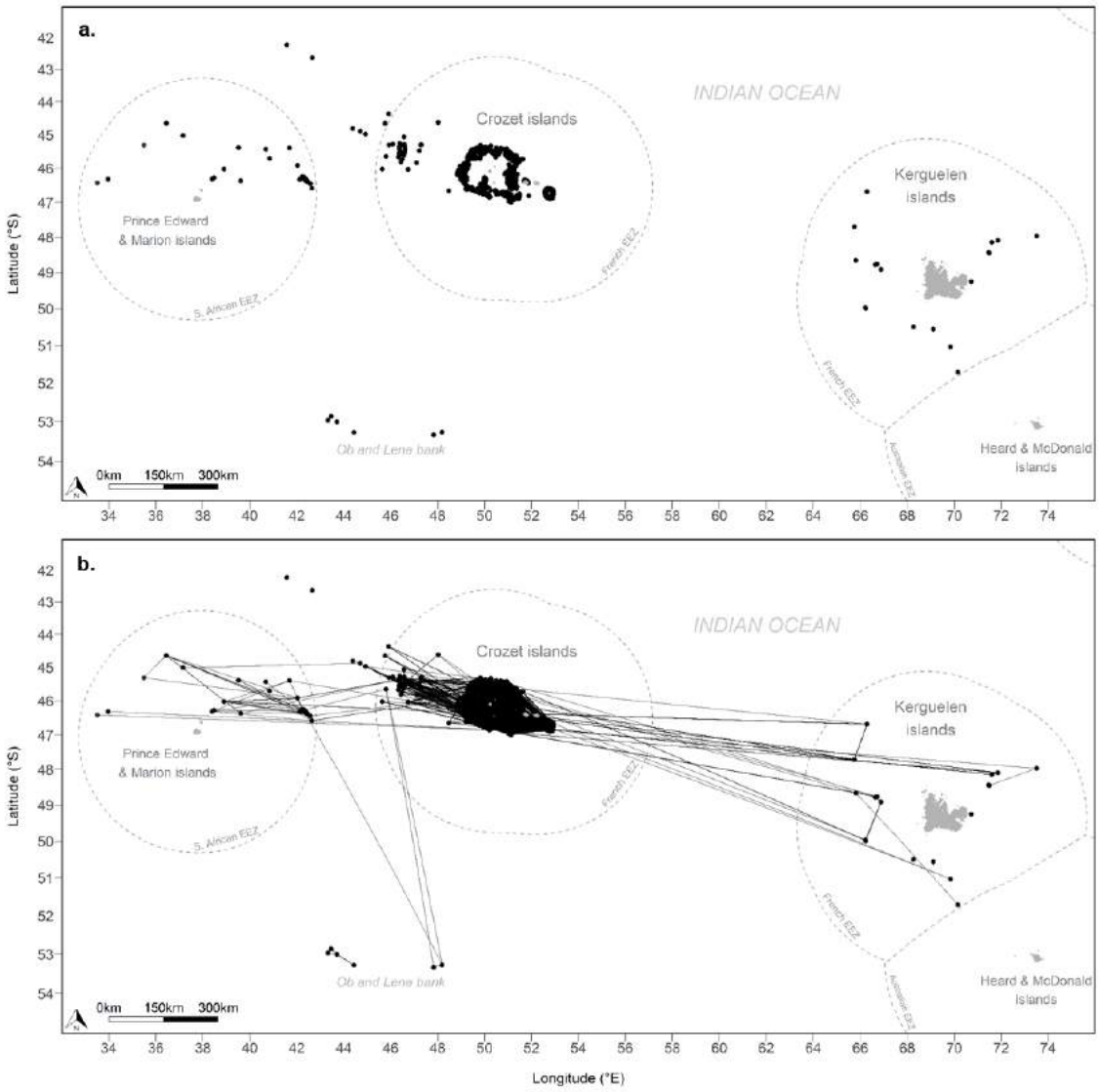

Figure 1. Distribution map of killer whale encounters with available photo-identification data collected between 2003 and 2020 across the Crozet EEZ and adjacent waters (Kerguelen EEZ, Prince Edward / Marion EEZ and international waters), with a. black dots representing locations of encounters, and b. black lines showing movements of individuals between encounter locations.

Table 2. Number of individuals identified in each area (diagonal cells) and number of individuals identified in two areas (non-diagonal cells) between 2003 and 2020 as part of this study.

Area	Number of individuals identified			
	Crozet EEZ	Kerguelen EEZ	Prince Edward / Marion EEZ	International waters
Crozet EEZ	**188**	22	13	13
Kerguelen EEZ		**30**	0	1
Prince Edward / Marion EEZ			**28**	2
International waters				**30**

Among the 13 individuals encountered in both the Crozet and Prince Edward / Marion EEZs, 12 were first photo-identified at Crozet. These individuals were from units CR100 (photographed at Crozet in 2003 and next photographed in 2014, 2015 and 2016 at Prince Edward / Marion), CR101 (Crozet in 2003 and 2008, Prince Edward / Marion in 2015 and 2016), CR088 (Crozet in 2007 and Prince Edward / Marion from 2011 to 2016) and CR160 (Crozet in 2005 and 2008, and Prince Edward / Marion in 2016 and 2018) (Figure 1b & Appendix 2). One individual, OL011, was first photo-identified in international waters around the Ob and Lena bank in 2014 before being encountered in the Prince Edward / Marion EEZ in 2017 and in the Crozet EEZ in 2018 (Figure 1b and Appendix 2). IN004, was the only other individual photo-identified both in the Prince Edward / Marion EEZ and in international waters, with one encounter in the latter occurring between the Crozet and Prince Edward / Marion EEZs (Figure 1b, Appendix 3).

Fifteen individuals from 7 social units were confirmed in the Marion Island catalogue of Jordaan *et al.* (2019). These included 2 individuals from the CR012 unit (CR012 and CR080; M023 and M006 in Jordaan *et al*., 2019 – both assumed dead) and 4 from the CR127 unit (CR025, CR119, CR127 and CR188 in Appendix 1; M016, M018, M017 and M042 in Jordaan *et al*., 2019 – all confirmed alive in 2019). Both units are frequently encountered from fishing vessels at Crozet, and 1 (CR012) has also been encountered from Île de la Possession and in the Kerguelen EEZ. Other individuals included the 3 whales of the CR160 unit encountered from fishing vessels both at Crozet and Prince Edward / Marion (CR134, CR159 and CR160 in Appendix 2 – M008, M009 and M033 in Jordaan *et al*., 2019), and 6 individuals from the PE010, PE014 and PE015 units encountered from fishing vessels at Prince Edward / Marion only (PE007, PE009, PE010, PE015, PE016 and PE017 in Appendix 3 – M007, M057, M004, M035, M046 M045 in Jordaan *et al*., 2019). These results provide evidence that killer whales frequently encountered along the shores of Marion Island do depredate toothfish and interact with longliners operating within the Prince Edward / Marion EEZ, and that some of them also interact with longliners in the Crozet EEZ and the Kerguelen EEZ.

OL011, OL012 and OL013 were the only individuals first encountered from fishing vessels in international waters (around the Ob and Lena Bank in 2014) and later in the Crozet EEZ (in 2018 - Figure 1b & Appendix 2). Among the other individuals photographed in international waters, 10 were from social units frequently encountered at Crozet (CR012, CR127 and CR139 – Appendix 1). Except IN004, the remaining individuals (n = 16) were only photographed in international waters and included 10 individuals associated over multiple encounters in 2012 around the Ob and Lena Bank (unit OL001), and 6 individuals from 2 potential social units photographed northwest of the Crozet EEZ (units IN001 and IN006 - Figure 1b & Appendix 3).

All individuals encountered in the Crozet EEZ: photo-identification data summary

In the Crozet EEZ, the photo-identification effort conducted from Île de la Possession and fishing vessels covered a latitudinal range of 44.5-47°S and a longitudinal range of 45-53°E (Figure 2a). While encounters with photographs from toothfish longliners occurred in the westernmost region of the EEZ near the EEZ border, most photo-identification effort from these vessels (n = 1,213 encounters, 85% of all encounters from fishing vessels within the Crozet EEZ) was conducted around the archipelago (along the 500 m isobath of the main shelf – Figure 2b). From Île de la Possession, encounters with photographs occurred from the north and west shores of the island (Figure 2c), with *Baie Américaine* and *Baie du Marin* being the two sites where most photo-identification data were collected (431 encounters for the two sites combined, 72% of all killer whale encounters with photographs on Île de la Possession since 1964).

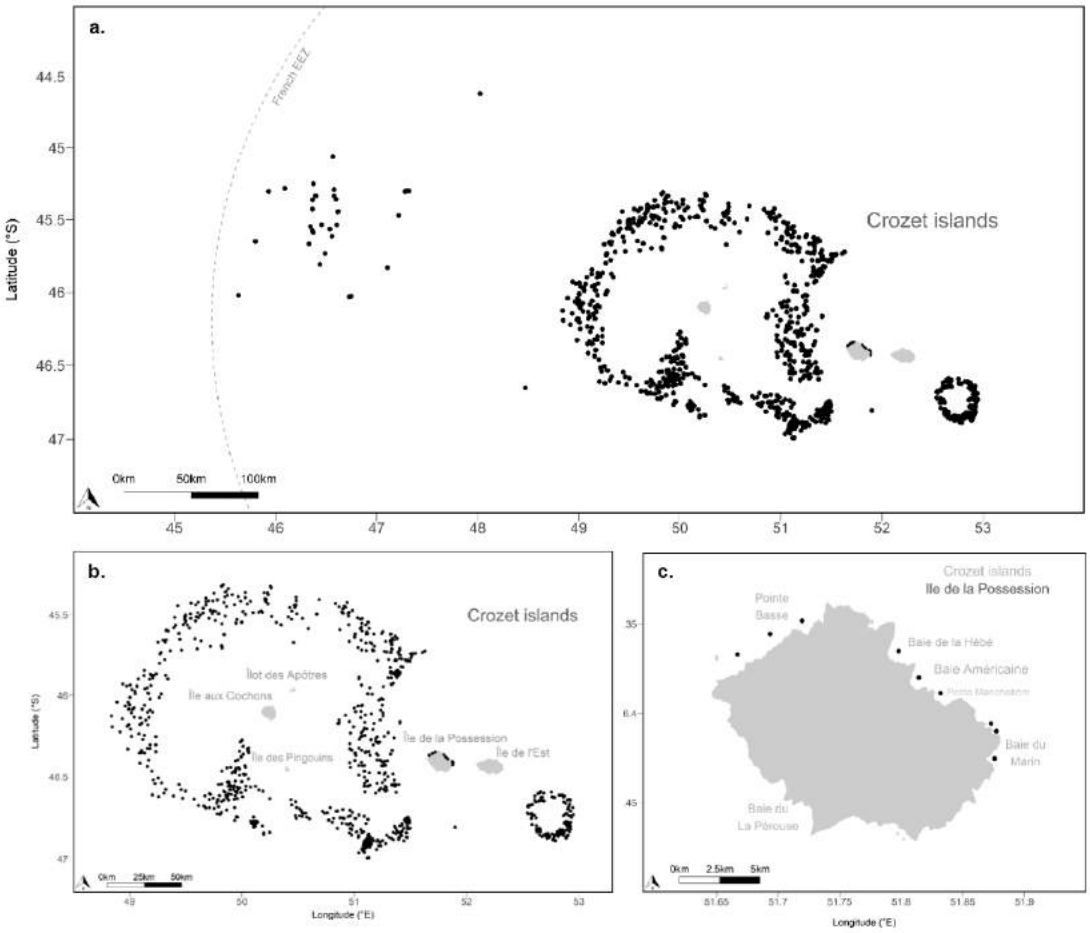

Figure 2. Distribution maps of killer whale encounters with photographs in the Crozet EEZ between 1964 and 2020, with a. all encounters, b. encounters from around the archipelago, and c. encounters from Île de la Possession only.

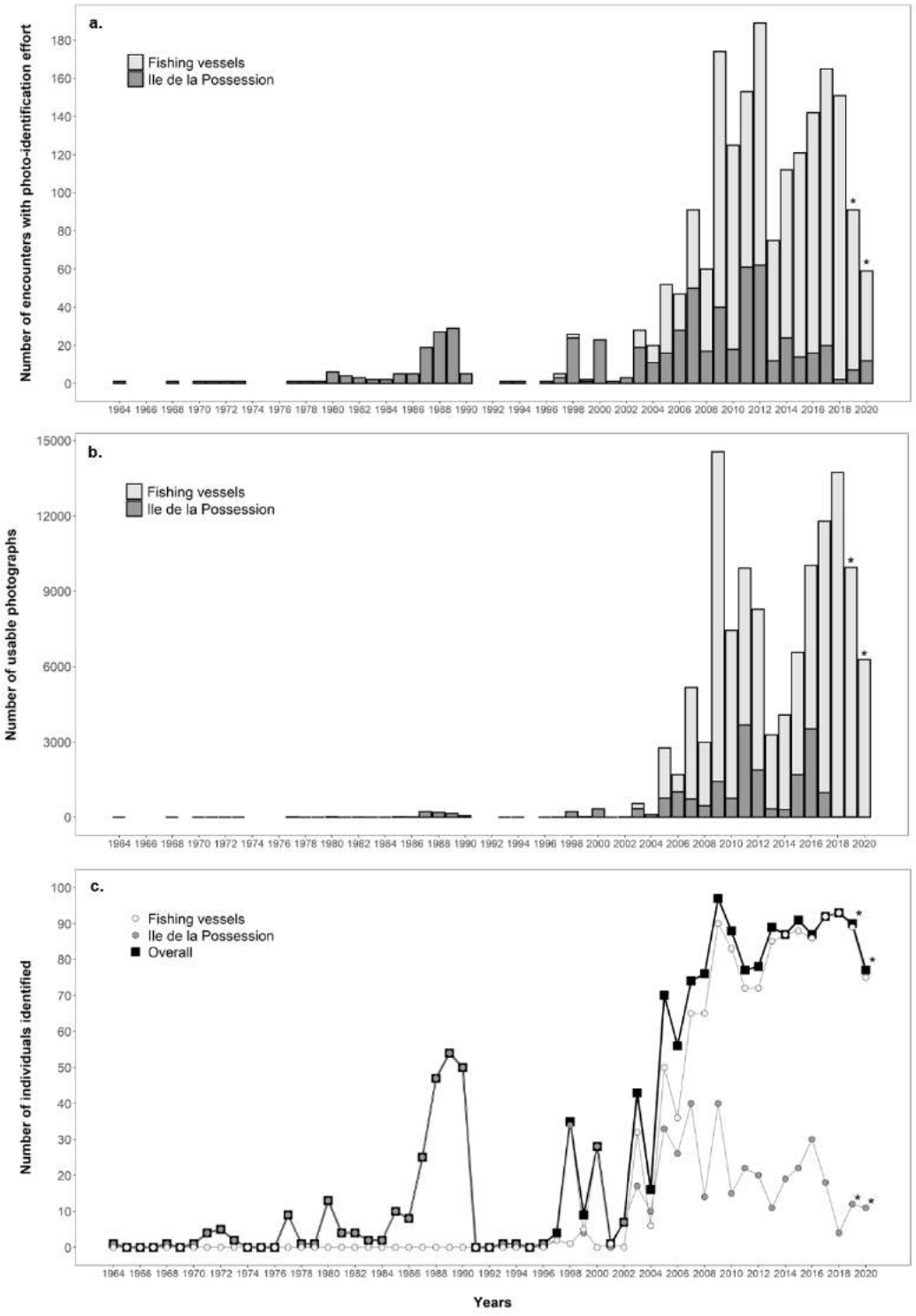

Figure 3. Annual killer whale photo-identification data in the Crozet EEZ between 1964 and 2020, from Île de la Possession (dark grey) and from fishing vessels (toothfish longliners – light grey), with a. the number of encounters with photo-identification effort, b. the number of usable photographs taken, and c. the number of individuals identified (black squares are the overall number of individuals identified in the EEZ, regardless of the platform). * designates years for which available data have been partially analysed (2019 – some photographs from Île de la Possession still to be received; 2020 – all photographs from Île de la Possession and photographs from after June still to be received).

The photo-identification effort for killer whales at Crozet has greatly varied over the 1964-2020 period, with most encounters prior to 2000 having occurred during dedicated fieldwork on Île de la Possession. There was a substantial increase in the number of encounters and photographs when photo-identification effort was implemented from fishing vessels in the 2000s (Figures 3a and 3b). While the mean (± *SD*) number of encounters with photographs from Île de la Possession between 2000 and 2020 (23 ± 17 encounters per year, n = 21 years) was similar to that of years of dedicated fieldwork in 1987-1990 and 1998, effort from fishing vessels has extended data coverage to offshore waters and increased this rate to an overall mean of 48 ± 45 encounters per year over the same period (Figure 3a). However, for both Île de la Possession and fishing vessels, the beginning of digital camera use in around 2005 resulted in a sharp increase in the number of photographs taken, with 3,703 ± 3,849 usable photographs taken and analysed per year between 2005 and 2020 (n = 16 years; maximum 13,713 photographs in 2009) (Figure 3b).

The annual number of individuals identified, as a metric highly dependent on annual effort, has been the highest between 2005 and 2020 with an overall mean of 83 ± 11 individuals per year (n = 16 years) during that period and a maximum of 97 individuals in 2009 (Figure 3c). However, from Île de la Possession, these annual numbers decreased from 47-57 individuals identified per year between 1988 and 1990 to a mean of 21 ± 10 individuals identified per year between 2005 and 2020 despite greater numbers of photographs taken during the latter period. Since 2014, all social units photographed from Île de la Possession with members considered alive in 2020 have also been photo-identified while depredating fish on longlines.

Frequently encountered individuals in the Crozet EEZ: population status for 2005-2020

For the Crozet killer whales, previous demographic analyses have indicated that high annual detection probabilities (~1, meaning 100% of known individuals were identified each year) were attained when the number of photographs was greater than 3,000 for a given year (Tixier *et al.*, 2017). As this threshold was far exceeded for most years between 2005 and 2020 (Figure 3b), this period was chosen to accurately assess the status of the population.

Out of the 181 individuals identified in the Crozet EEZ between 2005 and 2020, 92 were considered as mature and with an alive or unknown status in 2020. Of these individuals, 10 (11%) were photographed in only one year, 67 (73%) in 7 years or more, and 9 (10%) in each of the 16 years of the study period (Figure 4a). Among these same individuals, 62 (67%) were last photographed in 2019 or 2020, and 73 (79%) between 2015 and 2020 (Figure 4b).

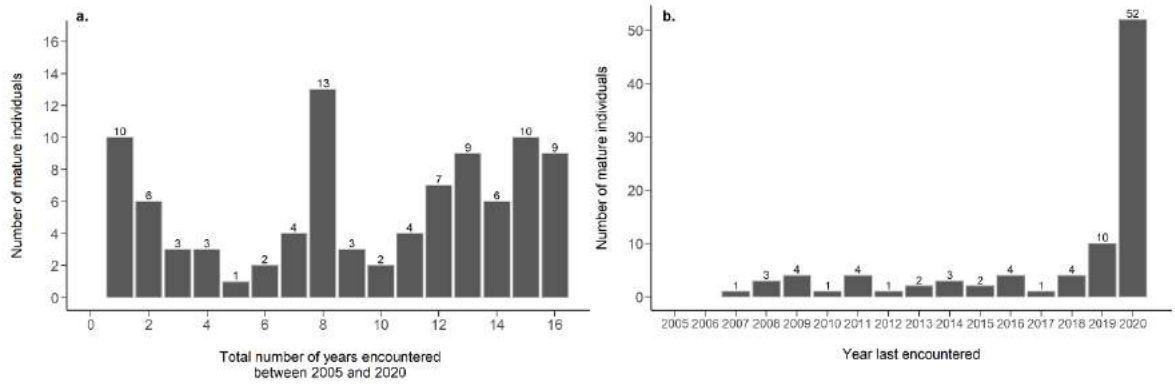

Figure 4. Frequency histograms of a. the total number of years encountered (photographed), and b. the year last encountered between 2005 and 2020 for mature individuals with status confirmed as alive or unknown in 2020.

Mature individuals photographed in 7 years or more during the study period, and last photographed after 2015 belonged to 19 social units considered as frequently encountered at Crozet in this report (Figure 5). Four additional units (CR024, CR037, CR081 and CR121 – photo-identified during a total of 370 encounters since 2005, ranging from 29 for CR081 to 180 for CR121), were also included to this subset because they were historically frequently encountered at Crozet but likely to have died off during the study period (Figures 5 & 6). In total, individuals from 23 social units (n = 145 whales identified between 2005-2020) were therefore considered as the frequently encountered subset used in subsequent analyses to assess the population status of the Crozet killer whales. This excludes individuals from 13 units (n = 36 whales identified between 2005-2020) designated as infrequently encountered (Figure 5 & Appendix 2).

On average, individuals from any of the 23 frequently encountered social units were photo-identified during 111 ± 46 encounters per year between 2005 and 2020 (n = 16 years). This rate ranged from 5 ± 3 encounters per year for unit CR167 to 30 ± 20 encounters per year for unit CR018 (Appendix 1). Individuals from 4 units (CR016, CR127, CR167 and CR191) encountered between 2016 and 2019 were not encountered in 2020 (Figure 5), but were assumed to be alive because photo-identification data was only available up to June 2020 (Figure 3).

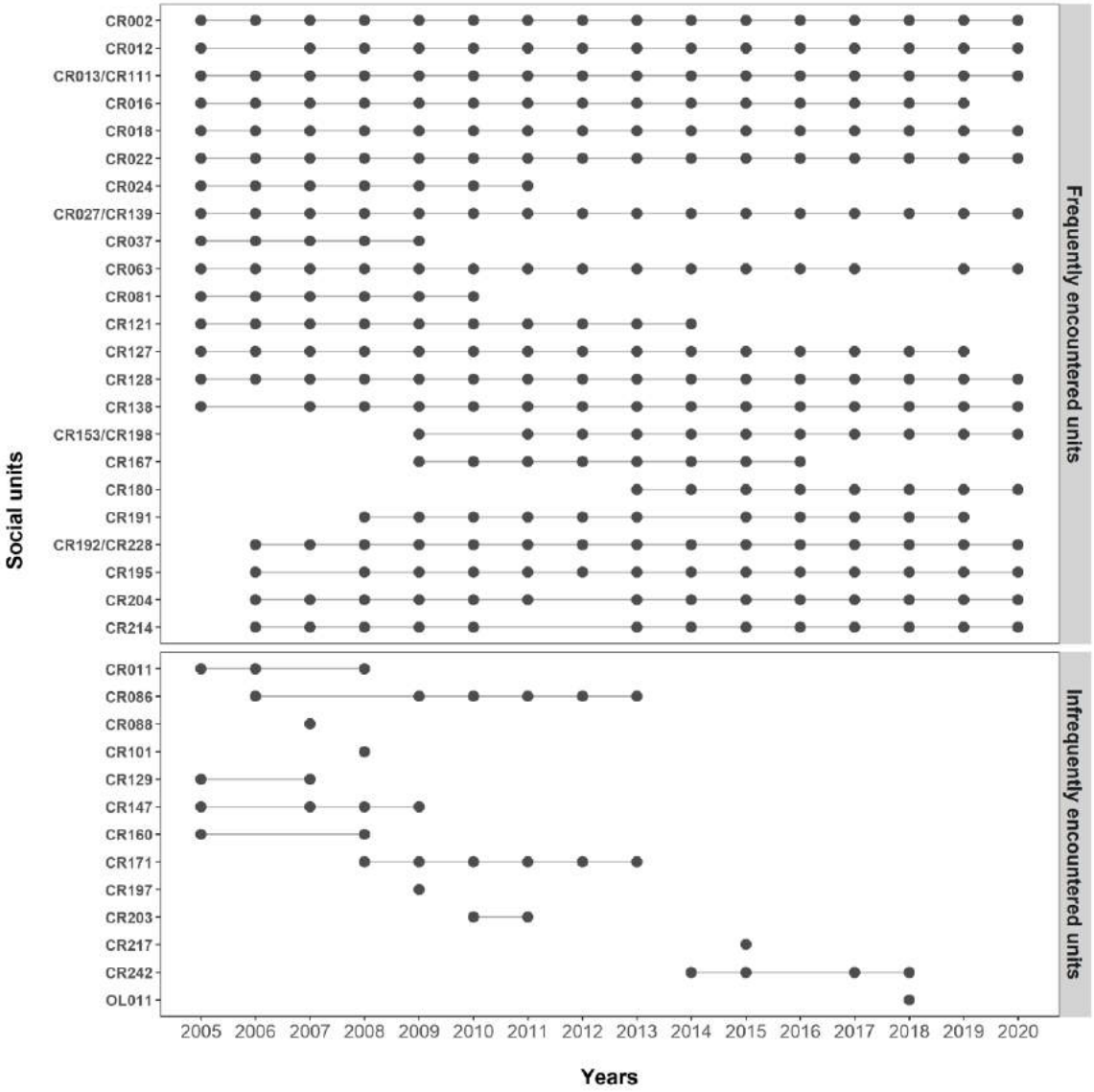

Figure 5. Years of encounters of the 36 killer whale social units encountered in the Crozet EEZ between 2005 and 2020. (Points refer to years when at least one individual from these units was photographed.) Totals of 23 and 13 social units were considered as frequently and infrequently encountered, respectively.

Among the 23 frequently encountered social units, 14 have been photographed from both Île de la Possession and fishing vessels and 9 from fishing vessels only (Figure 6). One unit (CR037) was only encountered from Île de la Possession but this unit died off in 2009 (Figure 7). CR018 and CR128 were the units most commonly encountered from fishing vessels (n = 386 encounters) and from Île de la Possession (n = 210 encounters), respectively, between 2005 and 2020 (Figure 6 & Appendix 1).

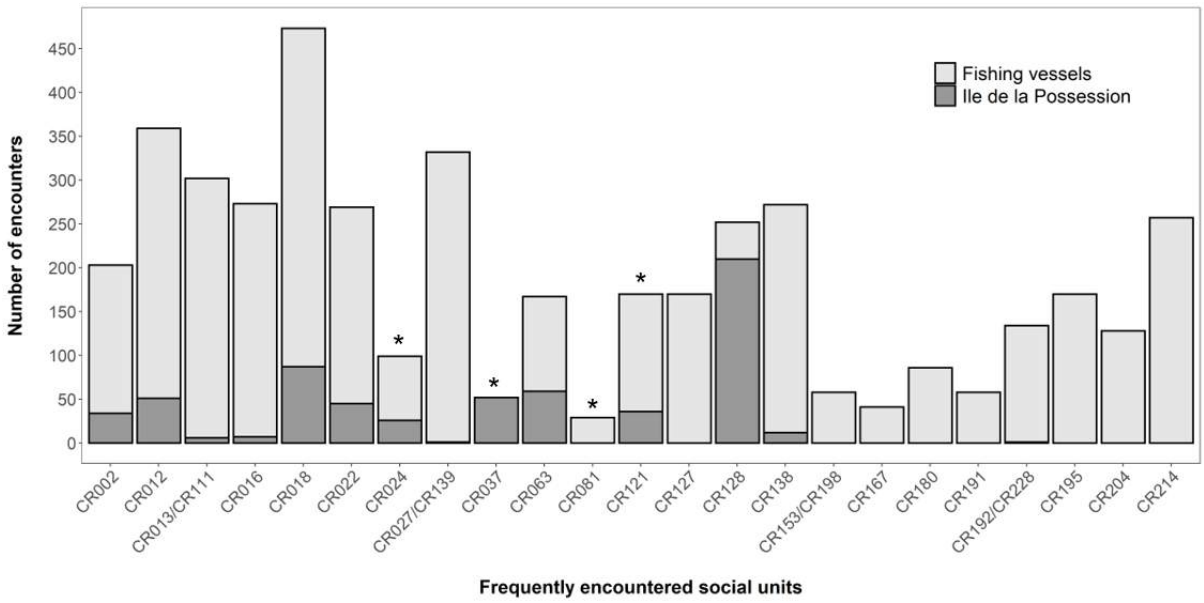

Figure 6. Number of encounters of each frequently encountered social unit by platform (light grey: fishing vessels - dark grey: Île de la Possession) in the Crozet EEZ between 2005 and 2020. * indicates units that have died off during this period.

The size of social units was 4 ± 2 individuals in 2005 (n = 23 units - ranging from 2 to 8 individuals) to 5 ± 3 individuals in 2020 (n = 19 units - ranging from 1 individual in the CR016 unit to 11 individuals in the CR195 unit – Appendix 1). In line with changes in the social organisation documented in Busson *et al.* (2019), instances of individuals associating with new units after their initial units died off occurred for CR116 and CR154, which permanently joined social units CR128 and CR214 after their initial units CR037 and CR081 died off in the late 2000s (Appendix 1). Another instance was CR207 being initially associated with individuals from the infrequently encountered unit CR147 when first photo-identified, before joining the frequently encountered unit CR204 in 2009 (Appendices 1 & 2). However, whether this switch occurred because unit CR147 died off is unknown since the death of individuals in that unit has not been confirmed. Regardless of these re-associations, the frequently encountered social units of the Crozet population have appeared highly stable between 2005-2020. Across individuals monitored since their birth year and for which the mother is known, dispersal from live natal maternal groups has only been documented once when an individual temporarily left its maternal group and travelled with another group for several months before re-joining its unit. This was CR161, an individual born in unit CR128 in the early 2000s and observed in unit CR018 between February and November 2011 before re-joining CR128 and remaining with them ever since (Appendix 1).

Such rare observations of dispersal from the social unit contrast somewhat with the assumption that dispersal was the main driver of associations within social units that comprised both related and unrelated individuals at Marion Island (Reisinger *et al.*, 2017). Additional years of monitoring will allow for dispersal patterns from natal units to be further examined at Crozet. However, it is also plausible that associations of unrelated individuals at Marion Island have occurred in response to an additive mortality event similar to the one undergone by the Crozet killer whales and caused by lethal interactions with IUU fisheries in the 1990s. This assumption is supported by individuals from Marion Island confirmed interacting with toothfish vessels (this report) and by the Prince Edward / Marion EEZ having been subject to extensive presence of IUU fishing vessels concomitantly to IUU activities at Crozet (Boonzaier *et al*., 2012; Pruvost *et al*., 2015).

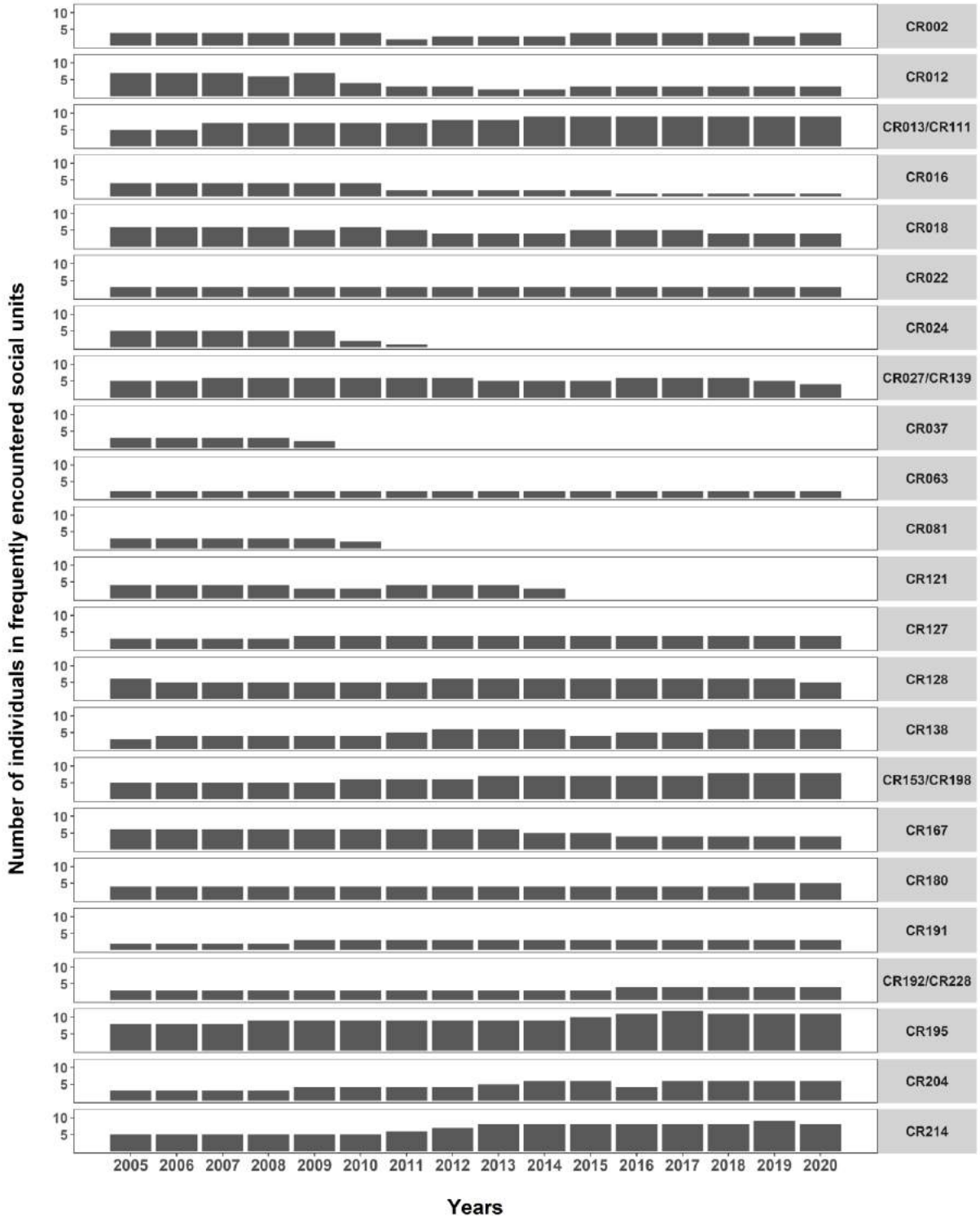

Figure 7. Size (number of individuals) of the frequently encountered social units of the Crozet killer whales per year between 2005 and 2020.

A total of 46 births and 51 deaths were confirmed within the frequently encountered subset of Crozet killer whales between 2005 and 2020 (Table 3), indicating an overall declining trend in population size (5.1% decrease in size considering 99 individuals in 2005) over that period. This number of deaths is conservative since 5 individuals missing from their social unit between 2018 and 2020 were not included despite repeated encounters of their regular associates during that period. These individuals

include 2 mother-calf pairs (CR106/CR243 and CR138/CR251) and a subadult male (CR009). Noticeably, CR106 and CR243 were photographed separated from the other individuals of the social unit CR027/CR139 (including CR106's offspring CR155 born in 2007 – Appendix 1) in 2017 and were not encountered again afterwards. If these individuals were classified as dead, the number of deaths would total 56, resulting in a 10.1% decline in the size of the population over the 2005-2020 period.

Table 3. Number of births, deaths and size of the frequently encountered subset of the Crozet killer whales from 2005 to 2020. Numbers are provided for deaths that were confirmed (upper section) and those that include uncertainty (lower section). Uncertain deaths involved 5 individuals missing from their social units between 2018 and 2020, yet to be confirmed as dead.

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Births	0	3	2	1	5	2	3	5	3	3	5	4	3	3	2	2	**46**
Deaths (confirmed)	1	1	1	4	9	9	2	2	3	6	4	0	2	3	4	0	**51**
Subset size	99	99	102	102	103	96	90	93	94	94	93	93	96	96	96	94	
Deaths (confirmed + uncertain)	1	1	1	4	9	9	2	2	3	6	4	0	4	3	7	0	**56**
Subset size	99	99	102	102	103	96	90	93	94	94	93	93	96	94	94	89	

A large proportion (35%) of the 51 confirmed deaths occurred in 2009 and 2010, resulting in a drop in abundance from 102 individuals in 2008 to 90 in 2011 (Figure 8). While 6 of these deaths were old individuals (1 adult male, 5 post-reproductive females), 7 were reproductive females and 3 were juveniles, indicating that mortality was widely distributed amongst sex and age classes during this period. As of June 2020, abundance for the frequently encountered subset of the Crozet killer whale population was 94 individuals (89 if deaths yet to be confirmed are included – Table 3 & Figure 8).

The highest number of deaths was recorded among reproductive females (n = 14 confirmed, 27% of all deaths) resulting in only 71% of all reproductive females of the population (n = 48) having survived from 2005 to 2020 (Table 4). More expectedly, mortality was also high for post-reproductive females (n = 12, 57% of all post-reproductive females) and adult males (n = 6, 30% of all adult males - Table 4). Five calves were confirmed as having died before 2 years of age, indicating that 88% of the 42 individuals born since 2005 and before 2019 have survived past that age (Table 4). This rate should be considered as a maximum since it is possible that viable calves were born and died, but were missed during gaps between encounters with their mothers. With 9 individuals confirmed as dead out of 39 individuals having been within the juvenile class (3-9 years old) since 2005, mortality within this class was 23%. Out of 19 individuals born or documented as juveniles between 2005 and 2010, only 12 (63%) have survived past the age of 9. In 2020, the 94 individuals in the population consisted of 33 (35%) calves, juveniles and sub-adult males (10-20 years old), 14 (15%) adult males, 34 (36%) reproductive females and 9 (10%) post-reproductive females (Table 4).

Together, these results indicate mortality rates within the Crozet killer whales were higher than those reported in the north-eastern Pacific northern resident population for all sex/age classes except calves (Olesiuk *et al.*, 2005). Noticeably, the survival of reproductive females at Crozet reported here for a 16-year period (71%) was especially low compared to that of reproductive female northern residents (93%) over a 24-year period from 1973-1996 (Olesiuk *et al*., 2005). Similarly, the proportion of juveniles surviving past the age of 9 at Crozet (63%) was substantially lower than the 80% of viable calves surviving to age 15 (assumed to be the age of recruitment to adults) in northern residents (Olesiuk *et al*., 2005). This difference was further reflected in the age structure of populations, with the

proportion of early classes (calves, juveniles, subadult males) at Crozet (35%) being lower than the 46% shown in Olesiuk *et al*. (2005) for northern residents.

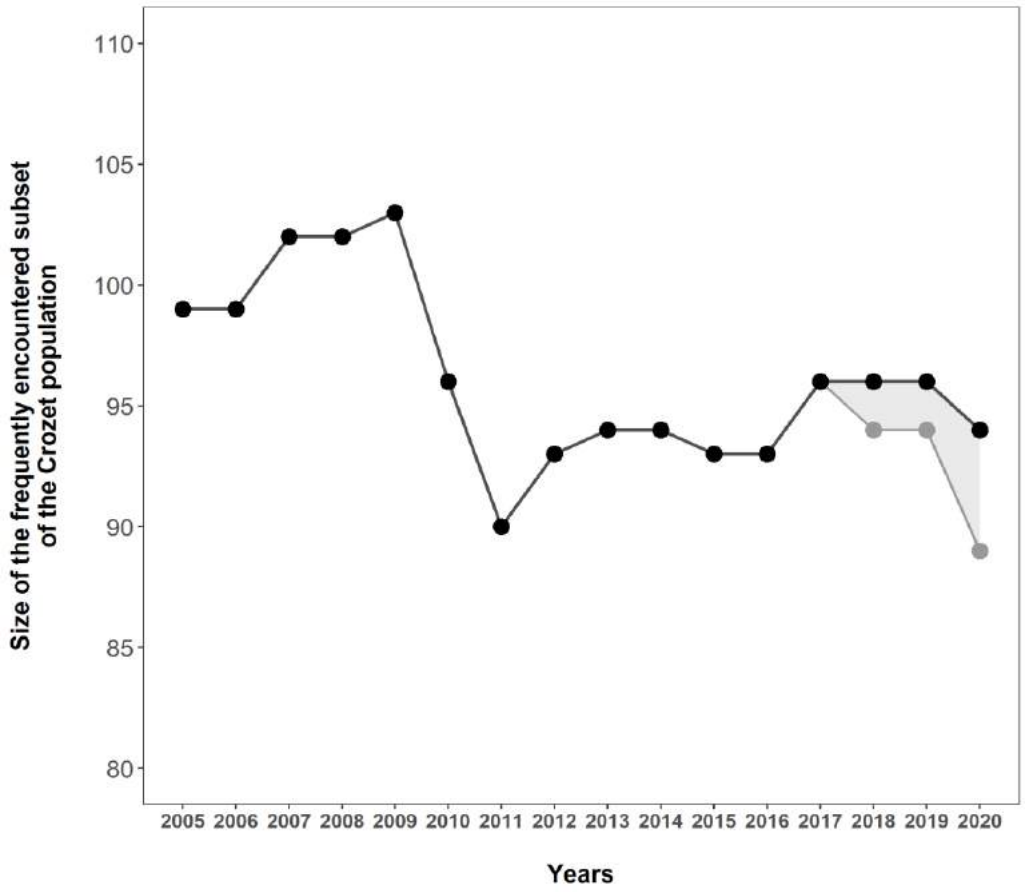

Figure 8. Annual abundance of the frequently encountered subset of the Crozet killer whale population between 2005 and 2020. Estimates are provided for confirmed deaths (black dots and line) and confirmed + uncertain deaths (grey dots and line). Uncertain deaths include 5 individuals missing from their social units between 2018 and 2020 that may be confirmed dead with more encounters.

Table 4. The number and percentage of individuals and deaths by sex and age class in the frequently encountered subset of the Crozet killer whales from 2005 to 2020. Details include: the overall number of individuals assigned to any class during the study period; the number of confirmed deaths by class; the percentage of individuals that have died in each class since 2005; the percentage of overall deaths in the population that have occurred in each class; the number of live individuals in 2020 (totalling 94 individuals) and the percentage of live individuals by class in 2020.

Sex/Age classes	# of individuals documented since 2005	# of confirmed deaths since 2005	% of individuals that have died within class since 2005	% of individuals that have died within population since 2005	# of individuals alive in 2020	% of individuals alive in 2020
Calves < 2 yrs	46	5	11%	10%	8	9%
Juveniles 3-9 yrs	39	9	23%	18%	19	20%
Subadult males 10-20 yrs	8	1	13%	2%	6	6%
Adult males >20 yrs	20	6	30%	12%	14	15%
Reproductive females 10-40 yrs	48	14	29%	27%	34	36%
Post-reproductive females > 40 yrs	21	12	57%	23%	9	10%
Adult females (unknown age)	8	4	50%	8%	4	4%

Conclusion

This study provides up to date details on the abundance and distribution of killer whales encountered within and adjacent to the Crozet EEZ with a detailed population assessment for those most frequently encountered near the Crozet archipelago. Results from analysis of photo-identification data collected with increasing effort since the 1960s indicates a negative trend in population growth between 2005 and 2020. This decrease, attributed to the abnormally high number of deaths within the juvenile and reproductive female age classes during that period, is deeply concerning since this population already underwent a sharp decline in the 1990s (Poncelet *et al*., 2010). Further research is urgently needed to determine the causes of these deaths and the resulting prolonged decline in population size. Potential causative factors that should be investigated are whether or not prey availability has been affected by due to environmental changes and/or overexploitation as well as whether or not interactions lethal to killer whales are occurring with IUU fishing vessels that may be operating within or between EEZs. Photo-identification data collected in waters adjacent to Crozet and included in this report provide evidence of long-distance movements across Crozet, Prince Edward / Marion, Kerguelen EEZs and international waters. As these killer whales are known, for the most part, to be heavily involved in depredation from legal toothfish longliners, individuals may respond indifferently to the presence of IUU vessels and subsequently be exposed to lethal retaliation practices.

One individual (CR216, social unit CR214 in Appendix 1) photographed in 2019 with what could be a bullet wound in his dorsal fin, further strengthen the likelihood of this risk exposure.

The high priority for conservation of Crozet killer whales stresses the need to maintain extensive photo-identification monitoring efforts, both from the islands and from fishing vessels. Beyond assessments of trends in population abundance, which could only be conducted here on a subset of frequently encountered individuals, the consistent collection of photo-identification data across the whole southern Indian Ocean sector in upcoming years will increase our understanding of killer whale population structure, distribution and ecology in this region. In particular, continuing to determine the level of connectivity between clusters of individuals identified in the Crozet, Prince Edward / Marion and Kerguelen EEZs will be crucial for delineating populations, assessing their abundance and implementing effective conservation measures.

Acknowledgements

We are deeply grateful to all the persons that have contributed to the collection of photo-identification data, and to all the entities that have supported this monitoring program over the years. In particular, we wish to thank all the fishery observers onboard French, South African and Japanese toothfish longliners for dedicating their time to taking many high quality killer whale pictures in the difficult conditions in offshore waters of the southern Indian Ocean. We are equally thankful to all fieldworkers of the French subantarctic islands, and especially those working on Île de la Possession for their involvement, often on a voluntary basis, in the monitoring of killer whales along the shores. Among these fieldworkers, special thanks are due to the VSCs of the French Polar Institute (IPEV) programme 109 for perpetually leading this effort and encouraging others to contribute.

We wish to thank the Terres australes et antarctiques francaises (TAAF) and the réserve naturelle nationale des Terres australes françaises (RNN TAF) for supporting and facilitating the program and for providing photographic equipment to fishery observers, but also to fieldworkers on the islands. Among these entities, special thanks are due to Cédric Marteau, Axel Falguier, Julien Ringelstein, Sylvain Gutjahr, Thibaut Thellier, Marion Kauffmann and Simon Fournier for their involvement.

We are immensely thankful to the Muséum National d'Histoire Naturelle de Paris (MNHN), especially Prof. Guy Duhamel for his support in the initial implementation of the program from French toothfish longliners and Charlotte Chazeau for facilitating the photo-identification data transfer over the years. We also thank the MNHN for consolidating and making the fishing data of the PECHEKER database (Martin and Pruvost, 2007) available for this study and other research on whale depredation. On that aspect, we especially thank Patrice Pruvost, Alexis Martin, Clara Péron and Felix Massinot-Gannier.

We wish to thank the IPEV for supporting the programme, and the researchers and staff of the Centre d'Etudes Biologiques de Chizé (CEBC - CNRS) for their contribution, primarily by coordinating the work of VSCs on the islands through the Programme 109 (current coordinator: Christophe Barbraud, and former coordinators Henri Weimerskirch and Pierre Jouventin). Special thanks are due to Karine Delord and Dominique Besson for facilitating the photo-identification data transfer from the islands.

We are thankful to the persons that participated in dedicated trips to Crozet as part of research programs on killer whales. These include Antoine Dervaux, Gaëtan Richard, Anaïs Janc and Fabio Cassiano.

We thank all skippers and fishing crews from F/Vs Antarctic III, Albius, Cap Horn, Cap Kersaint, Croix du Sud, El Shaddai, Île Bourbon, Île de la Réunion I & II, Koryo Maru 11, Mascareignes III, Saint André in facilitating, and sometimes even contributing, to collecting these images. To a greater

extent, we are very grateful to all toothfish fishing companies involved, namely SAPMER, Cap Bourbon, Pêche Avenir and Comata-Scapêche, as well as to the Syndicat des Armements Réunionnais de Palangriers Congélateurs (SARPC, Delphine Ciolek) and the Fondation d'Entreprises des Mers Australes.

For photo-identication data collected in the Prince Edward / Marion EEZ, we are extremely thankful to Chris Heineken and Melanie Smith from CAPFISH for encouraging and facilitating effort from fishery observers as well as for sharing the images. We also thank Richard Ball and Sobahle Somhlaba for sharing data associated with killer whale sightings. To a greater extent, we are grateful to the Coalition of Legal Toothfish Operators (COLTO), and in particular to Rhys Arangio, for supporting collaborative research across toothfish fisheries.

Additional support for the programme was received from the Agence Nationale pour la Recherche (ANR – project ORCADEPRED 2018-2021).

References

Bigg, M. A., McAskie, I. B., & Ellis, G. (1976). Abundance and Movements of Killer Whales off Eastern and Southern Vancouver Island with Comments on Management, Preliminary Report, Arctic Biological Station, Sainte Anne de Bellevue, Quebec, Canada.

Boonzaier, L., Harper, S., Zeller, D., & Pauly, D. (2012). A brief history of fishing in the Prince Edward Islands, South Africa, 1950–2010. In S., Harper, K., Zylich, L., Boonzaier, F., Le Manach, D., Pauly, & D., Zeller (Eds.). *Fisheries catch reconstructions: islands, Part II. Fisheries Centre Research Reports, Vol. 20*. Fisheries Center, University of British Columbia, Vancouver, p 95−101.

Busson, M., Authier, M., Barbraud, C., Tixier, P., Reisinger, R.R., Janc, A., & Guinet, C. (2019). Role of sociality in the response of killer whales to an additive mortality event. *Proceedings of the National Academy of Sciences* 116(24): 11812-11817.

de Bruyn, P. N., Tosh, C. A., & Terauds, A. (2013). Killer whale ecotypes: is there a global model?. *Biological Reviews* 88(1): 62-80.

Foote, A. D., Martin, M. D., Louis, M., Pacheco, G., Robertson, K. M., Sinding, M-H. S., Amaral, A. R. *et al.* (2019). Killer whale genomes reveal a complex history of recurrent admixture and vicariance. *Molecular Ecology* 28(14): 3427-3444.

Gasco, N., Tixier, P., Soffker, M. & Guinet, C. (2016). Whale depredation data collection guidelines, CCAMLR document, Hobart, Australia, 63pp. https://www.ccamlr.org/en/document/science/whale-depredation-%E2%80%93-data-collection-guidelines

Gasco, N., Tixier, P., Massiot-Granier, F., Péron, C. & Sarralde, R. (2019). No boundaries for whales interacting with fishing activities targeting Patagonian toothfish (*Dissostichus eleginoides*). Document WG-FSA-2019/54, CCAMLR, Hobart, Australia.

Guinet, C., & Jouventin, P. (1990). La vie sociale des «baleines tueuses». *La Recherche* 21: 508-510.

Guinet, C. (1991). Intentional stranding apprenticeship and social play in killer whales (*Orcinus orca*). *Canadian Journal of Zoology* 69(11): 2712-2716.

Guinet, C. (1992). Comportement de chasse des orques (*Orcinus orca*) autour des iles Crozet. *Canadian Journal of Zoology* 70(9): 1656-1667.

Guinet, C., & Bouvier, J. (1995). Development of intentional stranding hunting techniques in killer whale (*Orcinus orca*) calves at Crozet Archipelago. *Canadian Journal of Zoology* 73(1): 27-33.

Guinet, C., Barrett-Lennard, L.G., & Loyer, B. (2000). Co-ordinated attack behavior and prey sharing by killer whales at Crozet Archipelago: Strategies for feeding on negatively-buoyant prey. *Marine Mammal Science* 16(4): 829-834.

Guinet, C., Tixier, P., Gasco, N., & Duhamel, G. (2015). Long-term studies of Crozet Island killer whales are fundamental to understanding the economic and demographic consequences of their depredation behaviour on the Patagonian toothfish fishery. *ICES Journal of Marine Science* 72(5): 1587-1597.

Jordaan, R.K., Reisinger, R.R., & De bruyn, N. (2019). Marion Island killer whales 2006–2018. Mammal Research Institute, University of Pretoria, Pretoria. doi: 10.6084/m9.figshare.11938680.v1

Martin, A., & Pruvost, P. (2007). Pecheker, relational database for analysis and management of fisheries and related biological data from the French Southern Ocean fisheries monitoring scientific programs. Muséum national d'Histoire naturelle.

Olesiuk, P.F., Bigg, M.A., & Ellis, G.M. (1990). Life history and population dynamics of resident killer whales (*Orcinus orca*) in the coastal waters of British Columbia and Washington State. Report of the International Whaling Commission, Special 12: 209-243.

Olesiuk, P.F., Ellis, G.M., & Ford, J.K. (2005). Life history and population dynamics of northern resident killer whales (*Orcinus orca*) in British Columbia (pp. 1-75). Ottawa, Canada: Canadian Science Advisory Secretariat.

Pitman, R.L., Durban, J.W., Greenfelder, M., Guinet, C., Jorgensen, M., Olson, P.A., Plana, J., Tixier, P. & Towers, J. R. (2011). Observations of a distinctive morphotype of killer whale (*Orcinus orca*), type D, from subantarctic waters. *Polar Biology* 34(2): 303-306.

Poncelet, É., Barbraud, C., & Guinet, C. (2010). Population dynamics of killer whales (Orcinus orca) in the Crozet Archipelago, southern Indian Ocean: a mark–recapture study from 1977 to 2002. *Journal of Cetacean Research and Management* 11: 41-48.

Pruvost, P., Duhamel, G., Gasco, N., & Palomares, M.D. (2015). A short history of the fisheries of Crozet Islands. In M.L.D., Palomares & D., Pauly (Eds.). *Marine fisheries catches of subantarctic islands, 1950-2010. Fisheries Centre Research Reports, Vol. 23*. Fisheries Centre, University of British Columbia, Vancouver, p 31−37.

Reisinger, R.R., De Bruyn, P.J.N., Tosh, C.A., Oosthuizen, W.C., Mufanadzo, N.T., & Bester, M.N. (2011). Prey and seasonal abundance of killer whales at sub-Antarctic Marion Island. *African Journal of Marine Science* 33(1): 99-105.

Reisinger, R.R., de Bruyn, P.J.N., 2014. Marion Island killer whales: 2006-2013. Mammal Research Institute, University of Pretoria, Pretoria. doi: 10.6084/m9.figshare.971317

Reisinger, R. R., Keith, M., Andrews, R. D., & De Bruyn, P. J. N. (2015). Movement and diving of killer whales (*Orcinus orca*) at a Southern Ocean archipelago. *Journal of Experimental Marine Biology and Ecology* 473: 90-102.

Reisinger, R. R., Beukes, C., Hoelzel, A. R., & de Bruyn, P. N. (2017). Kinship and association in a highly social apex predator population, killer whales at Marion Island. *Behavioral Ecology* 28(3): 750-759.

Richard, G., Bonnel, J., Tixier, P., Arnould, J. P., Janc, A., & Guinet, C. (2020). Evidence of deep-sea interactions between toothed whales and longlines. *Ambio* 49(1): 173-186.

Roche, C., Gasco, N., Duhamel, G. & Guinet, C. (2007). Marine mammals and demersal longline fishery interactions in Crozet and Kerguelen Exclusive Economic Zones: an assessment of depredation levels. *CCAMLR Science* 14: 67-82.

Tixier, P. (2012). Déprédation par les orques (*Orcinus orca*) et les cachalots (*Physeter macrocephalus*) sur les palangriers à la légine australe dans la ZEE de l'archipel de Crozet (Doctoral dissertation, Université Aix-Marseille II). URL : http://www.theses.fr/2012AIXM4096

Tixier, P., Gasco, N., & Guinet, C. (2014). Killer whales of the Crozet Islands: photo-identification catalogue 2014. Villiers en Bois: Centre d'Etudes Biologiques de Chizé-CNRS. doi : 10.6084/m9.figshare.1060247.v1

Tixier, P., Authier, M., Gasco, N., & Guinet, C. (2015). Influence of artificial food provisioning from fisheries on killer whale reproductive output. *Animal Conservation* 18(2): 207-218.

Tixier, P., Gasco, N., Duhamel, G., & Guinet, C. (2016). Depredation of Patagonian toothfish (*Dissostichus eleginoides*) by two sympatrically occurring killer whale (*Orcinus orca*) ecotypes: Insights on the behavior of the rarely observed type D killer whales. *Marine Mammal Science* 32(3): 983-1003.

Tixier, P., Barbraud, C., Pardo, D., Gasco, N., Duhamel, G. & Guinet, C. (2017). Demographic consequences of fisheries interaction within a killer whale (*Orcinus orca*) population. *Marine Biology* 164(8): 170.

Tixier, P., Giménez, J., Reisinger, R.R., Méndez-Fernandez, P., Arnould, J.P.Y., Cherel, Y., & Guinet, C. (2019). Importance of toothfish in the diet of generalist subantarctic killer whales: Implications for fisheries interactions. *Marine Ecology Progress Series* 613: 197-210.

Towers, J.R., Ellis, G.M. & Ford, J.K.B. (2015). Photo-identification catalogue and status of the northern resident killer whale population in 2014. *Canadian Technical Report of Fisheries and Aquatic Sciences* 3139: iv + 75 p.

Towers, J.R., Sutton, G.J., Shaw, T.J.H., Malleson, M., Matkin, D., Gisborne, B., Forde, J., Ellifrit, D., Ellis, G.M., Ford, J.K.B., & Doniol-Valcroze, T. (2019). Photo-identification Catalogue, Population Status, and Distribution of Bigg's Killer Whales known from Coastal Waters of British Columbia, Canada. *Canadian Technical Report of Fisheries and Aquatic Sciences* 3311: vi + 299 p.

Towers, J.R., Pilkington, J.F., Gisborne, B., Wright, B.M., Ellis, G.M., Ford, J.K.B., & Doniol-Valcroze, T. (2020). Photo-identification catalogue and status of the northern resident killer whale population in 2019. *Canadian Technical Report of Fisheries and Aquatic Sciences* 3371: iv + 69 p.

Appendices

***Appendix 1** : Killer whales frequently encountered at Crozet: photo-identification catalogue and distribution maps*

***Appendix 2** : Killer whales infrequently encountered at Crozet: photo-identification catalogue and distribution maps*

***Appendix 3** : Killer whales encountered in adjacent waters only: photo-identification catalogue and distribution maps*

Appendix 1

Killer whales frequently encountered at Crozet

Photo-identification catalogue and distribution maps

Killer whales of the Crozet Archipelago and adjacent waters
Photo-identification catalogue, population status and distribution in 2020

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Summary table of the 23 killer whale social units considered as frequently encountered in the Crozet EEZ between 2005 and 2020. Summarized information includes the range and number of years that members of these units were encountered and photographed, as well as the full list of members, numbers of individuals identified per unit for the full period and those confirmed or assumed alive in 2019/2020. Identification photographs from only 19 of these units are presented in this catalogue as all individuals in 4 units (CR024, CR037, CR081 and CR121) are believed to have successively died out during the 2005-2020 period.

Social units	**Range of years encountered** 2005-2020	**# of years encountered** 2005-2020	**Individuals** 2005-2020 (bold: individuals confirmed or assumed alive in 2019/2020)	**# of individuals 2005-2020**	**# of individuals in 2019/2020**
CR002	2005-2020	16	CR002, **CR004**, CR006, CR135, **CR199**, **CR238**, **CR257**	7	4
CR012	2005-2020	15	CR012, CR080, CR124, CR131, CR132, CR133, **CR137**, **CR187**, **CR241**	9	3
CR013/CR111	2005-2020	16	**CR013**, **CR087**, **CR111**, **CR122**, CR142, **CR173**, **CR174**, **CR213**, **CR223**, **CR253**	10	9
CR016	2005-2019	15	CR016, CR017, **CR023**, CR149	4	1
CR018	2005-2020	16	CR014, CR015, CR018, **CR019**, **CR020**, **CR148**, CR178, **CR237**, CR240	9	4
CR022	2005-2020	16	**CR009**, CR022, **CR156**, **CR235**	4	3
CR024	2005-2011	7	CR010, CR024, CR032, CR157, CR158	5	0
CR037	2005-2009	5	CR035, CR037, CR038	3	0
CR027/CR139	2005-2020	16	CR027, **CR106**, CR124, CR139, CR140, **CR151**, **CR155**, **CR243**	8	4
CR063	2005-2020	15	**CR063**, **CR064**	2	2
CR081	2005-2010	6	CR081, CR082, CR083	3	0
CR121	2005-2014	10	CR007, CR021, CR121, CR143, CR175, CR200, CR211	7	0
CR127	2005-2019	15	**CR025**, **CR119**, **CR127**, **CR188**	4	4
CR128	2005-2020	16	CR067, **CR068**, **CR069**, **CR116**, CR128, **CR161**, **CR229**	7	5
CR138	2005-2020	15	**CR138**, **CR184**, **CR185**, **CR186**, CR212, CR230, **CR245**, **CR251**	8	6
CR153/CR198	2009-2020	8	**CR153**, **CR198**, **CR222**, **CR224**, **CR227**, **CR247**, **CR248**, **CR252**	8	8
CR167	2009-2016	8	**CR165**, CR166, **CR167**, CR168, **CR169**, **CR170**	6	4
CR180	2013-2020	8	**CR177**, **CR179**, **CR180**, **CR181**, **CR255**	5	5
CR191	2008-2019	11	**CR190**, **CR191**, **CR202**	3	3
CR192/CR228	2006-2020	15	**CR189**, **CR192**, **CR228**, **CR239**	4	4
CR195	2006-2020	13	**CR193**, **CR194**, **CR195**, **CR196**, **CR201**, CR220, **CR221**, **CR225**, **CR226**, **CR236**, **CR244**, **CR249**	12	11
CR204	2006-2020	10	**CR204**, **CR206**, **CR207**, **CR210**, CR231, CR234, **CR246**, CR250, **CR256**	9	6
CR214	2006-2020	8	CR154, **CR214**, **CR215**, **CR216**, **CR218**, **CR219**, **CR232**, **CR233**, **CR254**	9	8

● CR004 ♀ 1986

CR199 2012

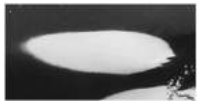
CR238 2015

CR257 2020

● CR004 ♀ 1986

CR199 2012

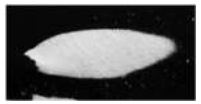
CR238 2015



CR257 2020

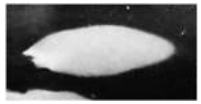
No image

CR137 ♀ ≤1999



- CR187 ♀ 2009

CR241 2015

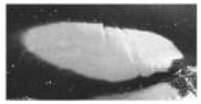


Left side

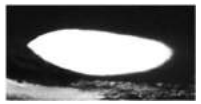
CR137 ♀ ≤1999

- CR187 ♀ 2009

CR241 2015



CR013 ♀ ≤1990



CR087 ♂ ~2000

CR173 2007

CR213 2012

CR253 2018

Left side

CR013 ♀ ≤1990

CR087 ♂ ~2000

CR173 2007

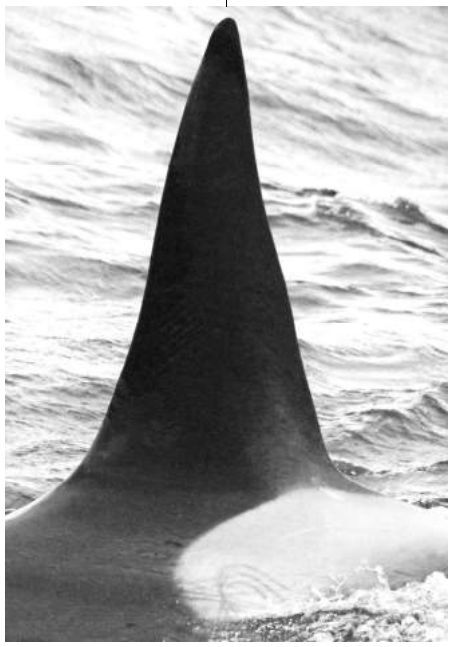
CR213 2012

CR253 2018

CR111 ♀ ≤1987

CR122 ♂ ≤1985

CR142 ♂ ~1997



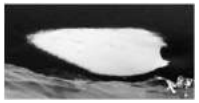
CR174 2007

CR223 2014

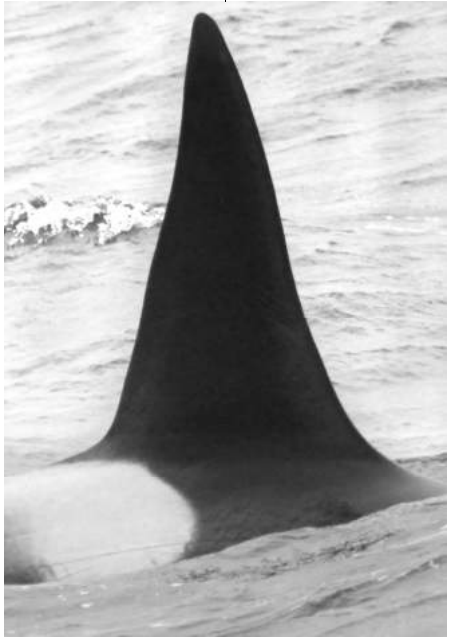
CR142 has been missing from the unit since March 2018

CR111 ♀ ≤1987

CR122 ♂ ≤1985



CR142 ♂ ~1997



CR174 2006

CR223 2014

Right side

CR023 ♂ ~1988

CR023 ♂ ~1988

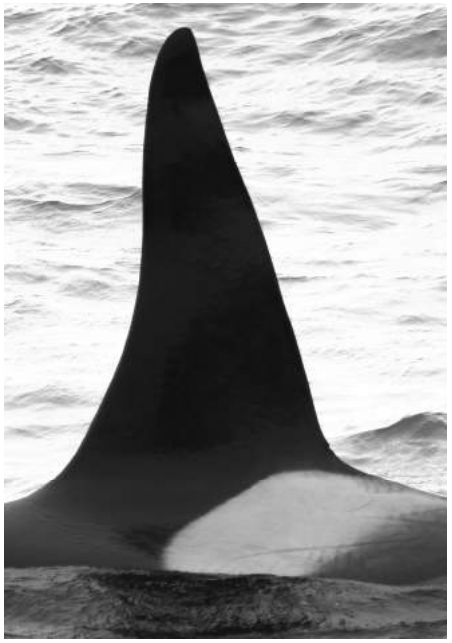
Left side

- CR019 ♀ ≤1990

- CR148 ♀ ~2000

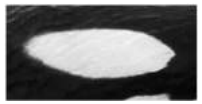
CR237 2015

- CR020 ♂ ≤1983



- CR019 ♀ ≤1990

- CR148 ♀ ~2000



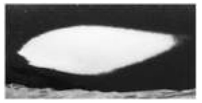
- CR020 ♂ ≤1983

CR237 2015

CR156 ♀ 1998

CR235 ♀ 2014

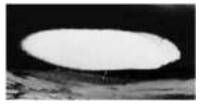
• CR009 ♂ ~1999



CR009 has been missing from the unit since March 2019

Left side

CR156 ♀ 1998



CR235 ♀ 2014

• CR009 ♂ ~1999

Left side

CR139 ♀ ≤1990

CR106 ♀ ≤1997

CR151 ♀ ≤1972

CR140 ♀ ~2000

CR155 ♀ 2007

CR243 2016

No image

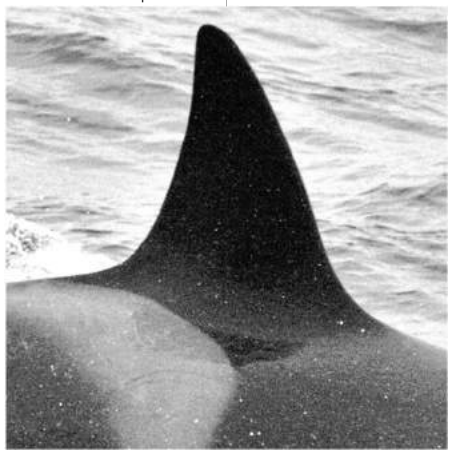
This unit has undergone multiple changes in recent years. CR140 has been missing since February 2018. CR139 was last photographed in April 2019 with CR151 and CR155, and appeared in poor condition. CR106 and CR243 were last photographed in January 2017, separated from the rest of the unit. CR155 and CR151 were the only two individuals still regularly encountered in 2020

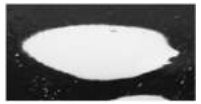
CR139 ♀ ≤1990

CR106 ♀ ≤1997

CR151 ♀ ≤1972

CR140 ♀ ~2000





CR155 ♀ 2007

CR243 2016

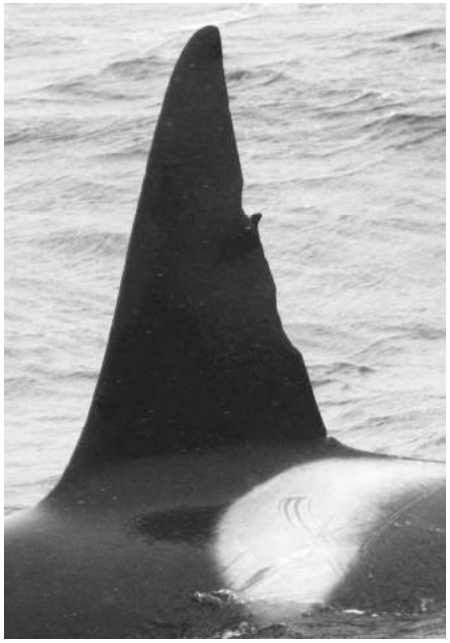
No image

No image

Right side

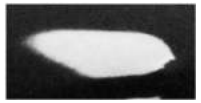
- CR063 ♀ ≤1979

CR064 ♂ ≤1983



Left side

- CR063 ♀ ≤1979

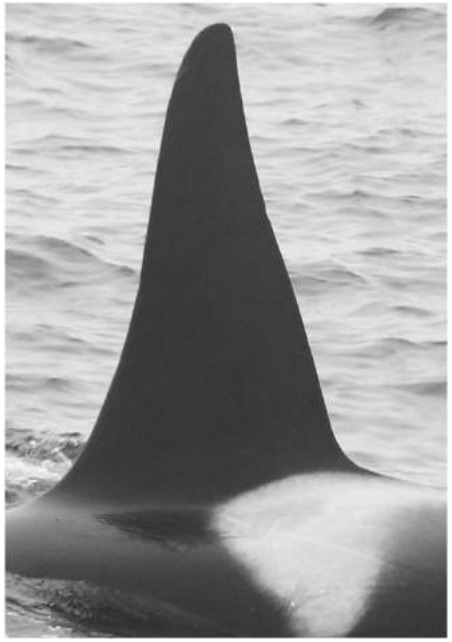


CR064 ♂ ≤1983

CR127 ♀ ≤1970

CR119 ♀ ≤1999

CR025 ♂ ≤1985



CR188 2009

Left side

This unit has been photographed from the shore of Marion Island (catalogued as M016 for CR025, M017 for CR127, M018 for CR119 and M042 for CR188 by Jordaan *et al.,* 2019).

CR127 ♀ ≤1970

CR119 ♀ ≤1999

CR025 ♂ ≤1985

CR188 2009

- CR128 ♀ ≤1965

- CR069 ♀ ≤1970

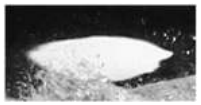
- CR116 ♀ ≤1995

CR229 2012

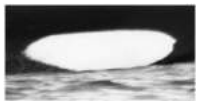
- CR068 ♂ ≤1983

• CR128 ♀ ≤1965

• CR069 ♀ ≤1970

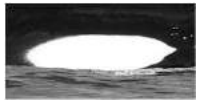


• CR116 ♀ ≤1995



CR229 2012

• CR068 ♂ ≤1983



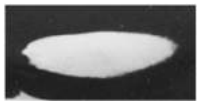
- CR161 unknown

- CR161 unknown

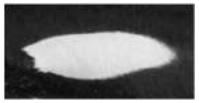
Left side

• CR138 ♀ ≤1995

• CR185 ♀ ≤1997



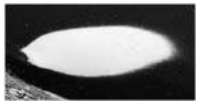
CR186 ♂ ~1998



CR251 2018

CR184 ♀ 2007

CR245 2016



• CR138 ♀ ≤1995

• CR185 ♀ ≤1997

CR186 ♂ ~1998

CR251 2018

No image

CR184 ♀ 2007

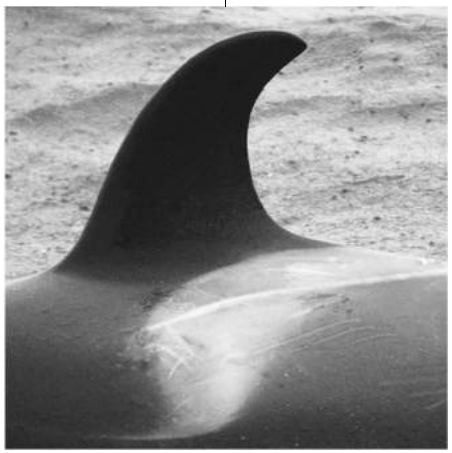
CR245 2016

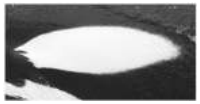
Right side

CR153 ≤1974

CR227 ♀ ≤2000

CR247 2010





Left side

CR153 ≤1974

CR227 ♀ ≤2000

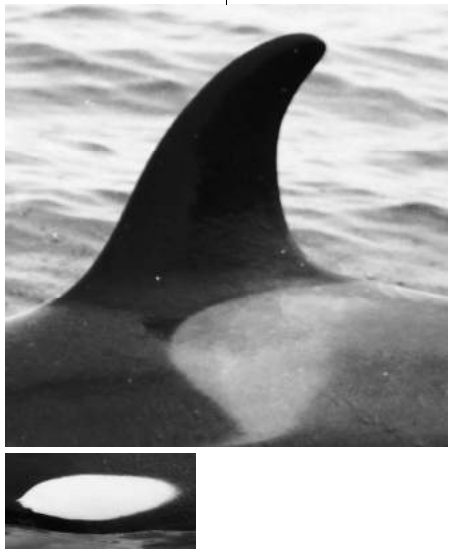
CR247 2010

CR198 ≤2000

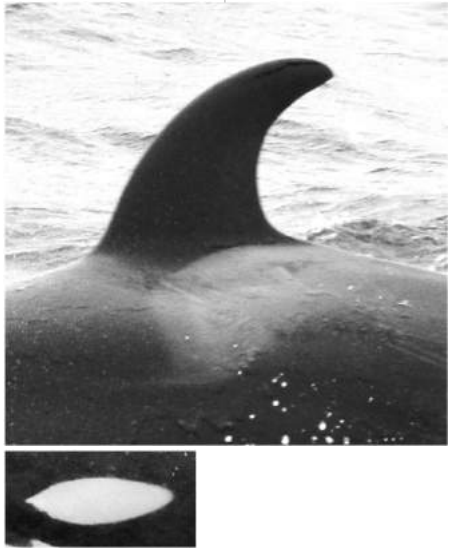
CR224 ≤2000

CR222 ♂ ~1997

CR248 2013



CR252 2018

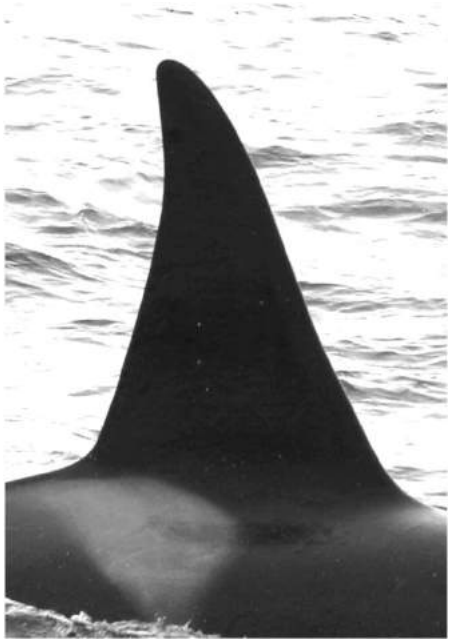


Left side

CR198 ≤1974

CR224 ≤2000

CR222 ♂ ~1997



CR248 2013

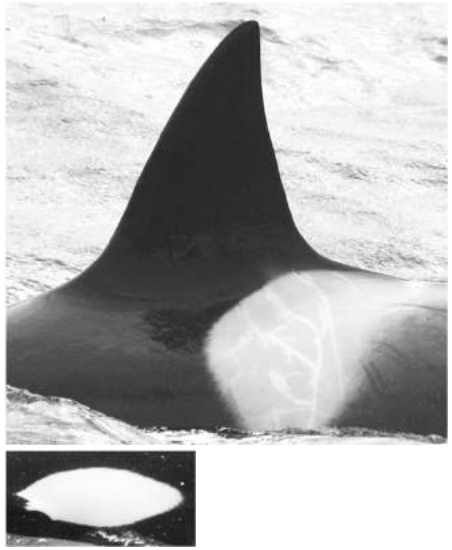
No image

CR252 2018

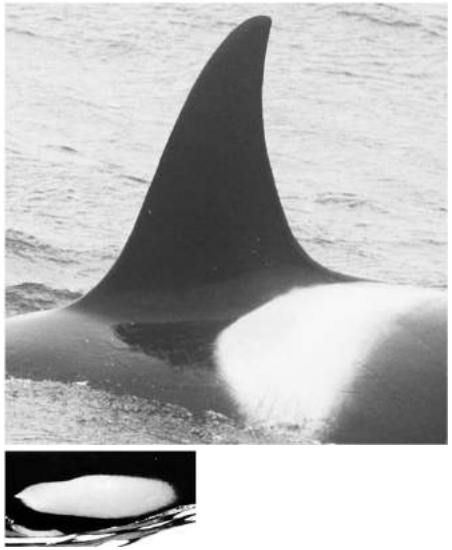
No image

Right side

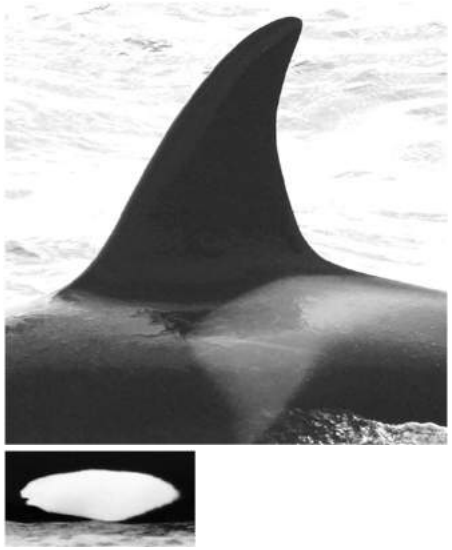
CR167 unknown



CR169 unknown



CR170 unknown



CR165 ♂ ≤1989

Left side

CR167 unknown

CR169 unknown

CR170 unknown

CR165 ♂ 2009

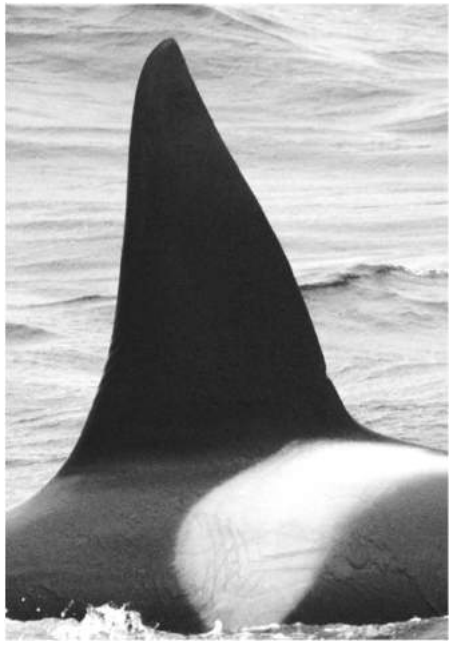
CR180 ≤1978

CR181 ♀ ≤2004

CR255 2019

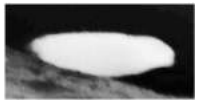
CR177 ♂ ~1998

CR179 ♂ ≤1993

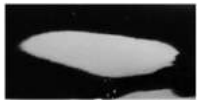


Left side

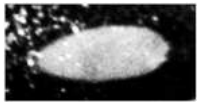
CR180 ≤1978



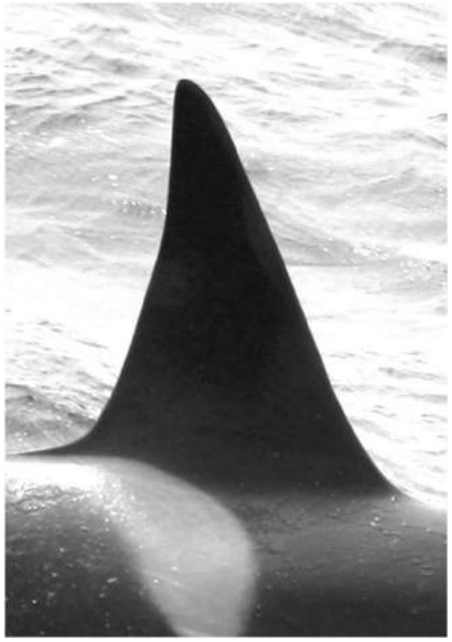
CR181 ♀ ≤2004

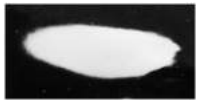


CR255 2019

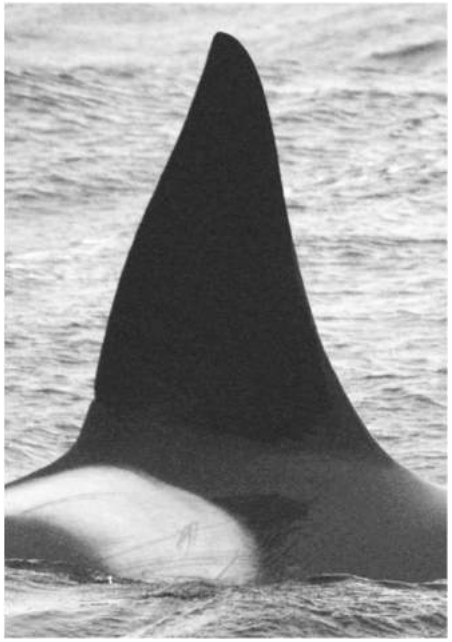


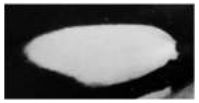
CR177 ♂ ~1998





CR179 ♂ ≤1993





CR192 ≤1971

CR189 ♂ ≤1986

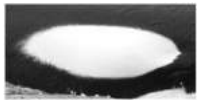
CR228 ♀ ≤2006

CR239 2016

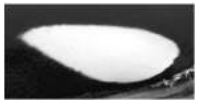
Left side

CR192 ≤1971

CR189 ♂ ≤1986



CR228 ♀ ≤2006



CR239 2016

CR191 ♀ ≤1999

CR190 ♂ ~1998

CR202 2009

Left side

CR191 ♀ ≤1999

No image

CR202 2009

CR190 ♂ ~1998

CR195 ♀ ≤1971

CR196 ♀ ≤1971

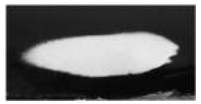
CR201 ♀ ≤1998

CR225 2008

CR244 2016

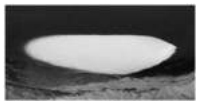
Left side

CR195 ♀ ≤1971



CR196 ♀ ≤1971

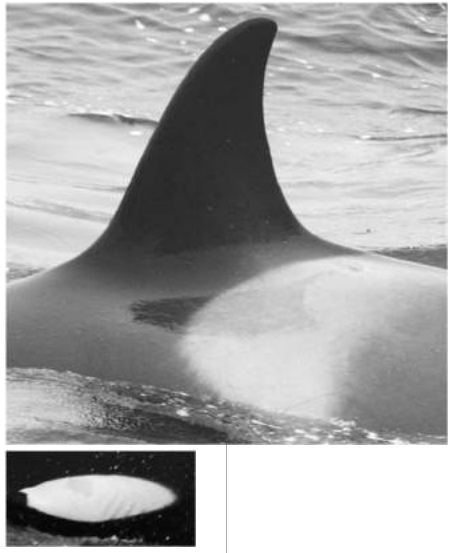
CR201 ♀ ≤1998



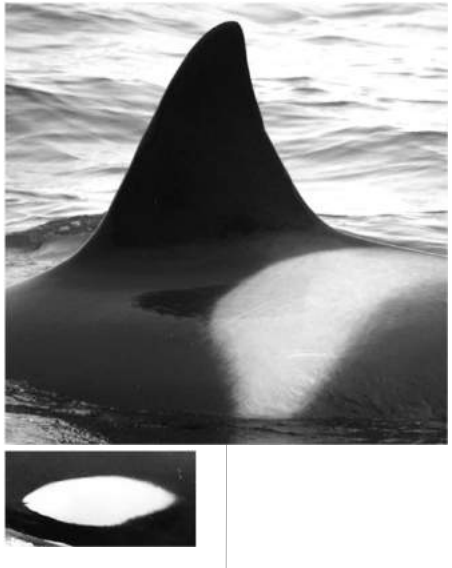
CR225 2008

CR244 2016

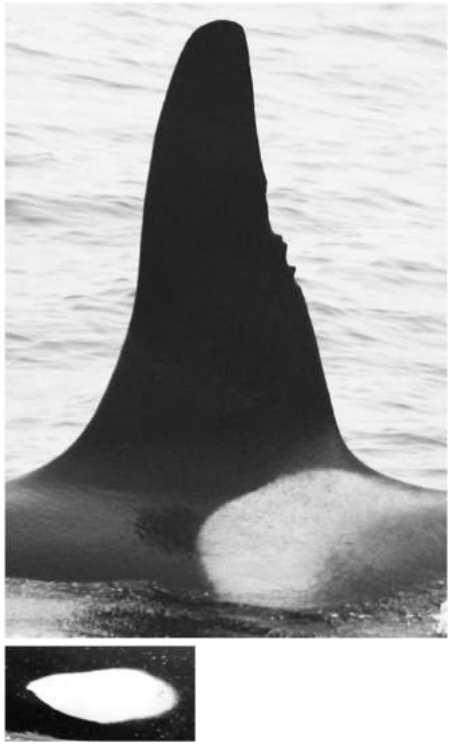
CR226 ♀ ~2004



CR221 ♀ ≤2005

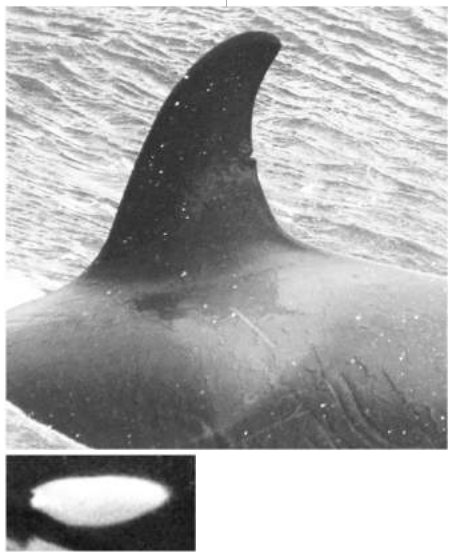


CR193 ♂ ≤1988

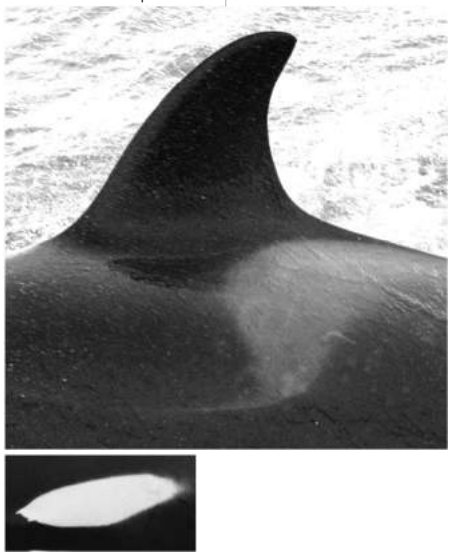


CR194 ♂ ≤1988

CR249 2017

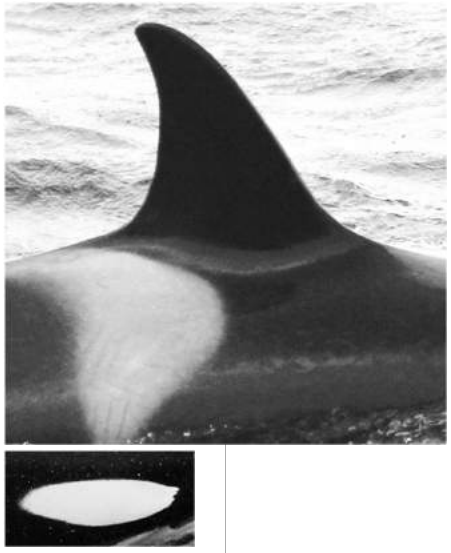


CR236 ♀ 2015

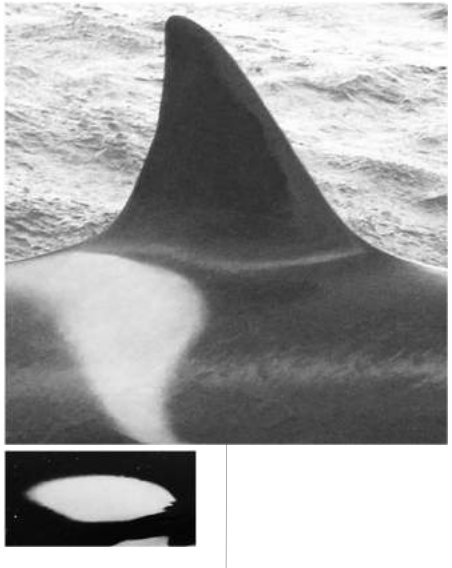


Left side

CR226 ♀ ~2004

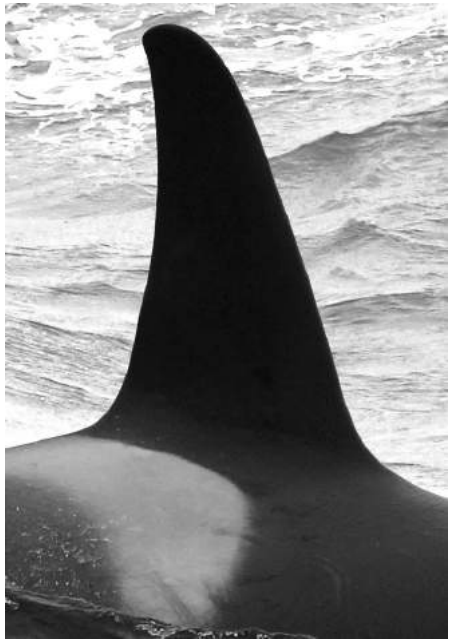


CR221 ♀ ≤2005

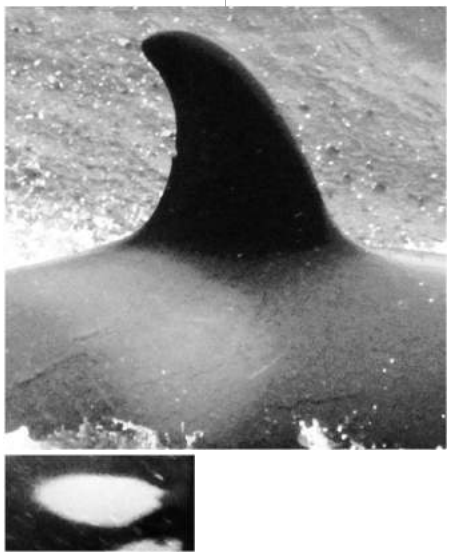


CR193 ♂ ≤1988

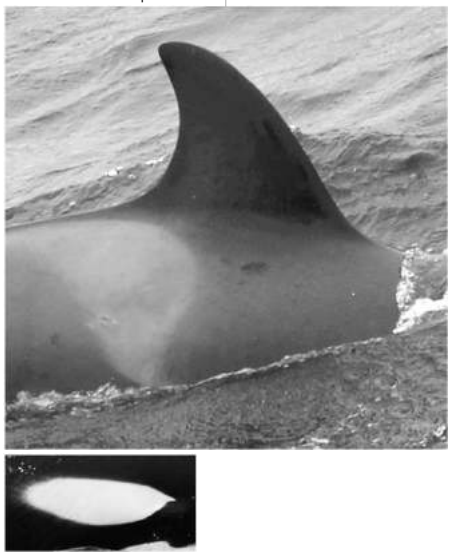
CR194 ♂ ≤1988



CR249 2017

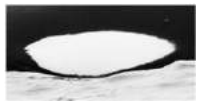


CR236 ♀ 2015



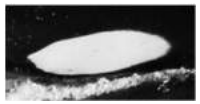
Left side

- CR204 ♀ ≤1999



CR207 ♀ ≤2000

CR210 ♀ ~2005



- CR206 2009

CR246 2017

CR250 2017

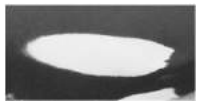
CR256 2020

No image

- CR204 ♀ ≤1999

CR207 ♀ ≤2000

CR210 ♀ ~2005



- CR206 2009 CR246 2017

CR250 2017

CR256 2020

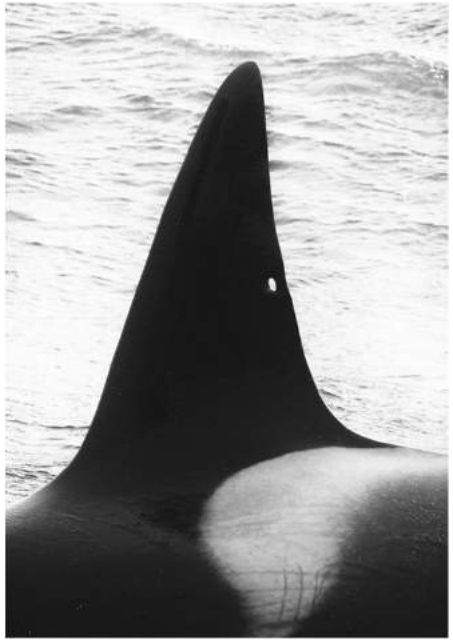
No image

Right side

CR214 ♀ ≤2002

CR218 ♀ ≤2003

CR216 ♂ ~2005



CR219 2012

CR254 2019

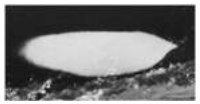
CR233 2013

The hole in CR216's dorsal fin, which may have been caused by a bullet, occurred between April 27th and July 7th 2019.

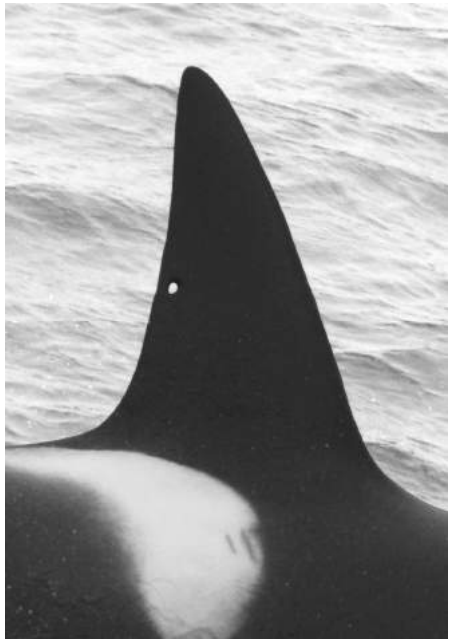
Left side

CR214 ♀ ≤2002

CR218 ♀ ≤2003



CR216 ♂ ~2005



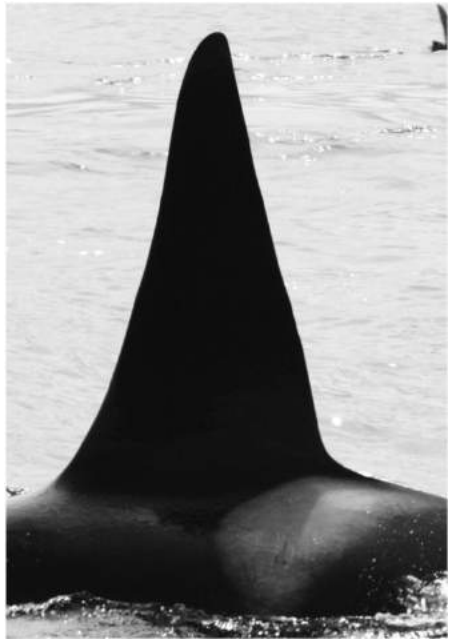
CR219 2012

CR254 2019

No image

CR233 2013

CR215 ♂ ≤1993



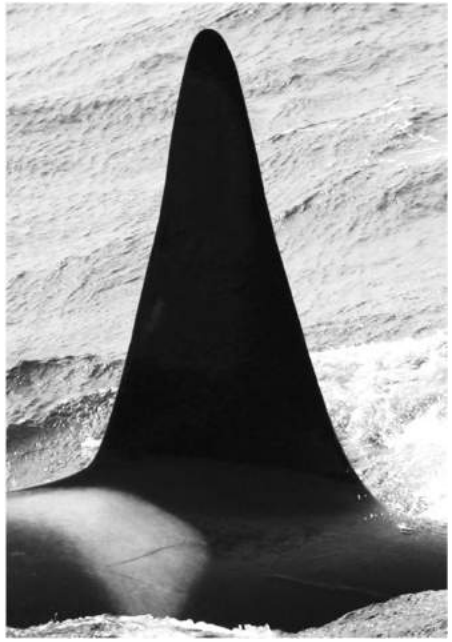
CR154 ♀ ≤2001

CR154 has been missing from the unit since April 2019

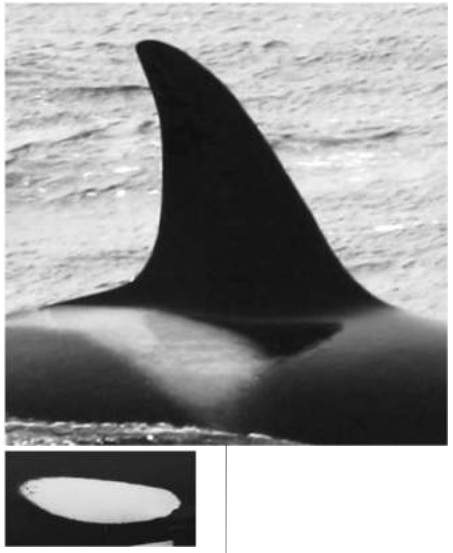
CR232 2011

Left side

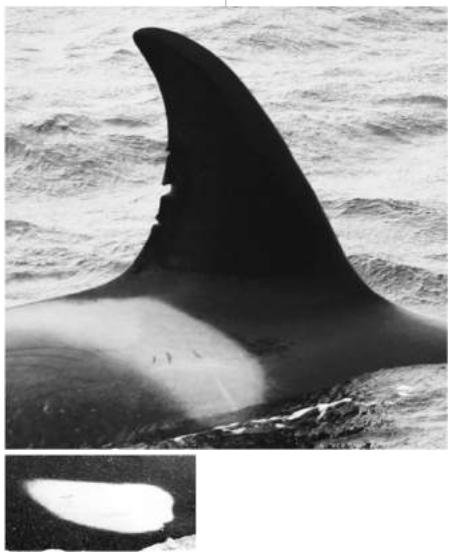
CR215 ♂ ≤1993



CR154 ♀ ≤2001



CR232 2011

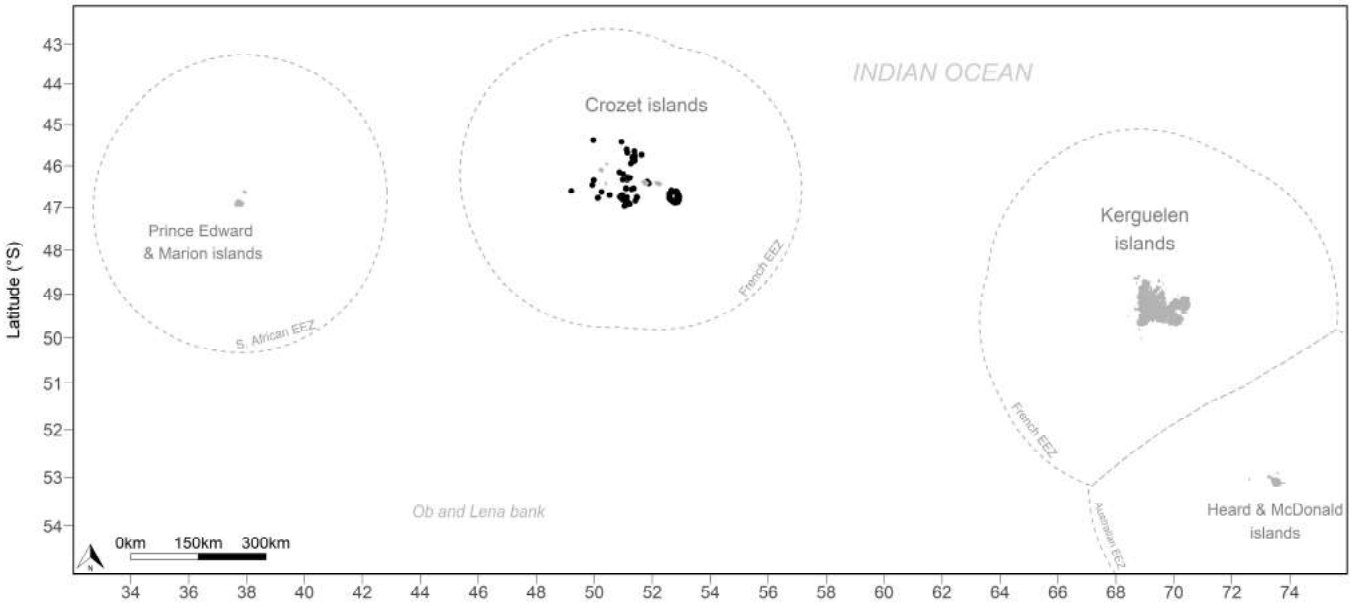


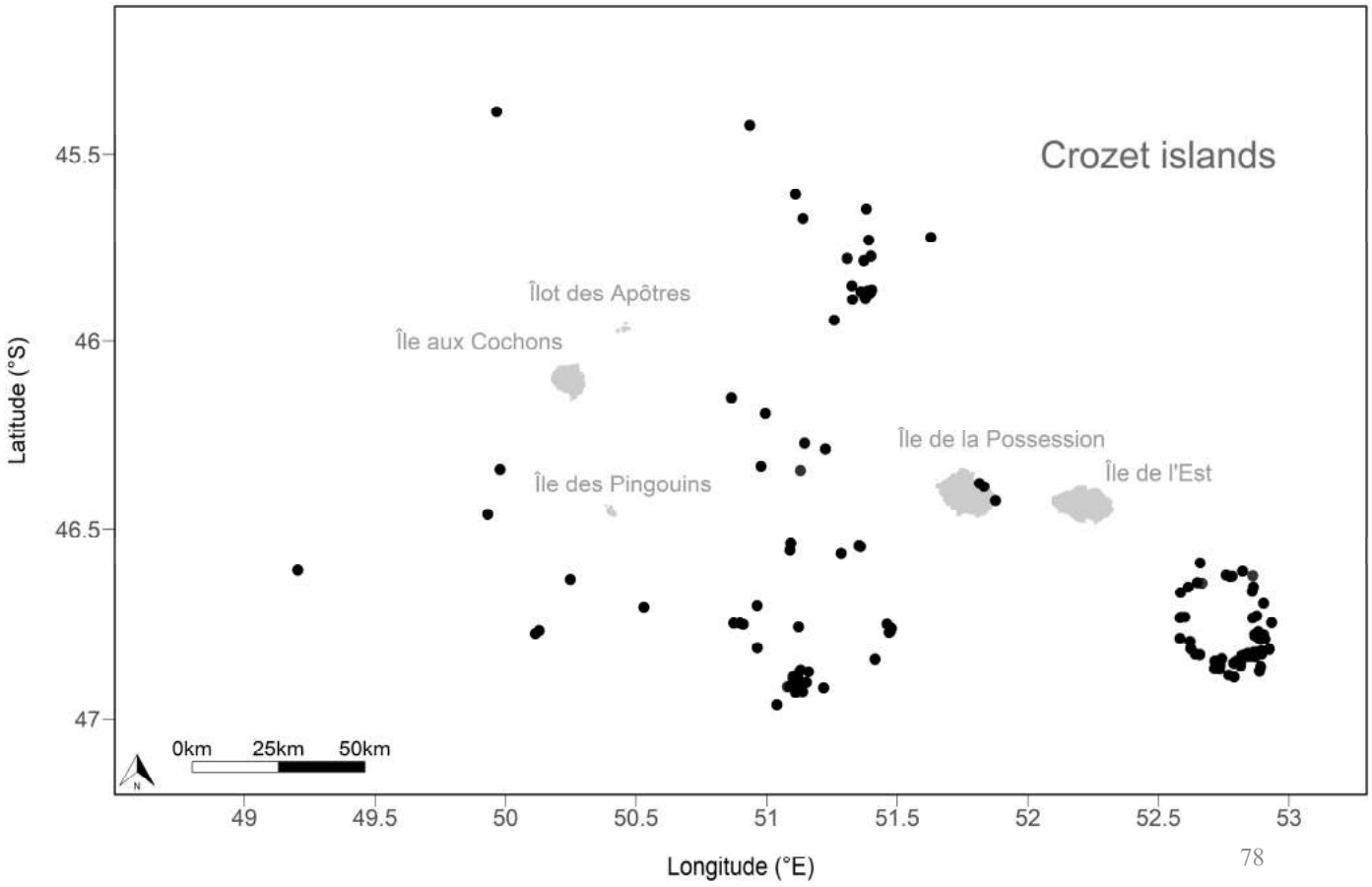
CR002 unit

Last encountered **2020**

Individuals (2020) **CR004, CR199, CR238, CR257**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**170**
Ile de la Possession	**34**
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



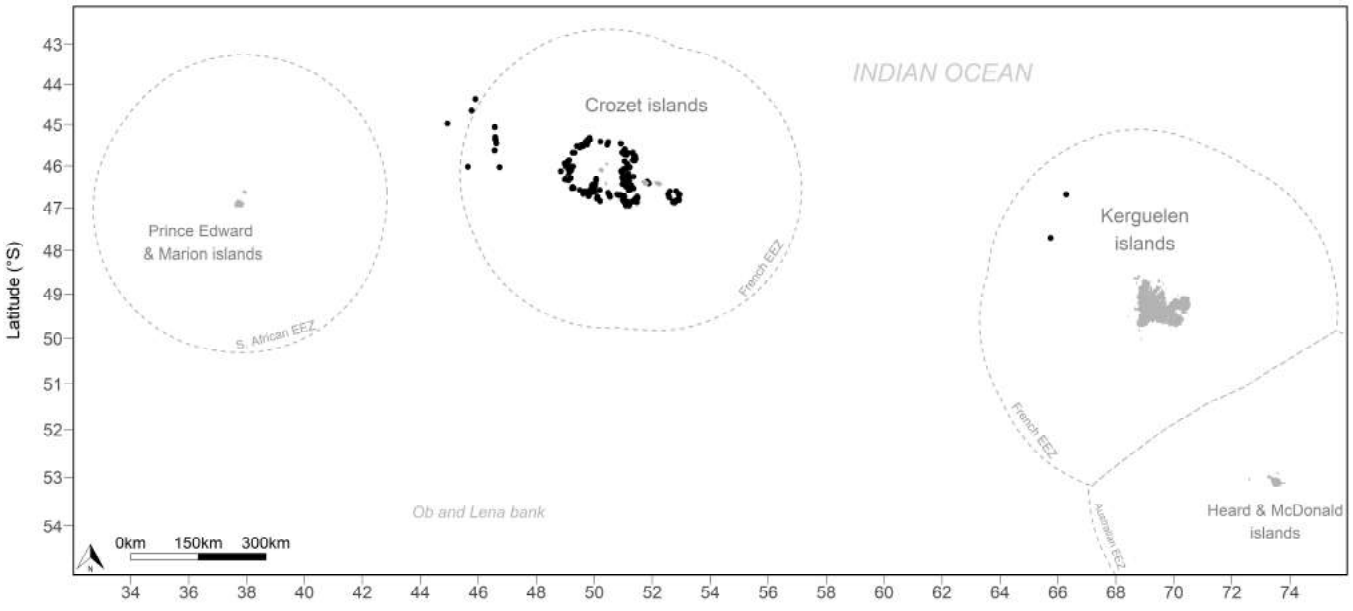


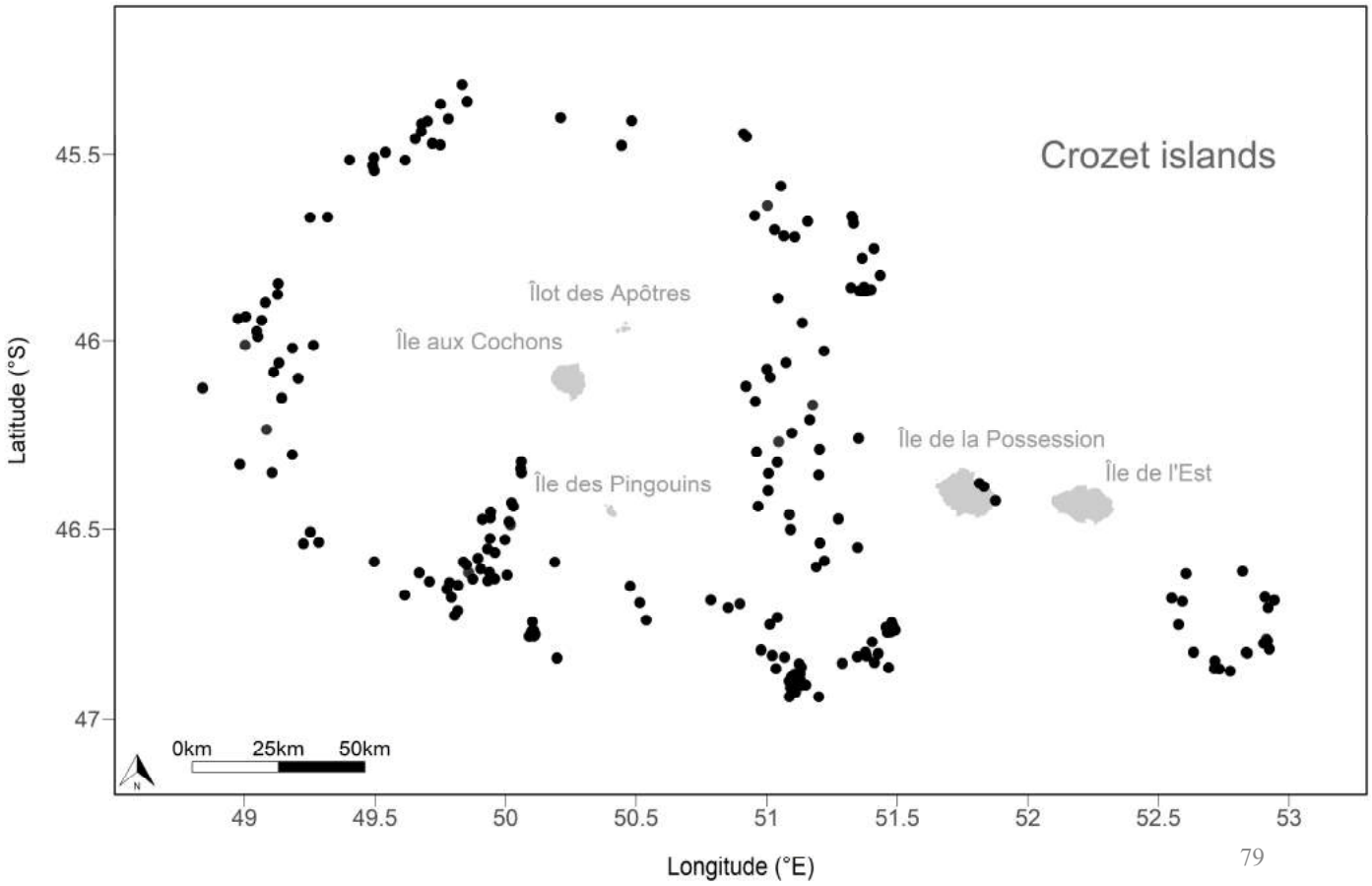
CR012 unit

Last encountered **2020**

Individuals (2020) **CR137, CR187, CR241**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**326**
Ile de la Possession	**51**
Kerguelen EEZ	
Fishing vessels	**2**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	**3**



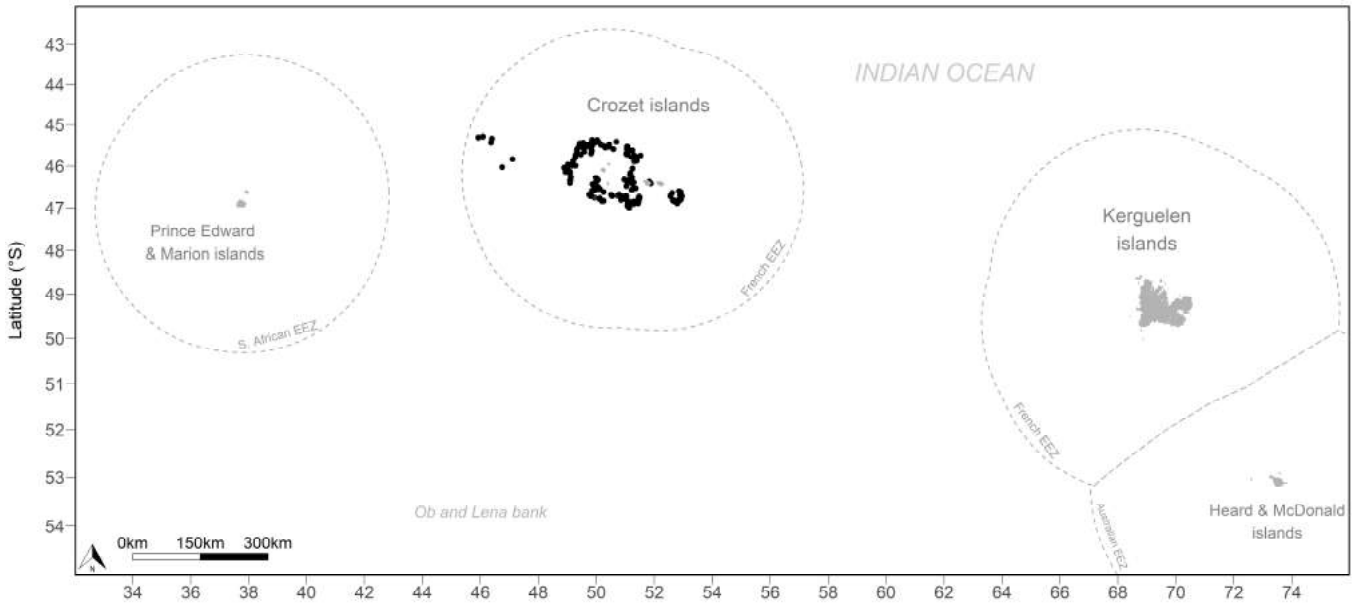


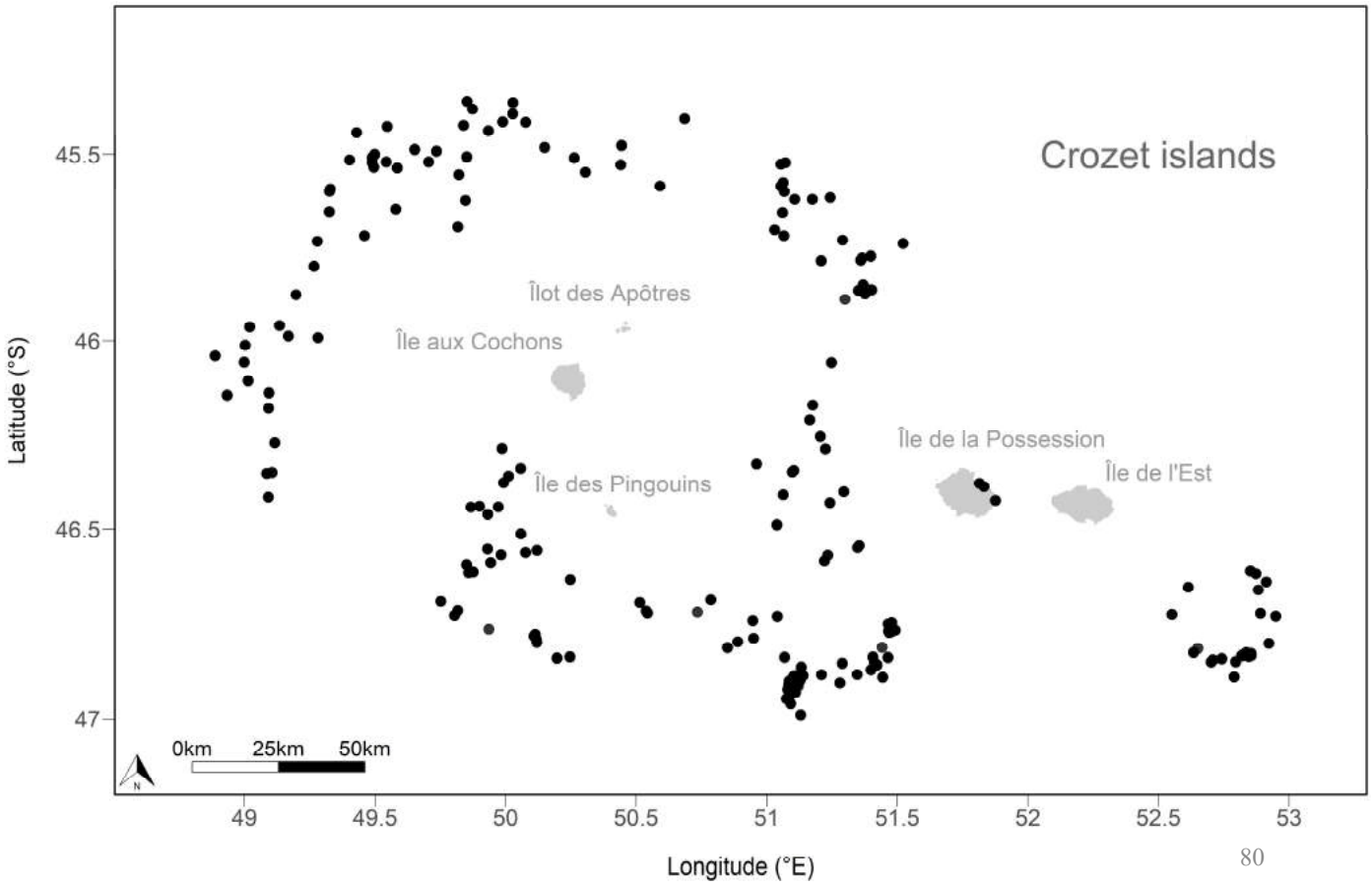
CR013/CR111 unit

Last encountered **2020**

Individuals (2020) **CR013, CR087, CR111, CR122, CR173, CR174, CR213, CR223, CR253**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**296**
Ile de la Possession	**6**
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



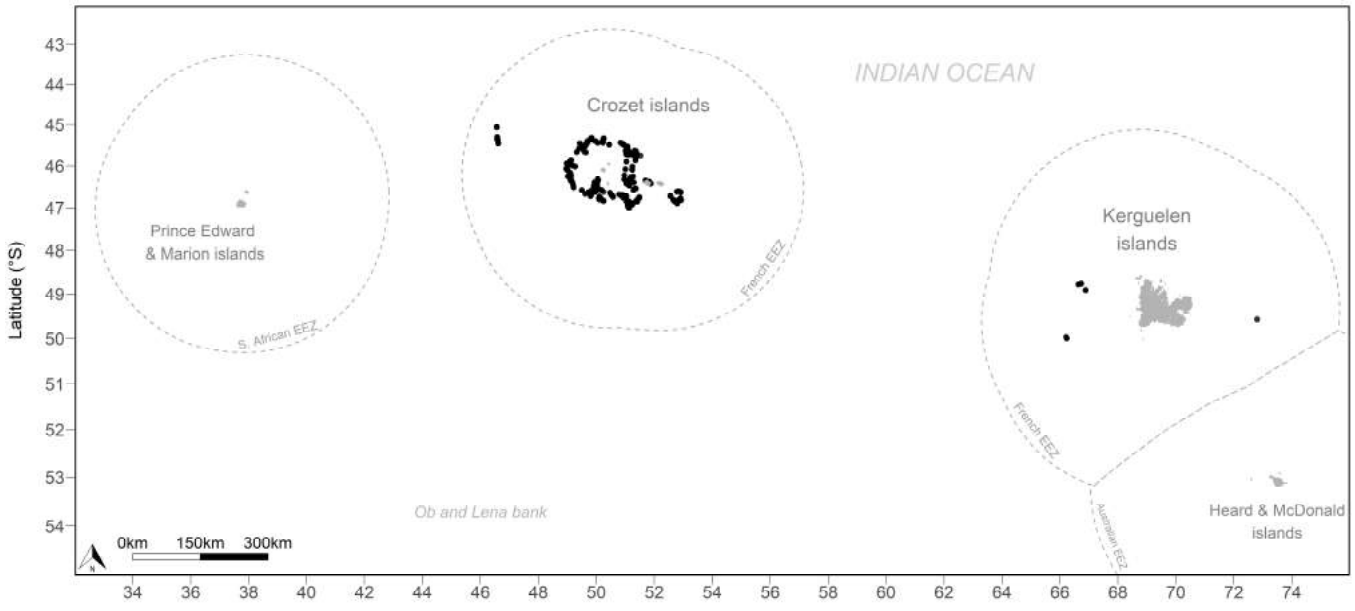


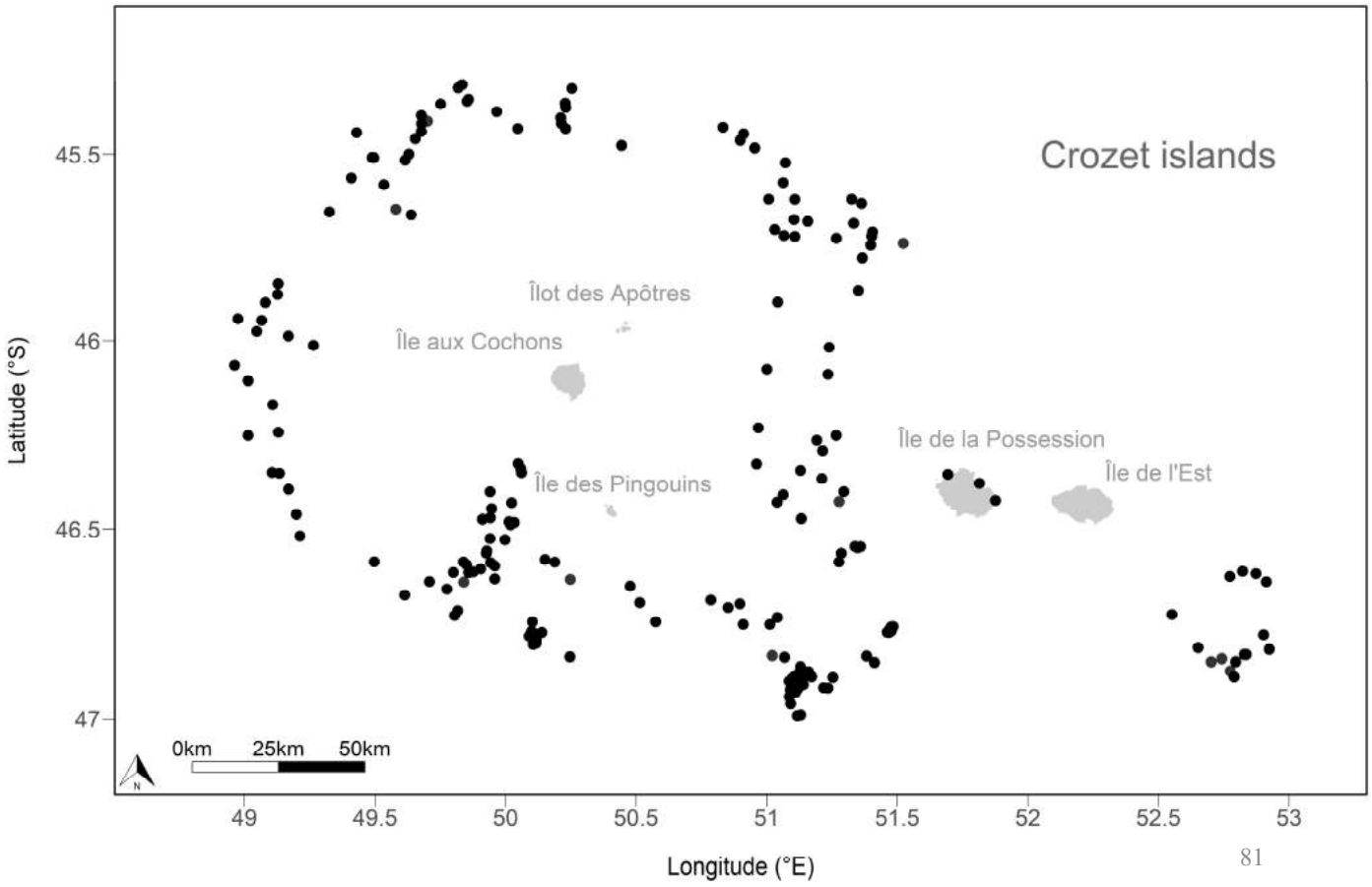
CR016 unit

Last encountered **2019**

Individuals (2020) **CR023**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**266**
Ile de la Possession	**7**
Kerguelen EEZ	
Fishing vessels	**5**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



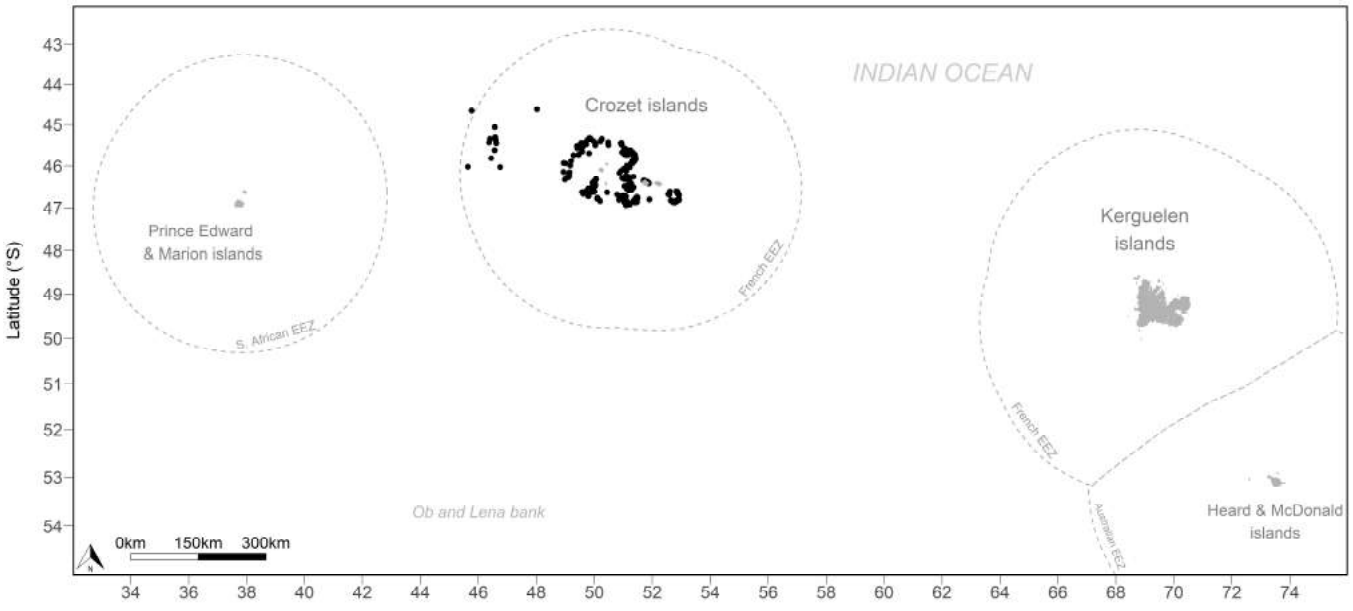


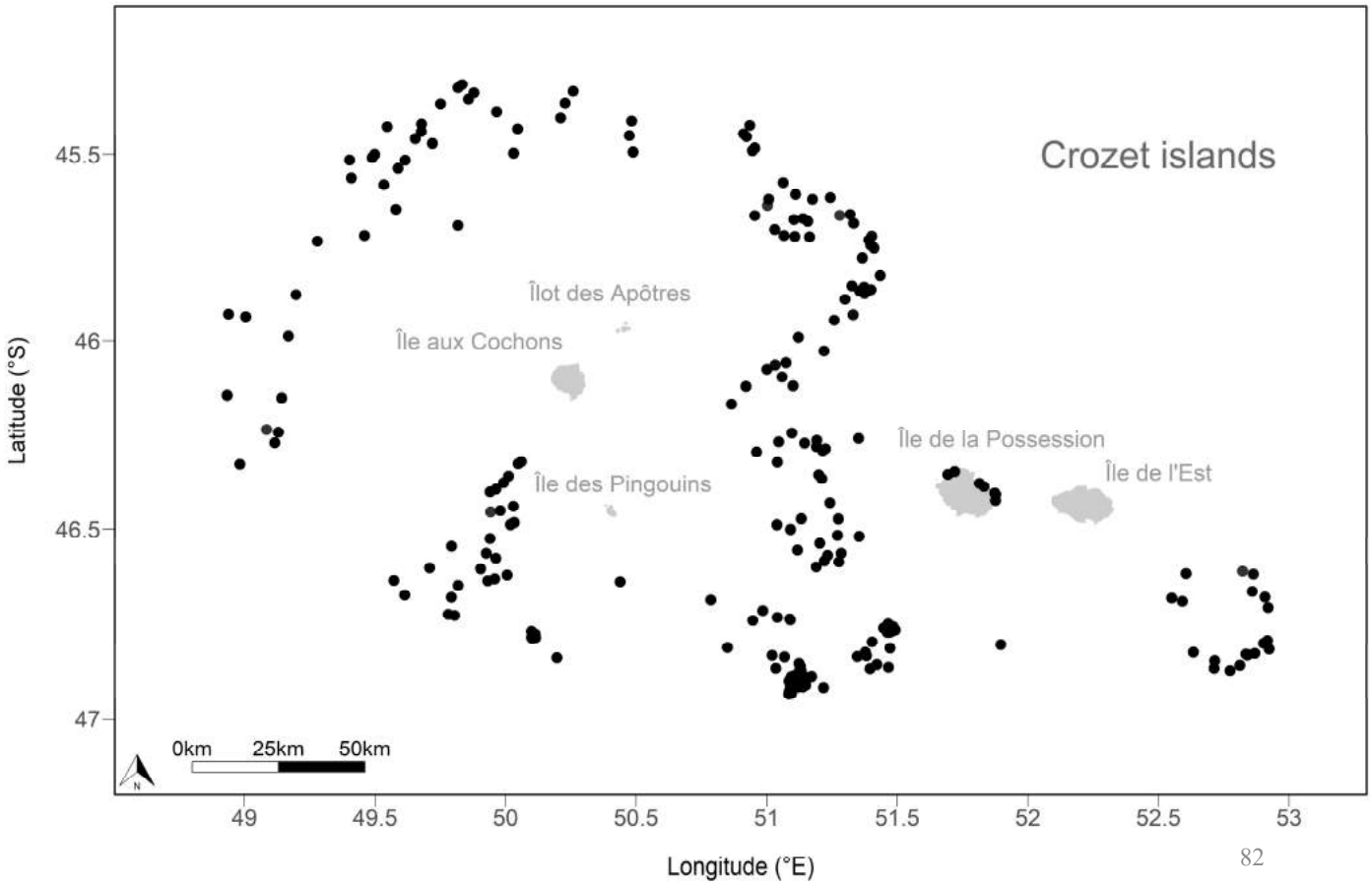
CR018 unit

Last encountered **2020**

Individuals (2020) **CR019, CR020, CR148, CR237**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**386**
Ile de la Possession	**87**
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



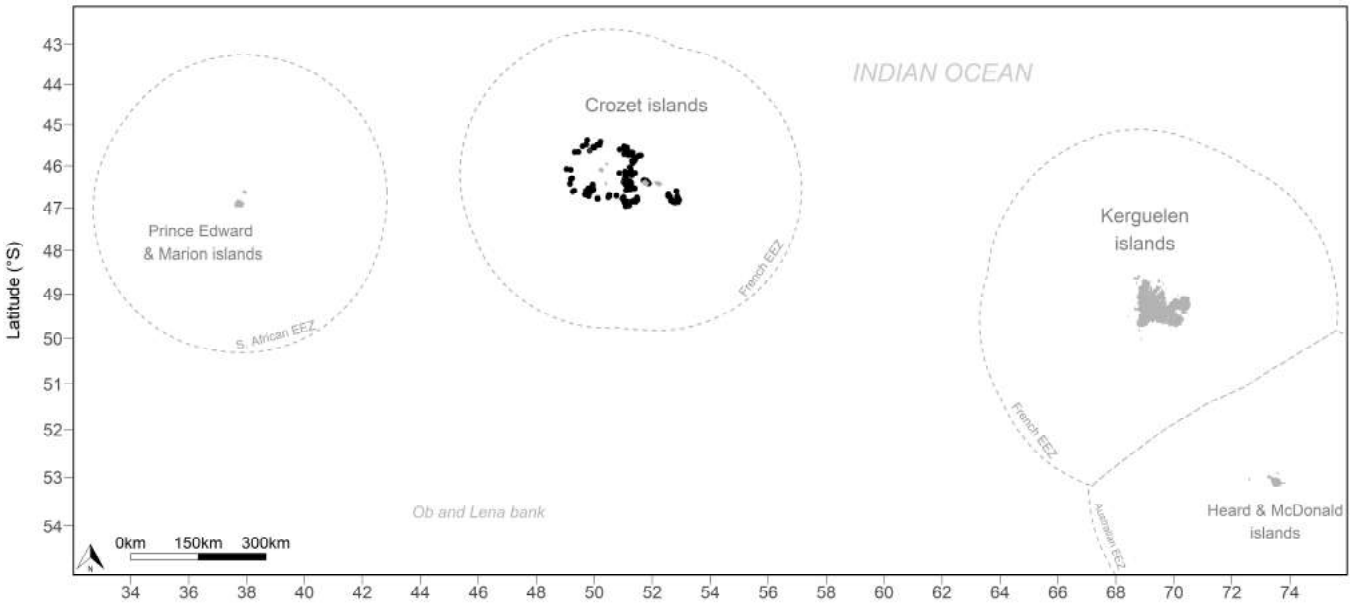


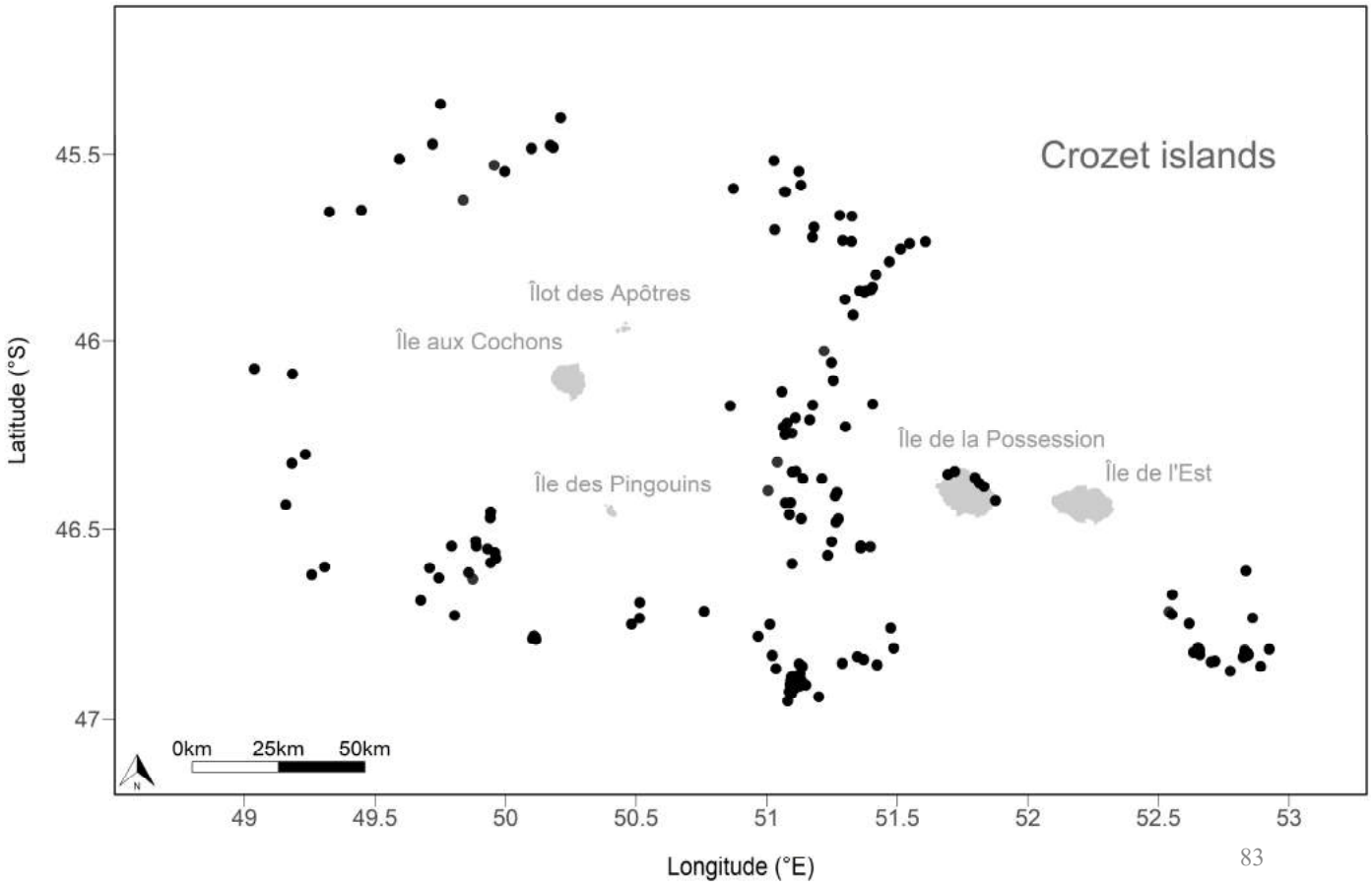
CR022 unit

Last encountered **2020**

Individuals (2020) **CR009, CR156, CR235**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**224**
Ile de la Possession	**45**
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



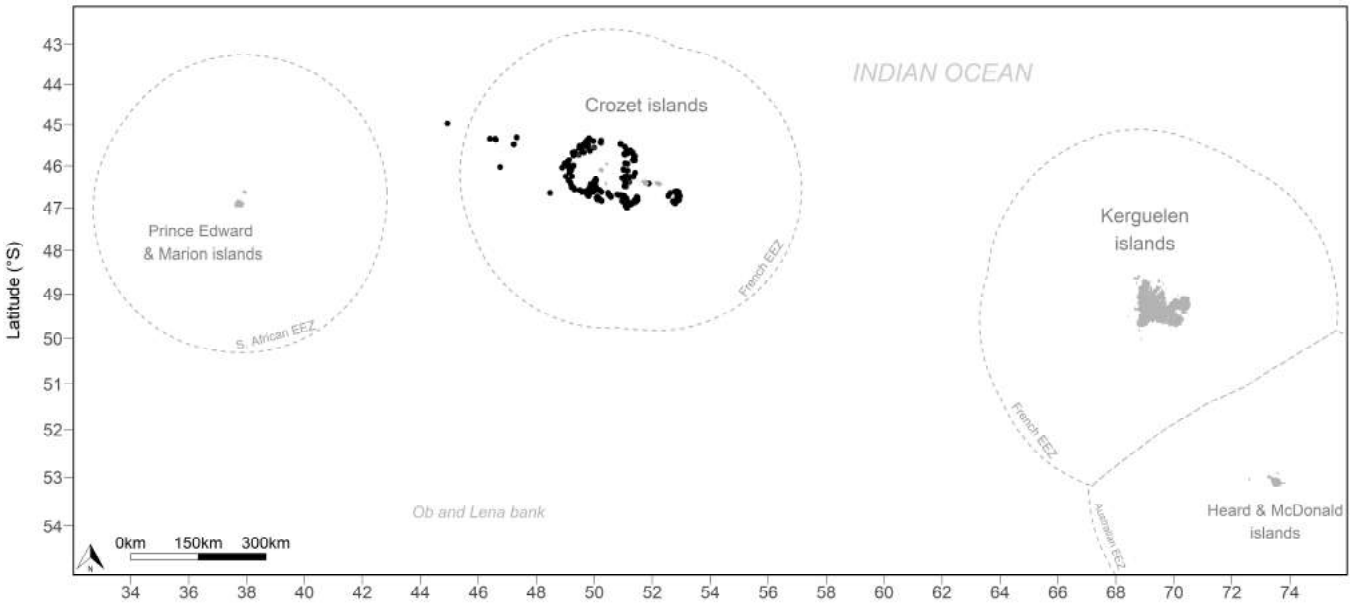


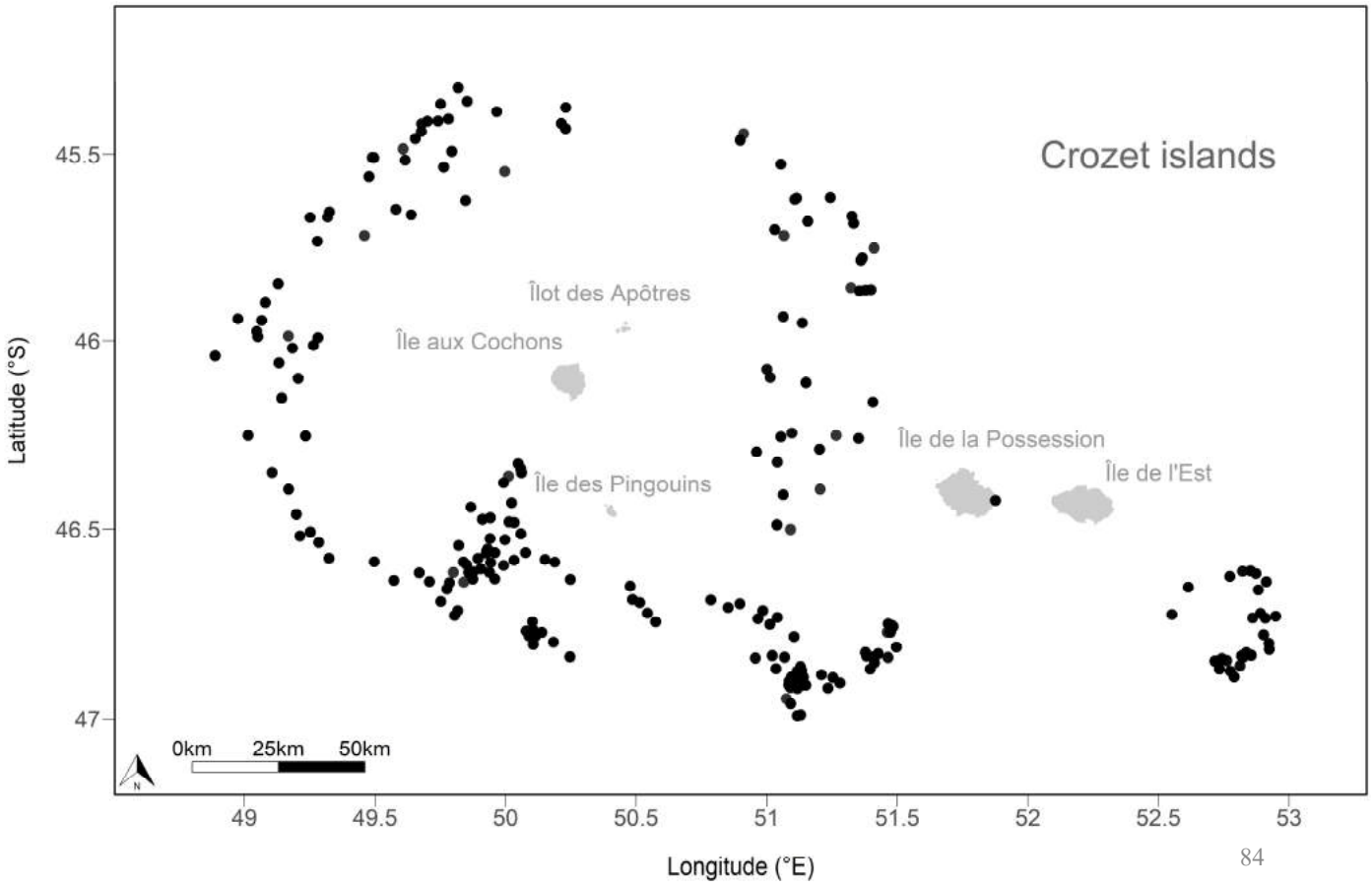
CR027/CR139 unit

Last encountered **2020**

Individuals (2020) **CR106, CR151, CR155, CR243**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**223**
Ile de la Possession	**1**
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	**1**



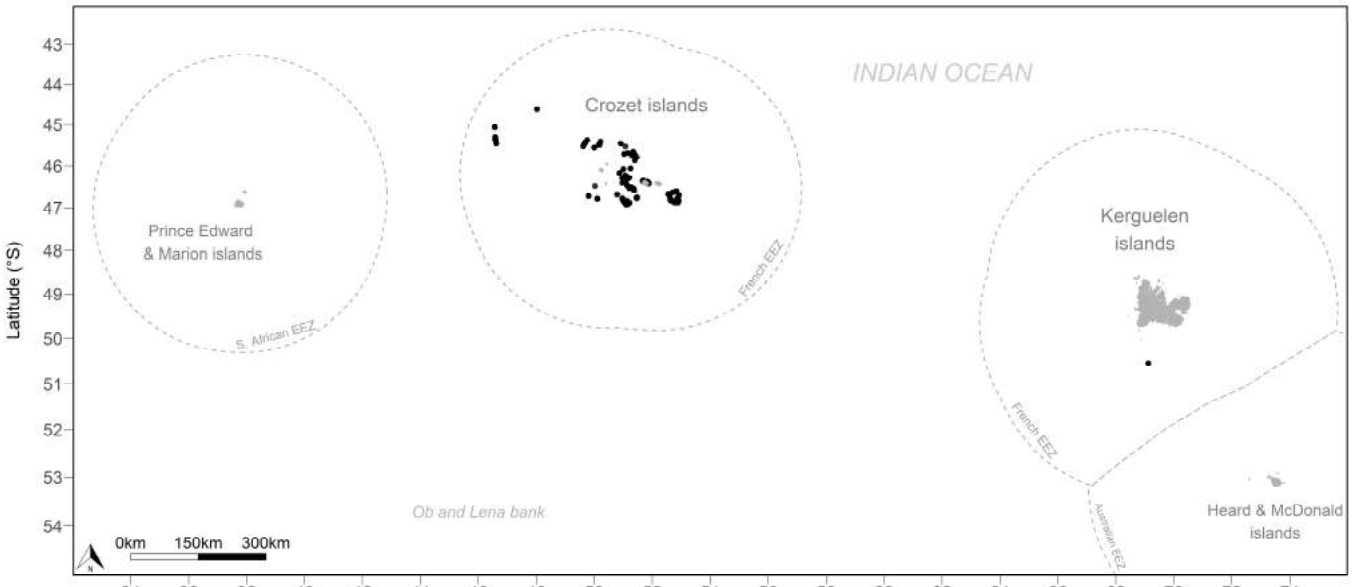


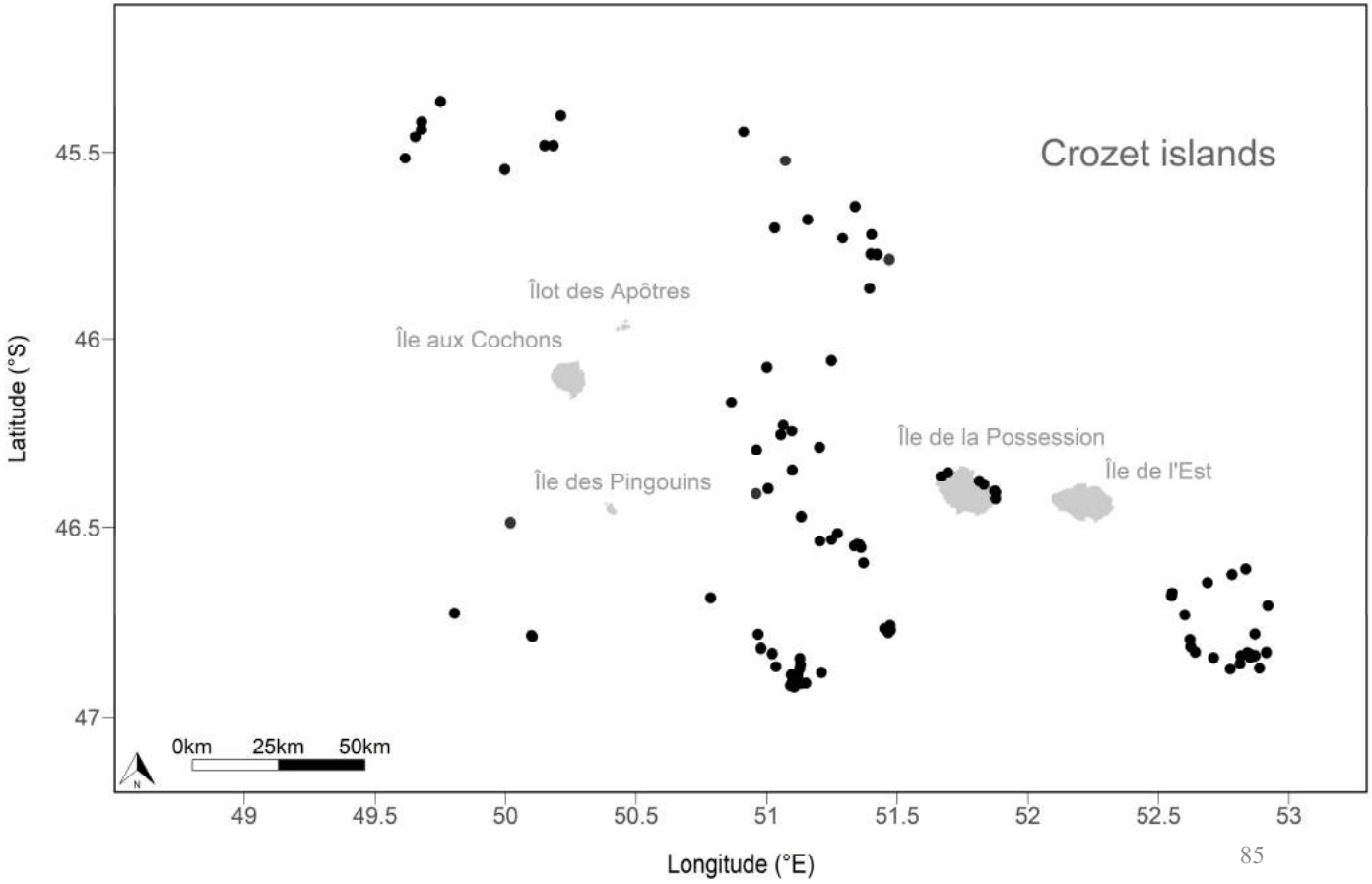
CR063 unit

Last encountered **2020**

Individuals (2020) **CR063, CR064**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**108**
Ile de la Possession	**63**
Kerguelen EEZ	
Fishing vessels	**1**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



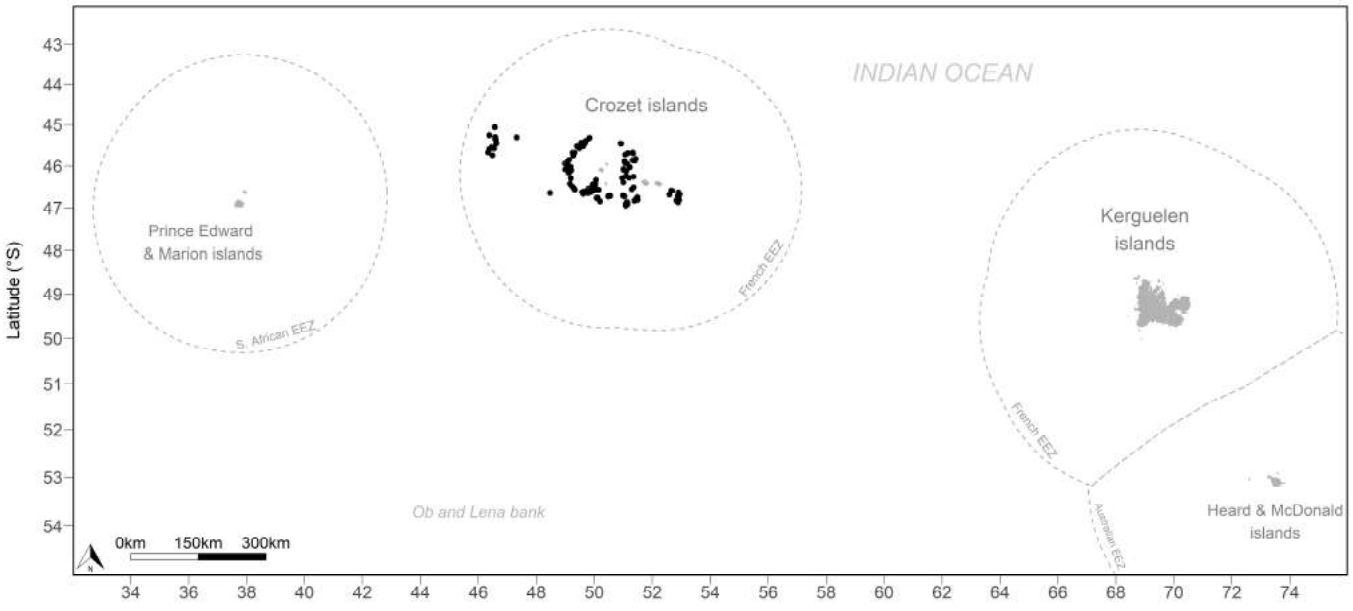


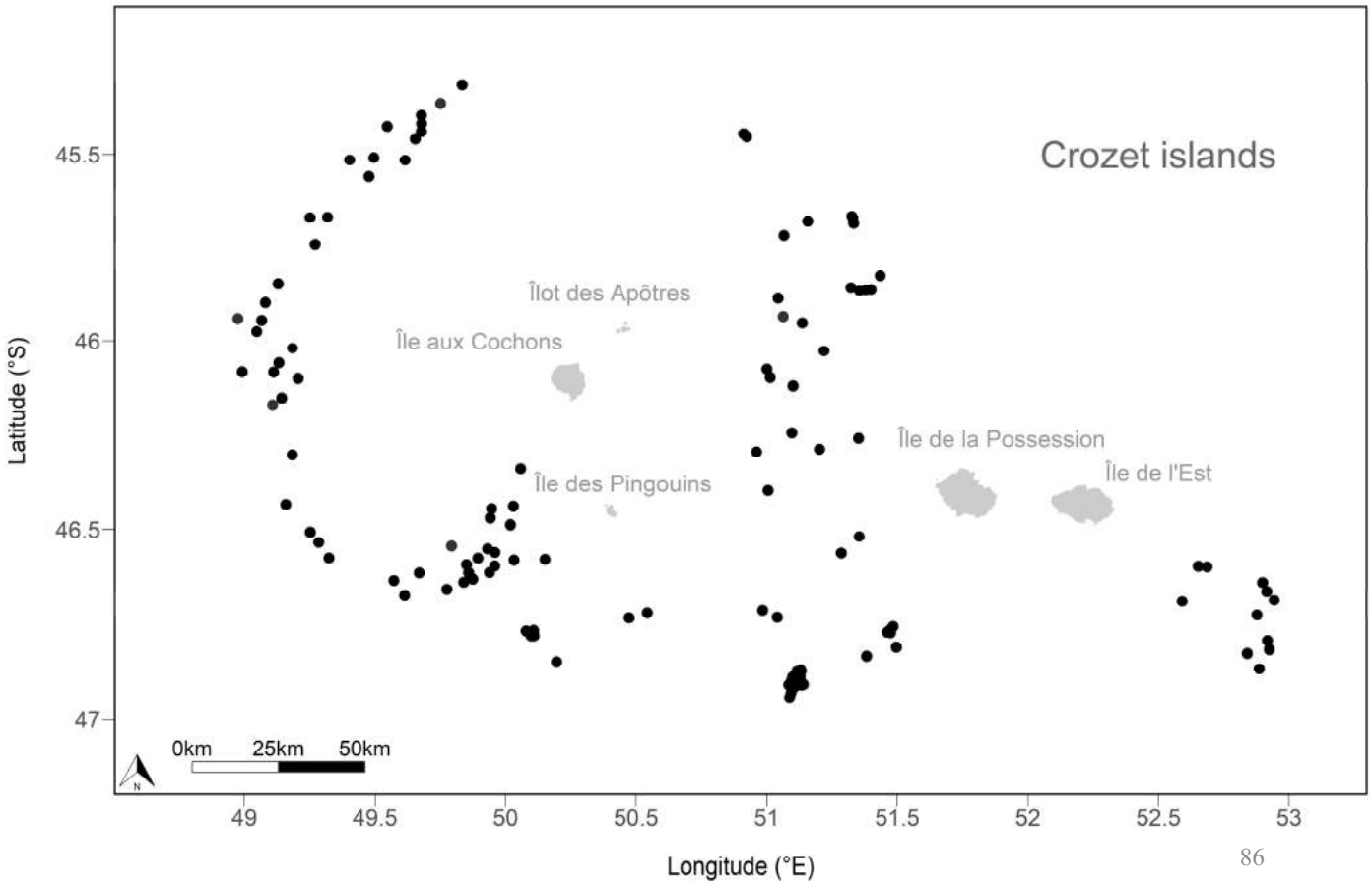
CR127 unit

Last encountered **2019**

Individuals (2020) **CR025, CR119, CR127, CR188**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**170**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



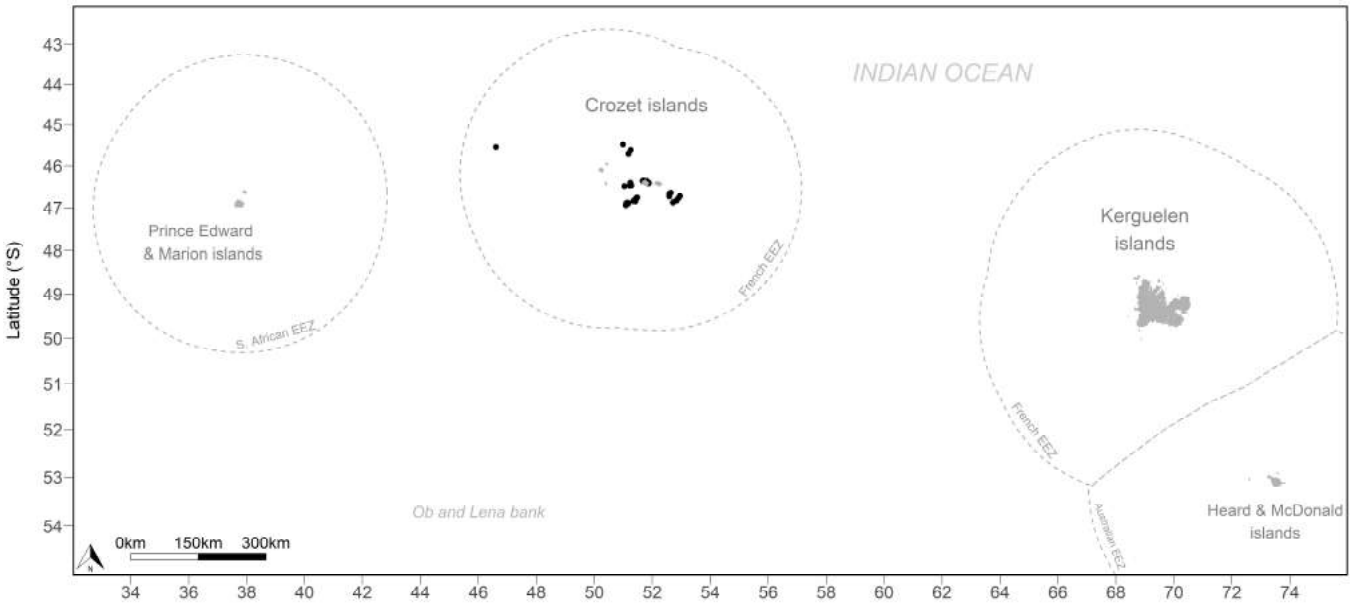


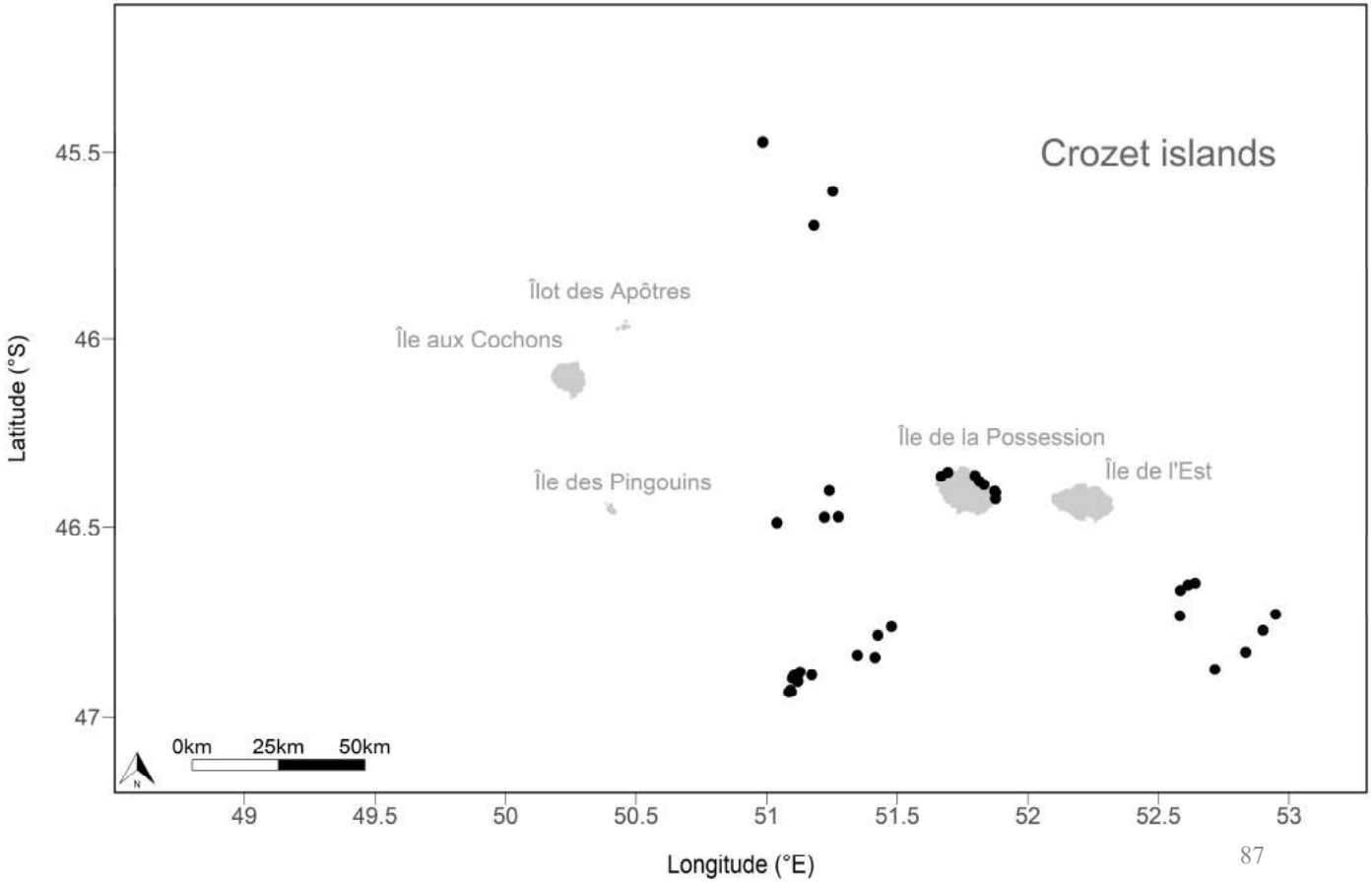
CR128 unit

Last encountered **2020**

Individuals (2020) **CR068, CR069, CR116, CR161, CR229**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**42**
Ile de la Possession	**210**
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



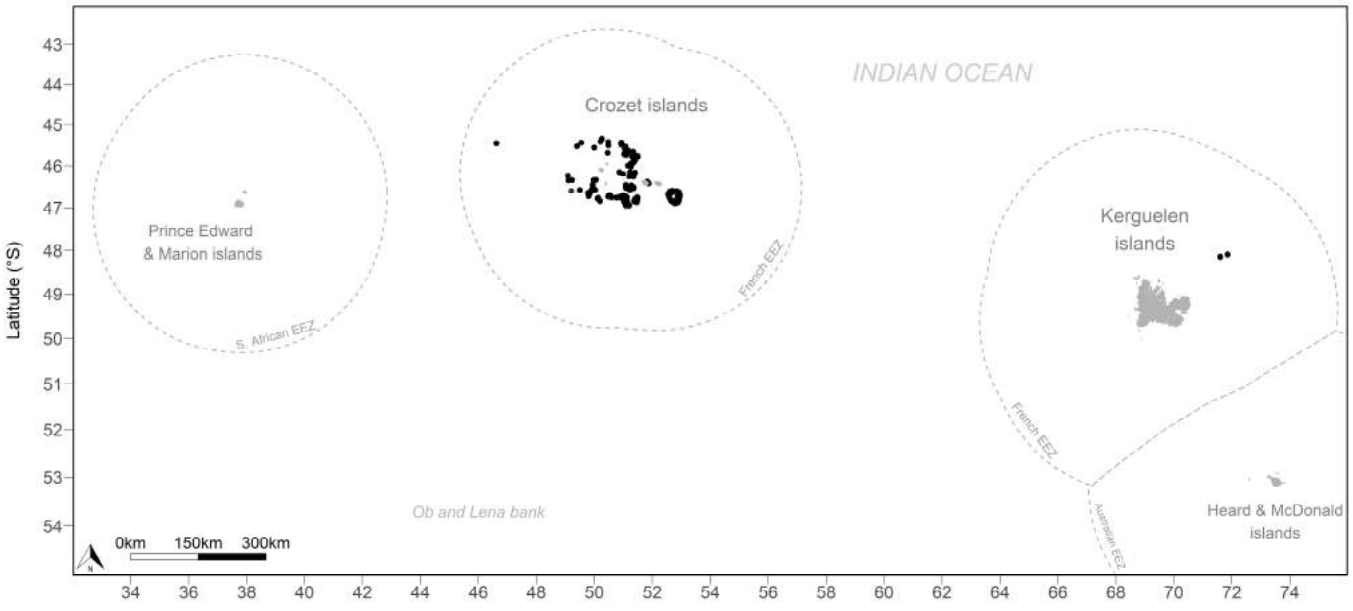


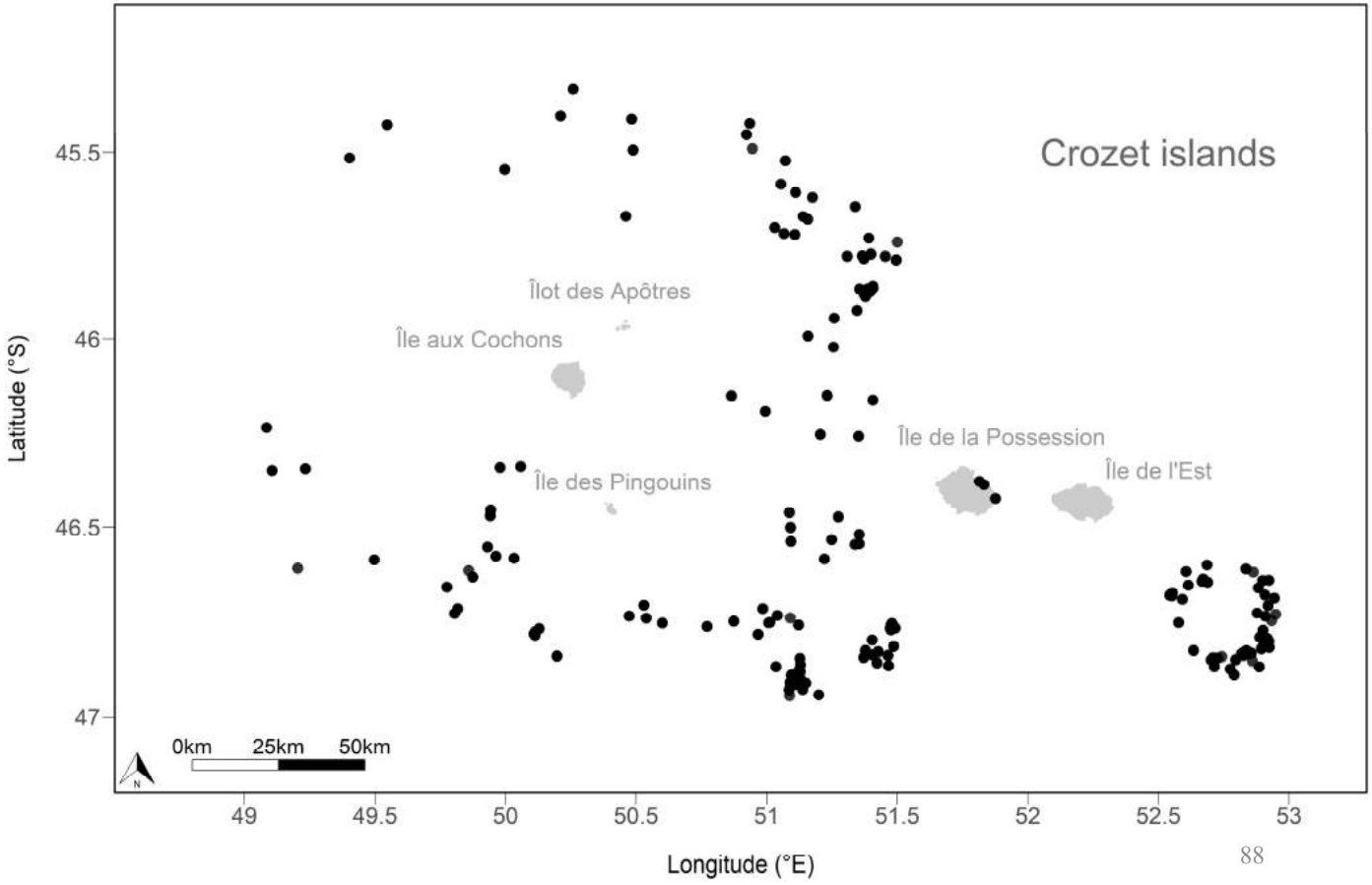
CR138 unit

Last encountered **2020**

Individuals (2020) **CR138, CR184, CR185, CR186, CR245, CR251**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**260**
Ile de la Possession	**12**
Kerguelen EEZ	
Fishing vessels	**3**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



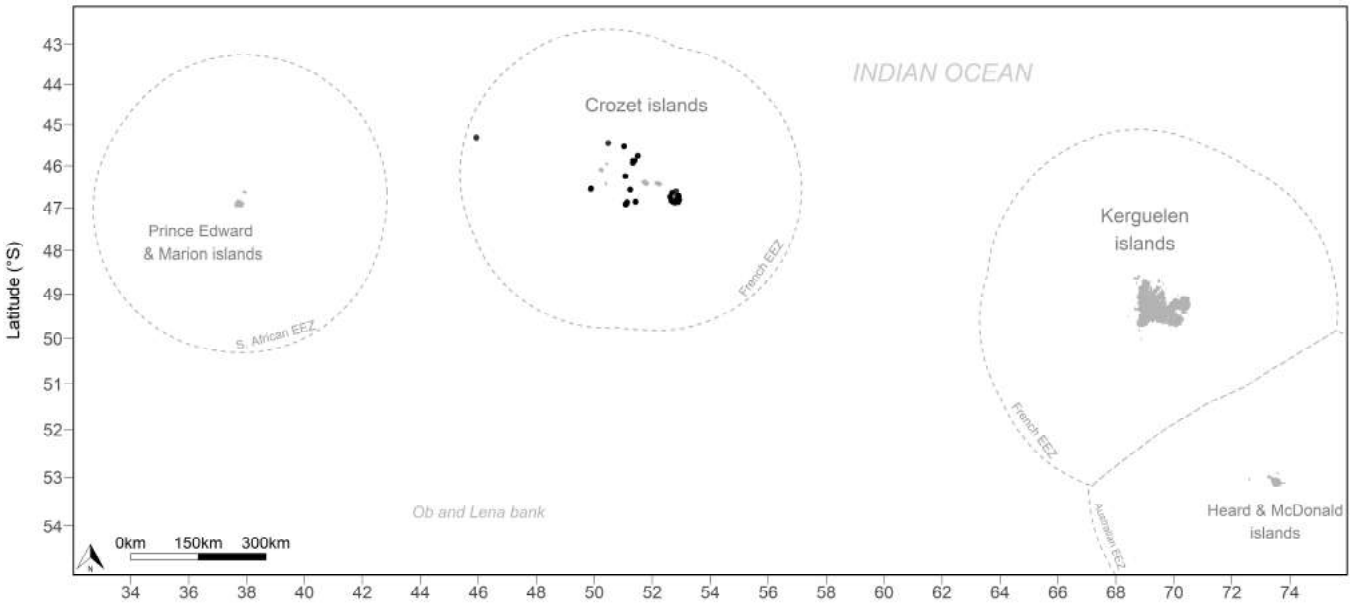


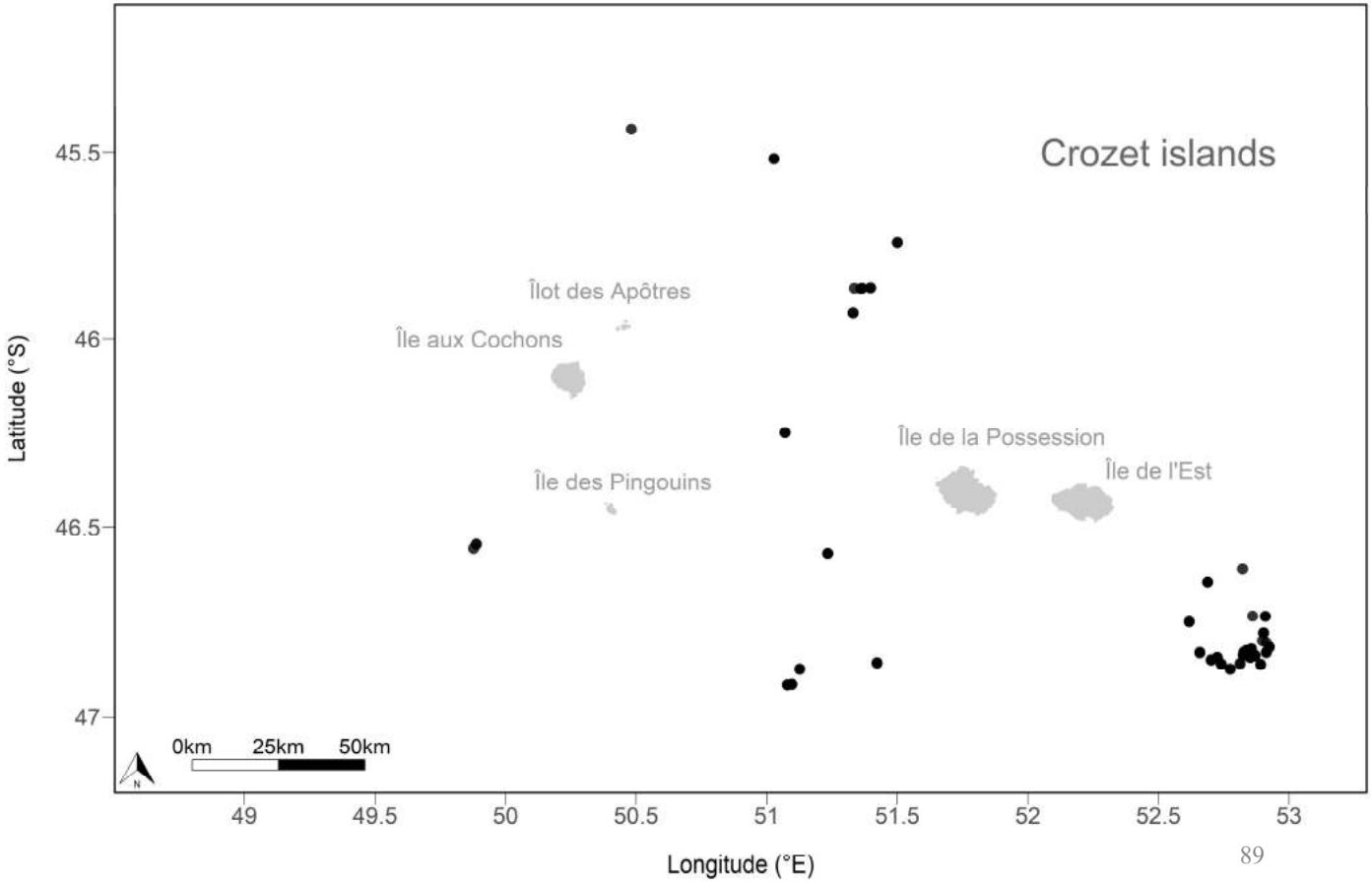
CR153/CR198 unit

Last encountered **2020**

Individuals (2020) **CR153, CR198, CR222, CR224, CR227, CR247, CR248, CR252**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**58**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



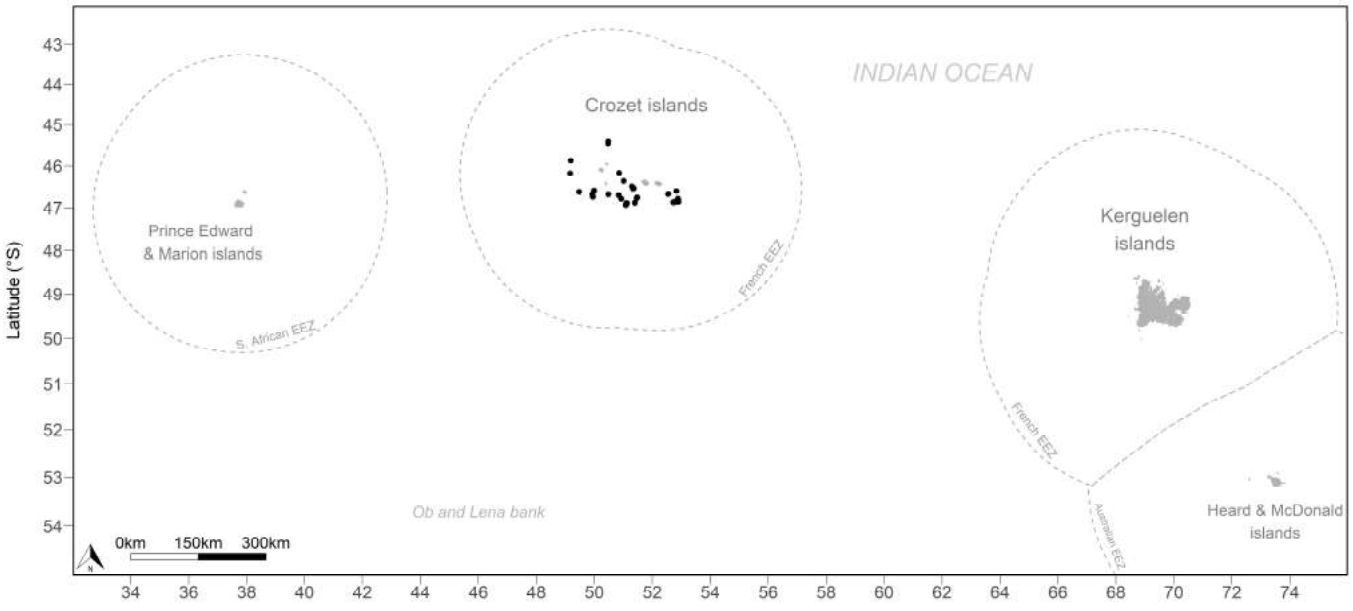


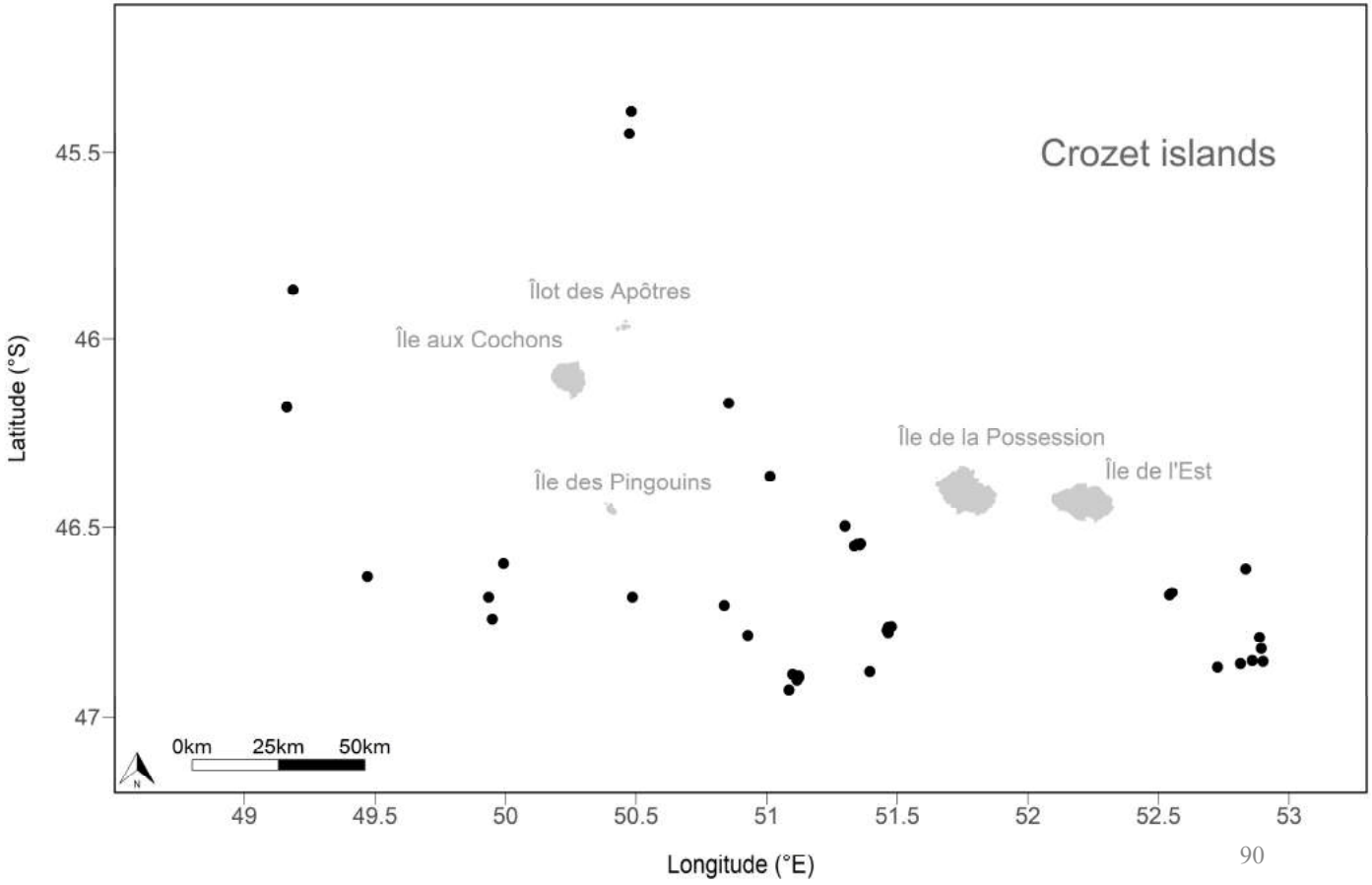
CR167 unit

Last encountered **2016**

Individuals (2020) **CR165, CR167, CR169, CR170**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**41**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



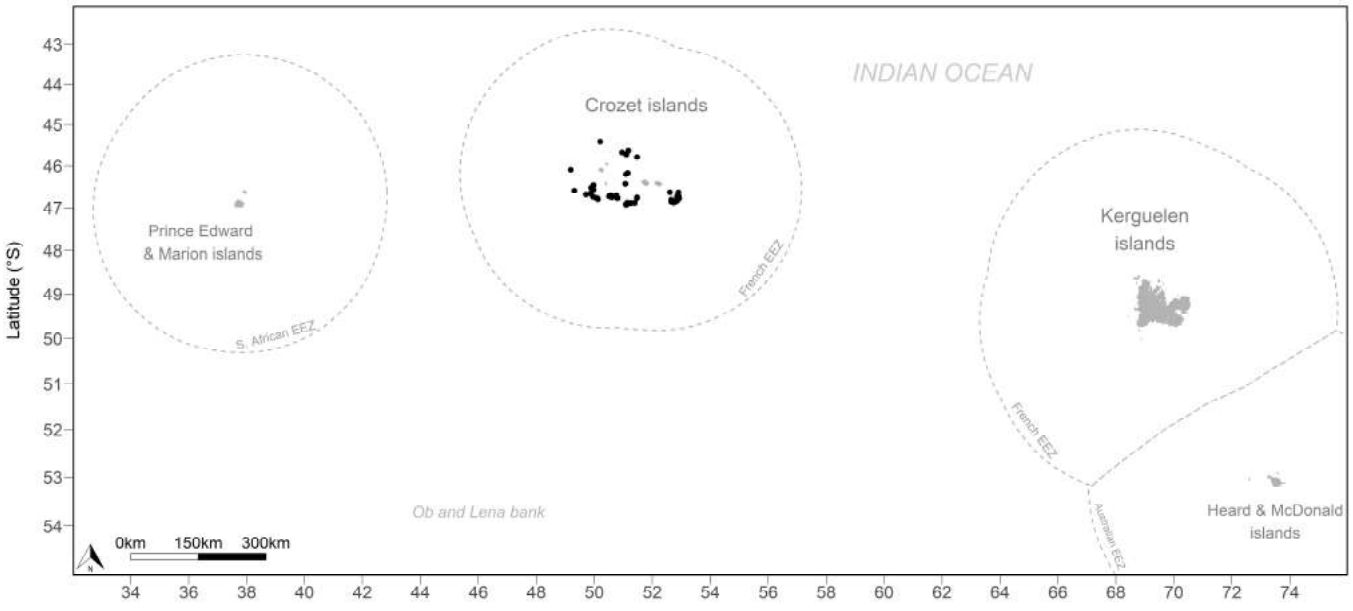


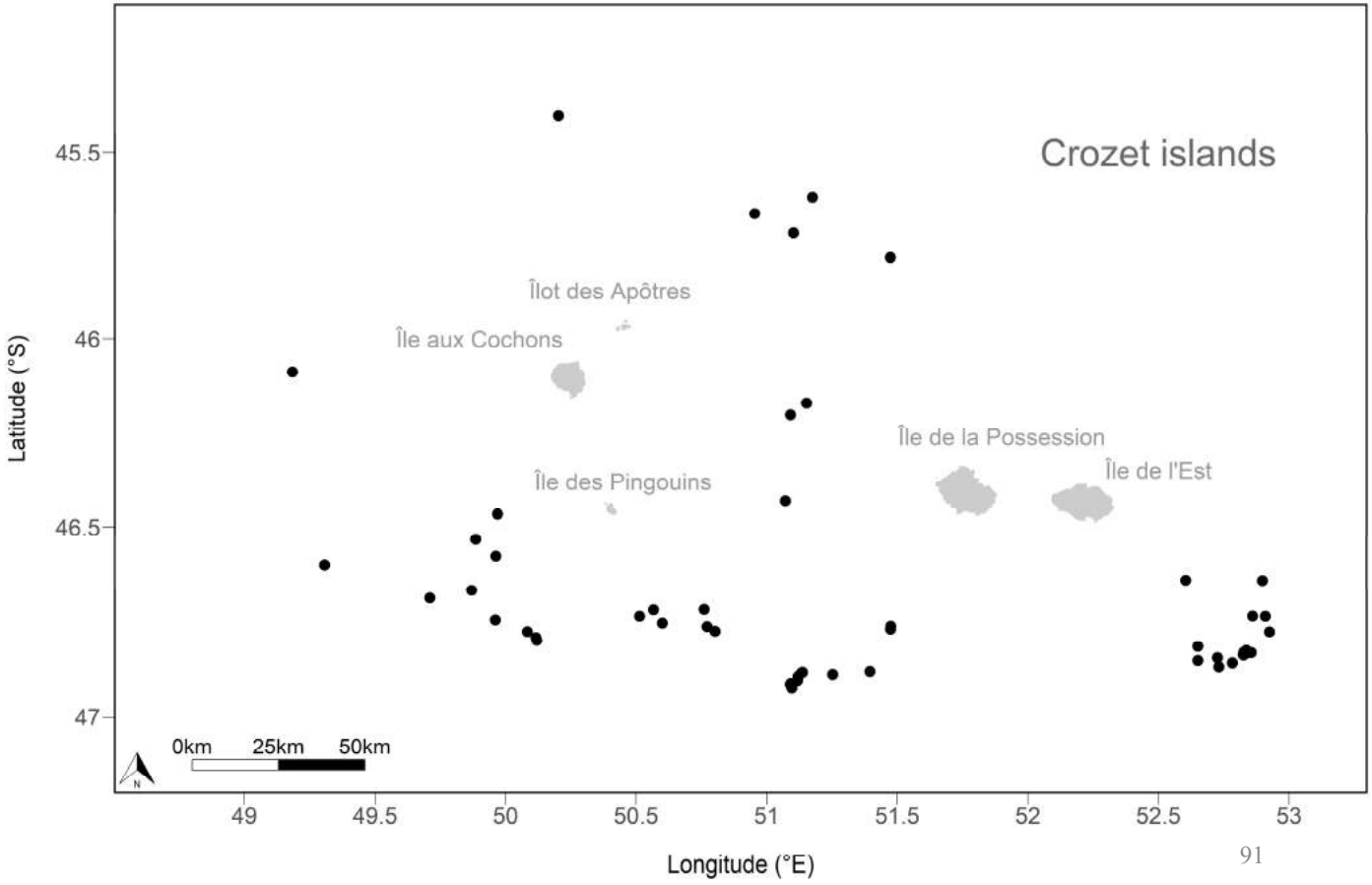
CR180 unit

Last encountered **2020**

Individuals (2020) **CR177, CR179, CR180, CR181, CR255**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**86**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



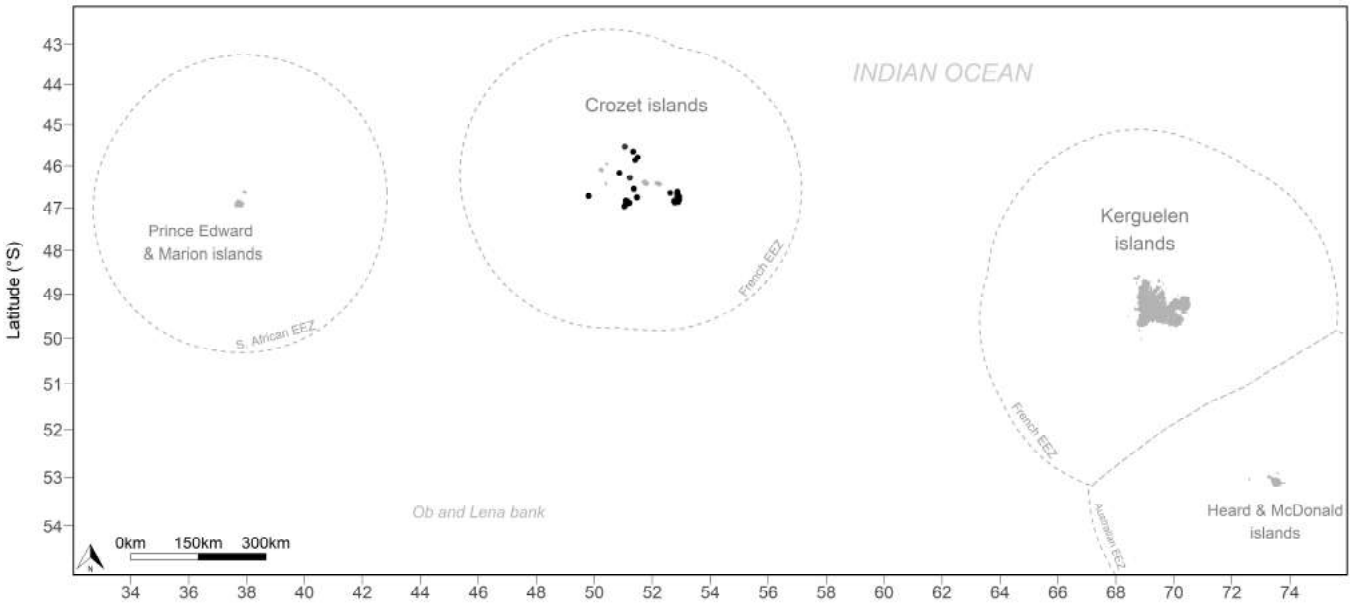


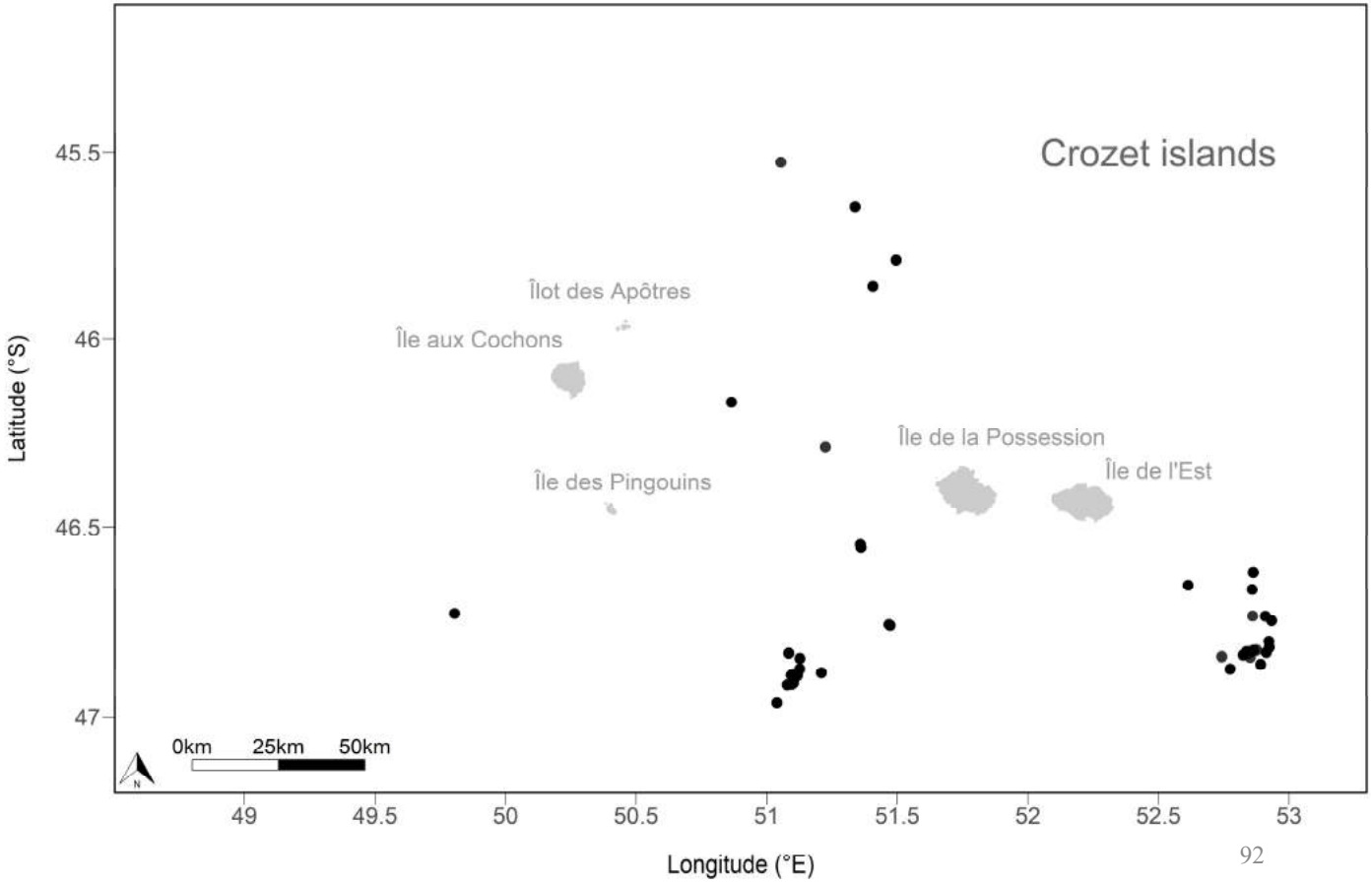
CR191 unit

Last encountered **2019**

Individuals (2020) **CR190, CR191, CR202**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**58**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



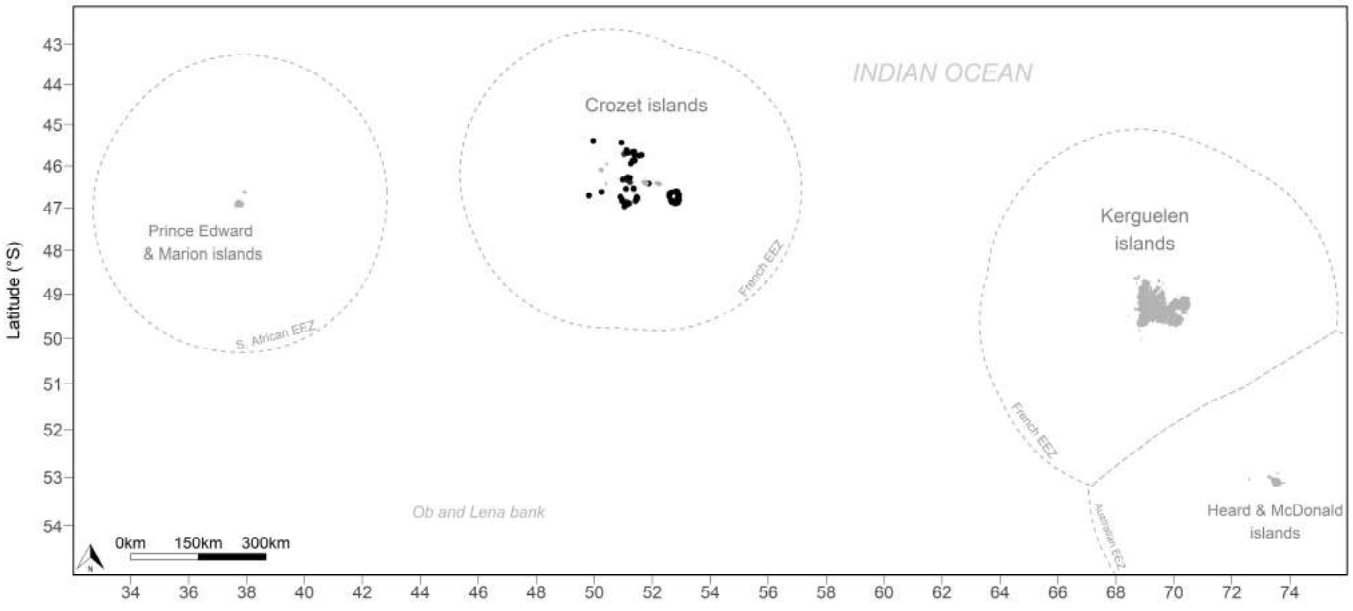


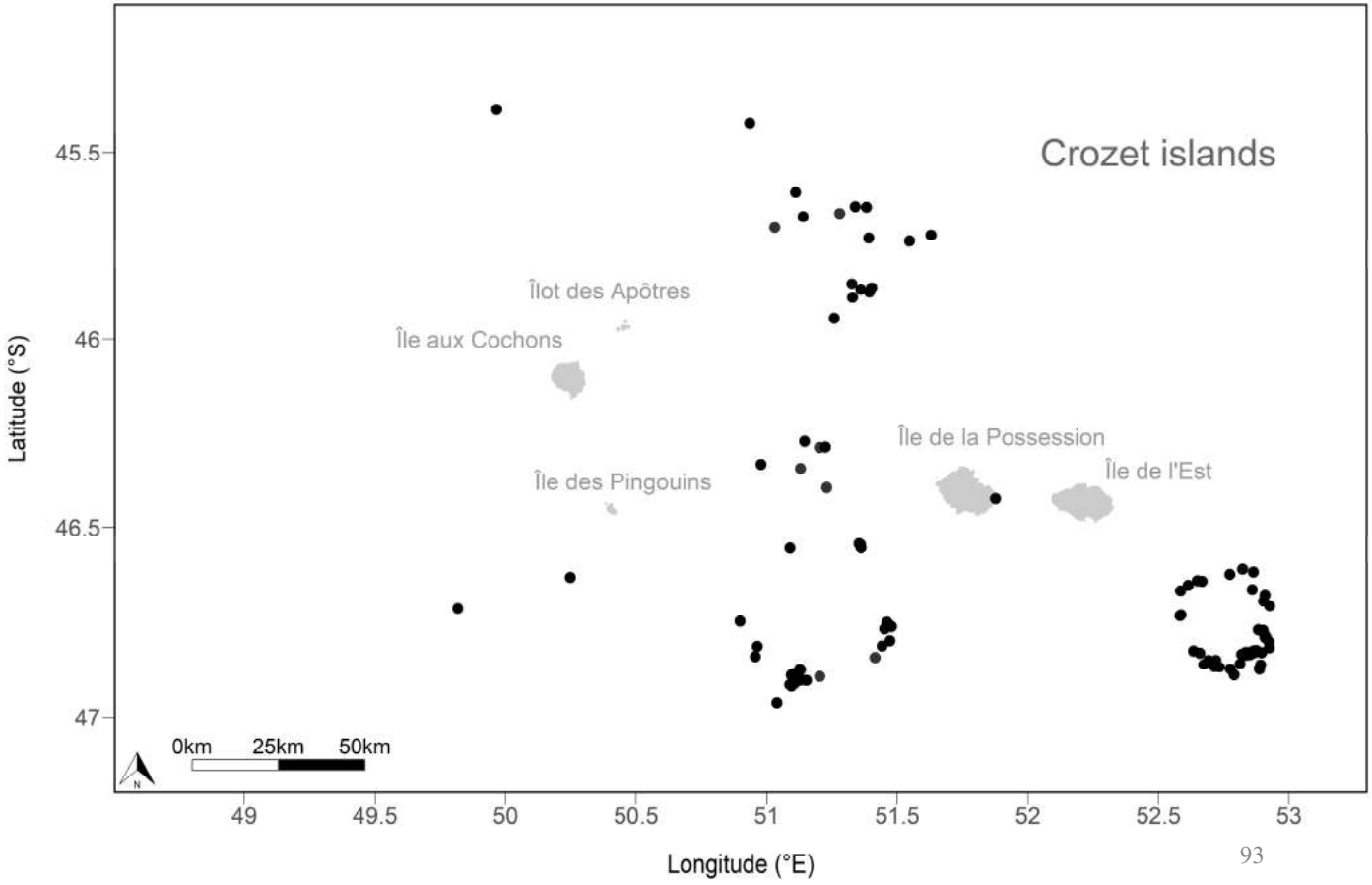
CR192/CR228 unit

Last encountered **2020**

Individuals (2020) **CR189, CR192, CR228, CR239**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**133**
Ile de la Possession	**1**
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



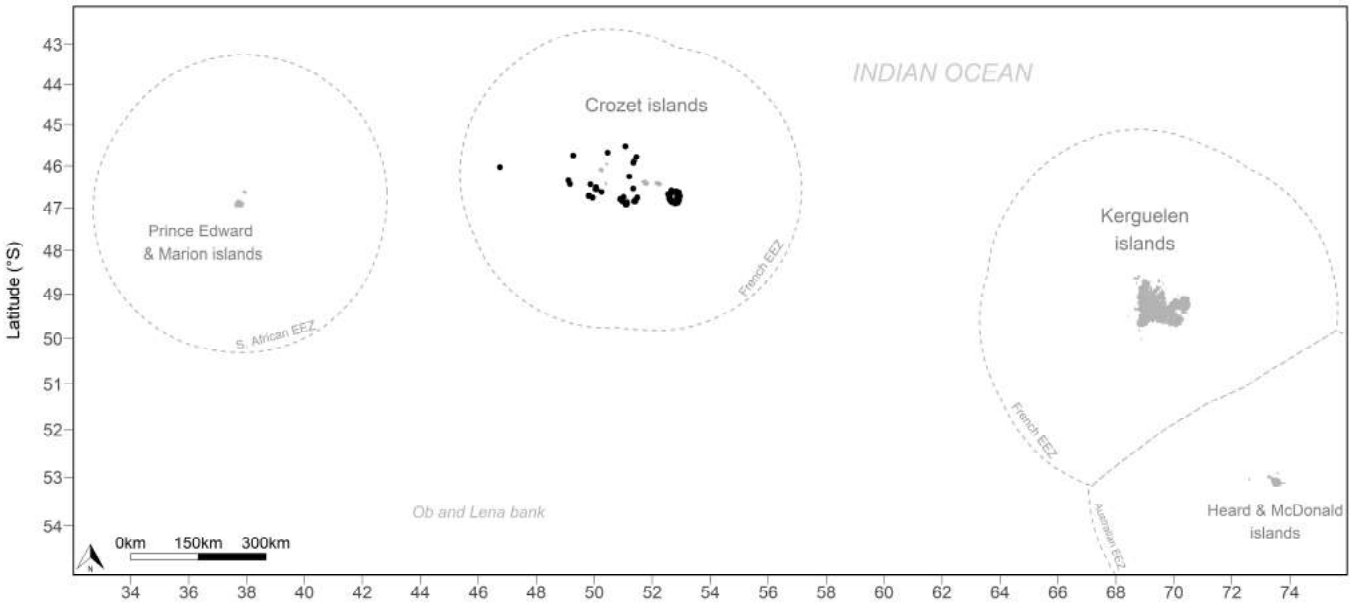


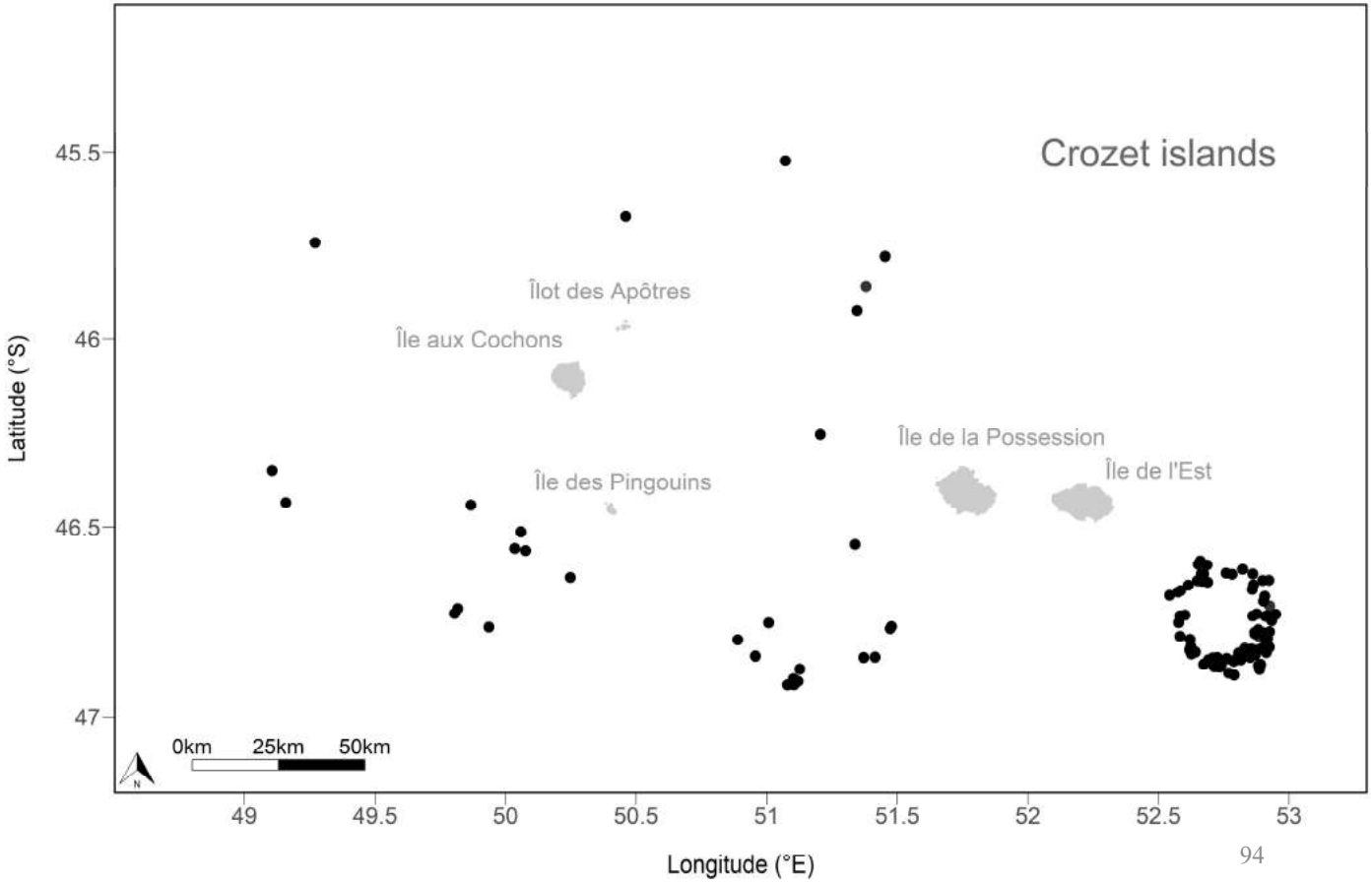
CR195 unit

Last encountered **2020**

Individuals (2020) **CR193, CR194, CR195, CR196, CR201, CR221, CR225, CR226, CR236, CR244, CR249**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**170**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



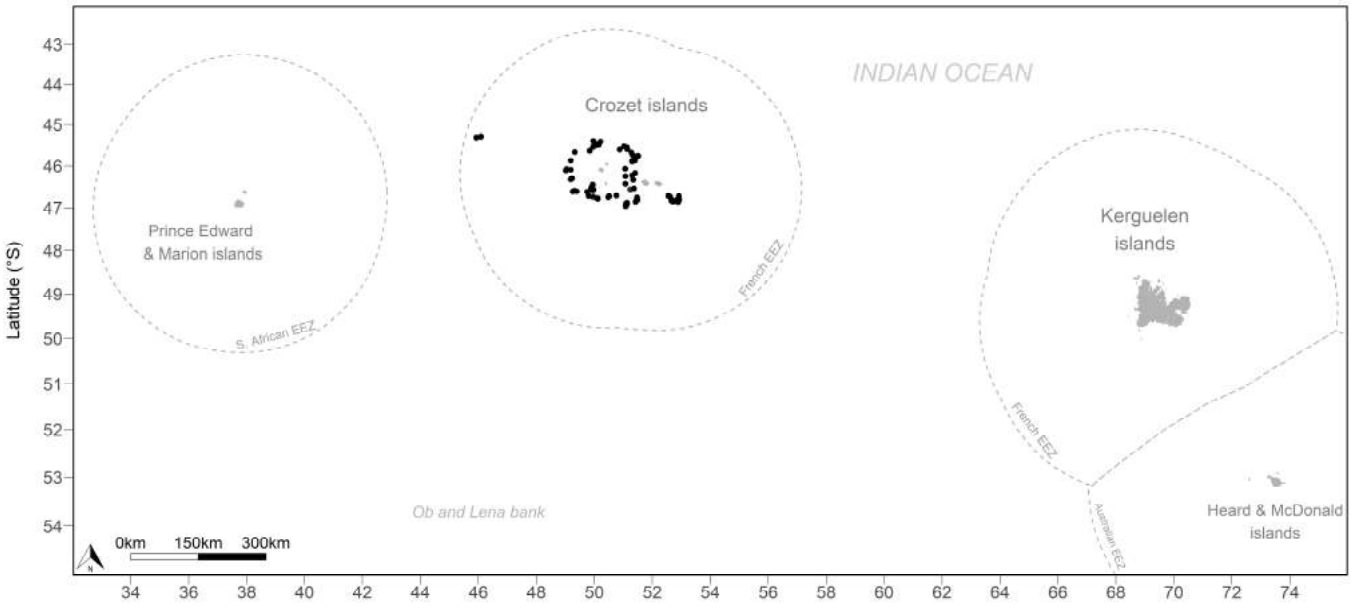


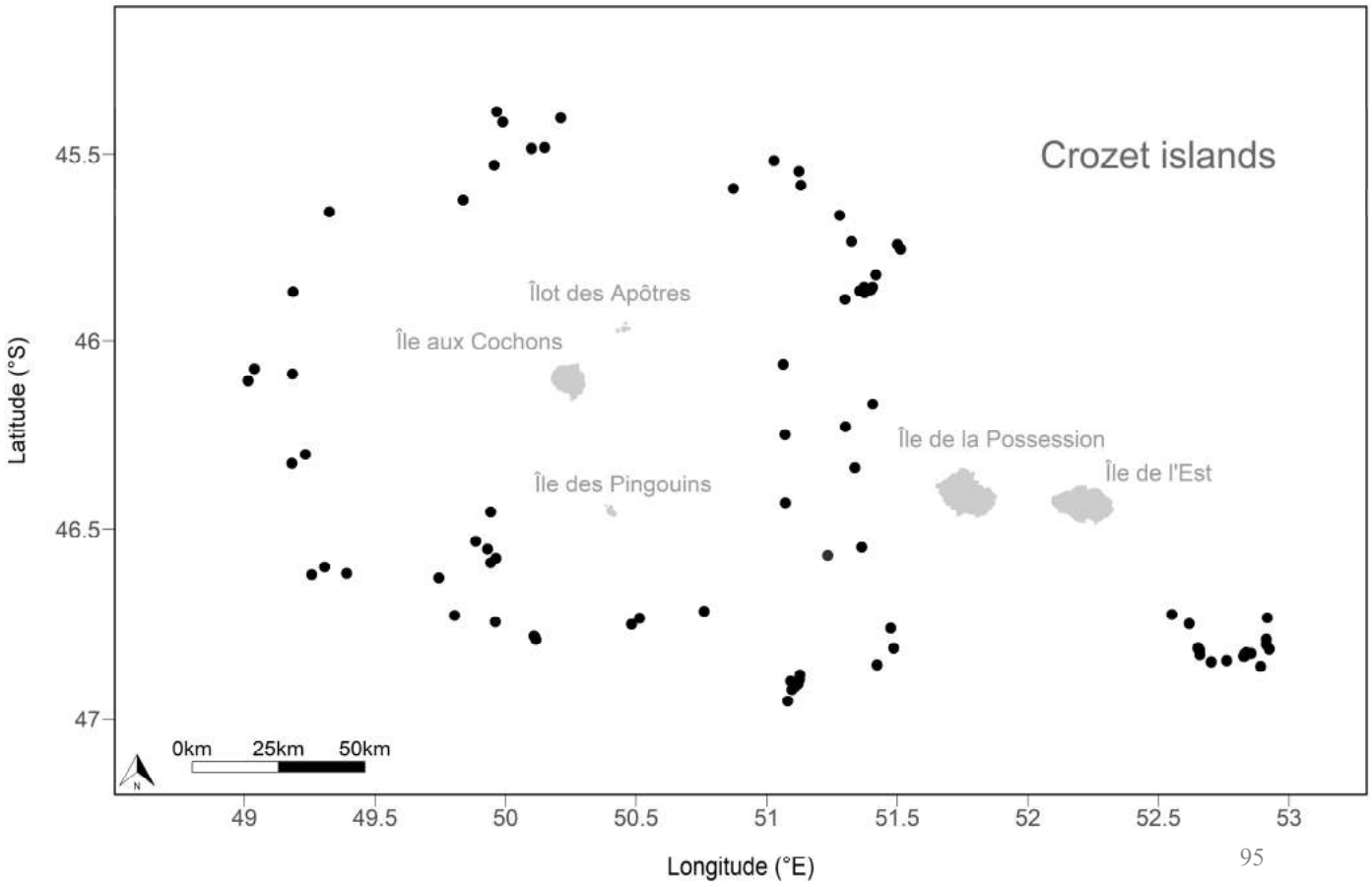
CR204 unit

Last encountered **2020**

Individuals (2020) **CR204, CR206, CR207, CR210, CR246, CR256**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**128**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



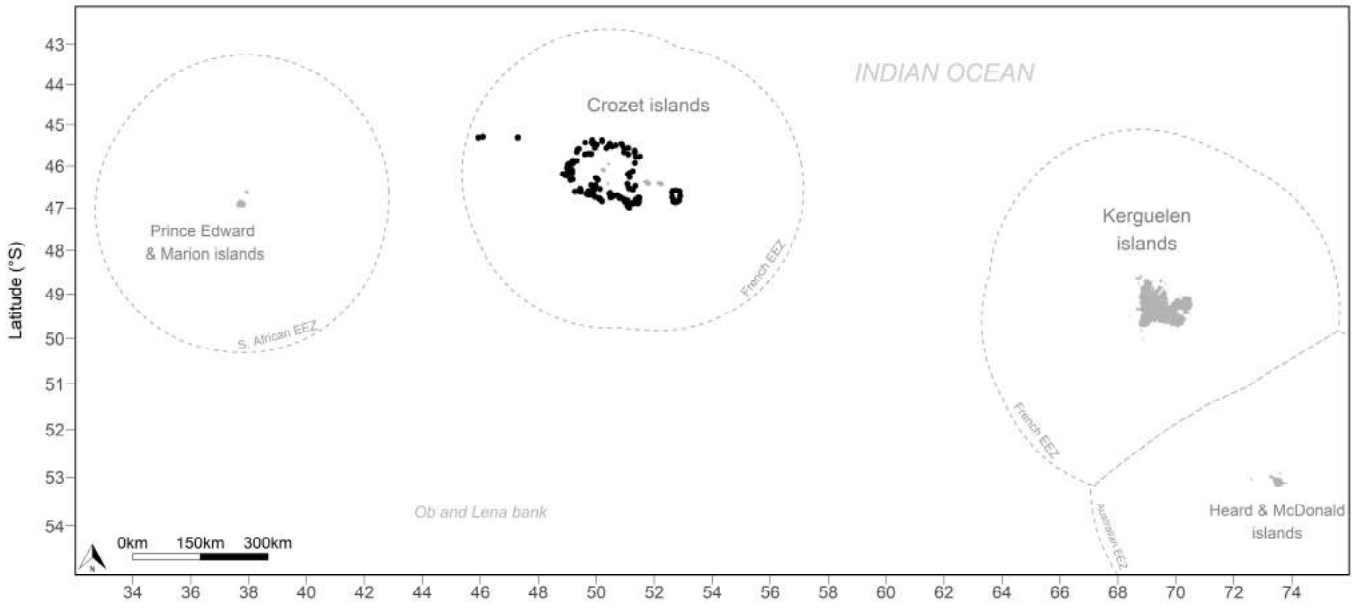


CR214 unit

Last encountered **2020**

Individuals (2020) **CR214, CR215, CR216, CR218, CR219, CR232, CR233, CR254**

Number of encounters 2005-2020	
Crozet EEZ	
Fishing vessels	**257**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0



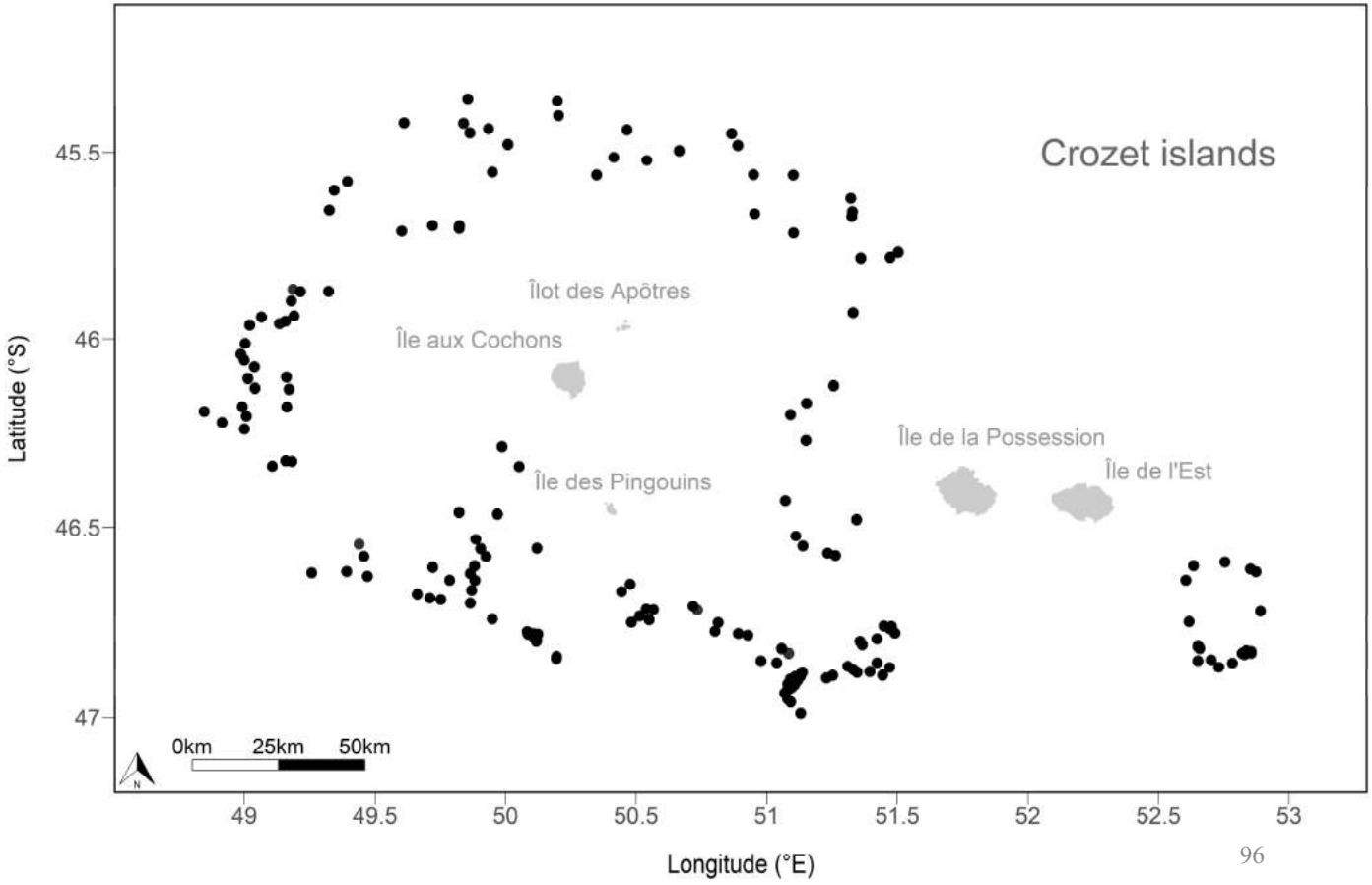


Table of photographers and dates for every image in Appendix 1

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
CR004	Niels Gins 2019-01-22	Nicolas Servera 2019-04-26	Romain Bochard 2012-10-23	Gaspard Bernard 2018-05-12
CR009	Quentin Diss 2019-01-31	Gabriel Devique 2017-02-02	Romain Bochard 2012-10-17	Nicolas Gasco 2009-02-22
CR013	Christian Lemarchand 2019-03-19	Gabriel Devique 2017-02-17	Marion Kauffman 2015-10-17	Antoine Dervaux 2009-04-22
CR019	Anaïs Janc 2017-02-27	Romain Bochard 2012-10-20	Paul Tixier 2011-02-06	Paul Tixier 2010-03-10
CR020	Hugues Vermande 2018-02-07	Simon Fournier 2018-01-26	Marion Kauffman 2015-10-06	Paul Tixier 2011-02-11
CR023	Paco Rodriguez 2015-02-06	Paco Rodriguez 2015-01-29	David Beaufils 2017-11-05	Romain Bochard 2012-10-11
CR025	Hugues Vermande 2019-05-17	Gaëtan Richard 2017-02-28	Thomas Auger 2013-03-24	Nicolas Gasco 2007-02-27
CR063	Olivier Guillotin 2017-11-02	Hugues Vermande 2011-02-19	Hugues Vermande 2011-02-23	Hugues Vermande 2011-02-19
CR064	Olivier Guillotin 2017-11-02	Fabien Aubert 2010-02-08	Fabien Aubert 2010-02-08	Fabien Aubert 2010-02-08
CR068	Quentin Diss 2019-01-31	Jean-Luc Aubert 2014-11-05	Hugues Vermande 2016-07-23	Paul Tixier 2011-12-01
CR069	Johan Lambelain 2020-02-11	Paul Tixier 2011-12-01	Paul Tixier 2011-12-01	Paul Tixier 2011-12-01
CR087	Hugues Vermande 2019-10-24	Christian Lemarchand 2019-03-16	Hugues Vermande 2010-05-25	Jean-Luc Aubert 2012-02-03
CR106	Thomas Auger 2013-10-17	Nicolas Gasco 2007-02-27	Nicolas Gasco 2007-02-27	Nicolas Gasco 2007-02-27
CR111	Romain Bochard 2019-10-30	Hugues Vermande 2020-05-28	Anthony Pere 2014-02-06	Nicolas Servera 2020-03-12
CR116	Johan Lambelain 2020-02-11	Paul Tixier 2011-12-01	David Beaufils 2017-11-09	Maud Berlincourt 2008-11-15
CR119	Anaïs Janc 2017-02-27	Gaspard Bernard 2018-05-12	Romain Bochard 2014-10-16	Thomas Auger 2013-04-07
CR122	Johan Lambelain 2020-02-04	David Beaufils 2017-11-07	Romain Bochard 2017-11-12	David Beaufils 2017-11-07
CR127	Paul Tixier 2010-02-12	Nicolas Guillon 2018-02-14	Romain Bochard 2012-10-29	Nicolas Gasco 2007-02-27
CR128	Hugues Vermande 2000-01-01	Yves Cherel 2011-11-28	David Beaufils 2017-11-09	Paul Tixier 2012-12-05
CR137	Olivier Guillotin 2017-11-02	Olivier Guillotin 2017-11-01	Gaëtan Richard 2018-02-13	Paul Tixier 2011-02-07
CR138	Olivier Guillotin 2017-11-02	David Beaufils 2015-09-06	Stephen Canté 2013-02-06	Olivier Guillotin 2017-10-31
CR139	Hugues Vermande 2018-02-19	Thomas Auger 2013-04-07	Hugues Vermande 2018-02-19	Thomas Auger 2013-04-07
CR140	Gaëtan Richard 2018-02-06	Benjamin Charreyre 2017-06-20	Maxime Castro 2017-01-14	Hugues Vermande 2009-06-27
CR142	Gaëtan Richard 2018-02-16	Hugues Vermande 2018-02-25	Hugues Vermande 2010-05-27	Antoine Dervaux 2009-04-21
CR148	Johan Lambelain 2020-02-04	Simon Fournier 2018-01-30	Paul Tixier 2011-02-07	Paul Tixier 2011-02-11

Table of photographers and dates for every image in Appendix 1 (continued)

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
CR151	Johan Lambelain 2020-02-11	Jean-Luc Aubert 2012-02-07	Hugues Vermande 2018-02-19	Gaspard Bernard 2018-05-12
CR153	Gaëtan Richard 2018-02-06	Gaspard Bernard 2018-05-12	Gaëtan Richard 2018-02-06	Gaspard Bernard 2018-05-12
CR154	Maxime Castro 2019-02-28	Paco Rodriguez 2016-10-15	Christian Lemarchand 2016-05-19	Christian Lemarchand 2017-07-07
CR155	Johan Lambelain 2020-02-09	Adélaïde Gamon 2020-02-01	Christophe Baillout 2015-02-23	Anaïs Janc 2017-02-27
CR156	Christian Lemarchand 2019-03-22	Gaspard Bernard 2018-05-12	Christian Lemarchand 2014-10-24	Gabriel Devique 2017-02-09
CR161	Jean-Luc Aubert 2014-11-17	Paul Tixier 2011-02-09	Paul Tixier 2011-02-09	Paul Tixier 2011-02-07
CR165	Hugues Vermande 2012-01-24	Paul Tixier 2010-03-07	Hugues Vermande 2012-01-24	Paul Tixier 2009-01-28
CR167	Hugues Vermande 2012-01-24	Hugues Vermande 2012-01-21	Hugues Vermande 2012-01-21	Paul Tixier 2009-01-28
CR169	Ewen Corouge 2012-02-21	Ewen Corouge 2012-02-21	Paul Tixier 2010-03-07	Hugues Vermande 2012-01-21
CR170	Paul Tixier 2010-03-07	Christophe Baillout 2016-01-30	Romain Bochard 2016-02-09	Gabriel Devique 2015-03-10
CR173	Johan Lambelain 2020-02-11	Johan Lambelain 2020-02-04	Thomas Auger 2013-10-17	Antoine Dervaux 2009-04-22
CR174	Johan Lambelain 2020-02-07	Gabriel Devique 2017-02-17	Gabriel Devique 2015-02-11	Quentin Diss 2017-10-14
CR177	Niels Gins 2019-01-24	Grégoire Houillot 2018-01-11	Nicolas Servera 2016-10-29	Paco Rodriguez 2015-01-19
CR179	Niels Gins 2019-01-24	Hugues Vermande 2019-10-26	Gabriel Devique 2017-02-09	Gabriel Devique 2017-02-09
CR180	Niels Gins 2019-01-24	Gabriel Devique 2017-02-09	Grégoire Houillot 2018-01-10	Christophe Delpont 2019-09-14
CR181	Maxime Castro 2019-02-15	Gaëtan Richard 2018-02-06	Gaëtan Richard 2018-02-12	Gabriel Devique 2017-02-09
CR184	Gaëtan Richard 2018-02-06	Simon Fournier 2018-01-24	Anaïs Janc 2017-02-27	Simon Fournier 2018-01-24
CR185	Johan Lambelain 2020-02-09	Jean-Luc Aubert 2011-02-16	Christian Lemarchand 2013-01-02	Olivier Guillotin 2017-10-31
CR186	Niels Gins 2019-01-22	Benjamin Charreyre 2017-06-18	Paul Tixier 2010-03-04	Benjamin Charreyre 2017-06-18
CR187	Christian Lemarchand 2019-08-24	Adélaïde Gamon 2020-01-30	Olivier Guillotin 2017-11-01	Jean-Luc Aubert 2016-03-10
CR188	Hugues Vermande 2018-10-17	Benjamin Charreyre 2017-06-20	Nicolas Servera 2016-01-15	Romain Bochard 2014-10-16
CR189	Jean-Tristan Huillier 2015-10-25	Jean-Tristan Huillier 2015-10-15	Romain Bochard 2012-10-23	Olivier Guillotin 2017-11-03
CR190	Gaëtan Richard 2018-02-06	Maxime Castro 2017-01-07	Gaëtan Richard 2018-02-06	Romain Bochard 2012-10-24
CR191	Gaëtan Richard 2018-02-06		Gaëtan Richard 2018-02-06	Gaëtan Richard 2018-02-06
CR192	Niels Gins 2019-02-07	Olivier Guillotin 2017-11-03	Simon Fournier 2018-01-26	Olivier Guillotin 2017-11-03

Table of photographers and dates for every image in Appendix 1 (continued)

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
CR193	Gaëtan Richard 2018-02-06	Gwenaël Bodiger 2016-10-27	Quentin Diss 2017-01-18	David Beaufils 2015-09-05
CR194	Adélaïde Gamon 2020-01-29	Simon Fournier 2018-01-23	David Beaufils 2015-09-05	Simon Fournier 2018-01-23
CR195	Gaëtan Richard 2018-02-06	Simon Fournier 2018-01-23	Hugues Vermande 2011-02-23	Simon Fournier 2018-01-23
CR196	Maxime Castro 2019-02-14	Simon Fournier 2018-01-23	Hugues Vermande 2011-02-23	Simon Fournier 2018-01-23
CR198	Maxime Castro 2019-02-27	Gaspard Bernard 2018-05-12	Patrick Gaspard 2013-03-01	Gaëtan Richard 2018-02-04
CR199	Johan Lambelain 2020-02-04	Nicolas Servera 2019-04-26	Christophe Baillout 2018-03-05	Simon Fournier 2018-01-26
CR201	Hugues Vermande 2019-10-20	Gaspard Bernard 2018-05-12	Gaëtan Richard 2018-02-06	Simon Fournier 2018-01-23
CR202	Gaëtan Richard 2018-02-06	Gaëtan Richard 2018-02-06	Romain Bochard 2012-10-19	Romain Bochard 2012-10-24
CR204	Gaspard Bernard 2018-05-12	Gabriel Devique 2017-02-02	Gabriel Devique 2017-02-02	Christian Lemarchand 2014-10-28
CR206	Maxime Castro 2019-02-27	Gaspard Bernard 2018-05-12	Gaëtan Richard 2018-02-12	Simon Fournier 2016-06-04
CR207	Hugues Vermande 2018-02-21	Gabriel Devique 2017-02-24	Niels Gins 2018-07-01	Gabriel Devique 2017-02-02
CR210	Quentin Diss 2019-11-16	Gabriel Devique 2017-02-02	Quentin Diss 2018-06-21	Gabriel Devique 2017-02-24
CR213	Johan Lambelain 2020-02-11	Marion Bourasseau 2020-01-29	Gabriel Devique 2017-02-17	Quentin Diss 2017-10-14
CR214	Gaspard Bernard 2018-05-04	Paco Rodriguez 2016-10-15	Maxime Castro 2017-01-17	Quentin Diss 2017-10-22
CR215	Niels Gins 2019-01-27	Paco Rodriguez 2016-10-15	Maxime Castro 2017-01-05	Quentin Diss 2017-10-22
CR216	Hugues Vermande 2020-05-28	Hugues Vermande 2019-10-24	Grégoire Houillot 2018-01-10	Benjamin Charreyre 2014-02-14
CR218	Niels Gins 2020-02-10	Corentin Matheron 2016-11-02	Maxime Castro 2017-01-17	Christian Lemarchand 2017-07-07
CR219	Hugues Vermande 2020-05-28	Niels Gins 2020-02-10	Grégoire Houillot 2018-01-10	Benjamin Charreyre 2014-02-14
CR221	Niels Gins 2019-01-22	Hugues Vermande 2020-05-16	Quentin Diss 2017-01-18	Simon Fournier 2018-01-23
CR222	Gaëtan Richard 2018-02-06	Gaspard Bernard 2018-05-12	Gaëtan Richard 2018-02-06	Gaspard Bernard 2018-05-12
CR223	Johan Lambelain 2020-02-04	Hugues Vermande 2019-10-24	Adélaïde Gamon 2020-02-01	Simon Fournier 2016-06-04
CR224	Romain Bochard 2012-10-23	Gaspard Bernard 2018-05-12	Gaëtan Richard 2018-02-06	Gaspard Bernard 2018-05-12
CR225	Adélaïde Gamon 2020-01-29	Gaëtan Richard 2018-02-10	Gaëtan Richard 2018-02-06	Simon Fournier 2018-01-23
CR226	Gaëtan Richard 2018-02-06	Hugues Vermande 2020-05-16	Romain Bochard 2012-10-23	Hugues Vermande 2011-02-24
CR227	Gaëtan Richard 2018-02-06	Gaëtan Richard 2018-02-04	Gaëtan Richard 2018-02-04	Gaëtan Richard 2018-02-04

Table of photographers and dates for every image in Appendix 1 (continued)

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
CR228	Johan Lambelain 2020-02-04	Olivier Guillotin 2017-11-03	David Beaufils 2016-05-07	Olivier Guillotin 2012-12-23
CR229	Johan Lambelain 2020-02-09	Johan Lambelain 2020-02-09	Hugues Vermande 2000-01-01	Johan Lambelain 2020-02-09
CR232	Maxime Castro 2019-02-28	Hugues Vermande 2018-02-25	Hugues Vermande 2018-02-25	Grégoire Houillot 2018-01-10
CR233	Niels Gins 2020-02-10	Grégoire Houillot 2018-01-10	Simon Fournier 2016-05-29	David Beaufils 2017-11-07
CR235	Nicolas Servera 2020-03-12	Hugues Vermande 2020-05-18	Gabriel Devique 2017-02-09	Gabriel Devique 2017-02-24
CR236	Marc Leménager 2020-06-09	Simon Fournier 2018-01-23	Gaëtan Richard 2018-02-06	Simon Fournier 2018-01-23
CR237	Johan Lambelain 2020-02-09	Johan Lambelain 2020-02-07	Niels Gins 2018-06-26	Johan Lambelain 2020-02-09
CR238	Nicolas Servera 2019-04-29	Simon Fournier 2018-01-24	Simon Fournier 2018-01-25	Simon Fournier 2018-01-24
CR239	Marc Leménager 2020-06-10	Marc Leménager 2020-06-10	Nicolas Guillon 2017-06-18	Nicolas Guillon 2017-06-18
CR241	Johan Lambelain 2020-02-09	Adélaïde Gamon 2020-01-30	Quentin Diss 2017-10-11	Adélaïde Gamon 2020-01-30
CR243	Maxime Castro 2017-01-04		Maxime Castro 2017-01-04	
CR244	Marc Leménager 2020-06-09	Marc Leménager 2020-06-09	Gaëtan Richard 2018-02-06	Quentin Diss 2017-01-16
CR245	Johan Lambelain 2020-02-09	Lucie Toussaint 2018-06-01	Johan Lambelain 2020-02-09	Niels Gins 2019-01-22
CR246	Nicolas Servera 2020-03-12	Hugues Vermande 2020-05-18	David Beaufils 2017-11-09	Christian Lemarchand 2017-07-10
CR247	Gaëtan Richard 2018-02-06	Gaëtan Richard 2018-02-04	Gaëtan Richard 2018-02-06	Christophe Baillout 2015-02-16
CR248	Gaëtan Richard 2018-02-10		Gaëtan Richard 2018-02-10	Maxime Castro 2019-02-27
CR249	Adélaïde Gamon 2020-01-29	Fabio Cassiano 2020-05-15	Adélaïde Gamon 2020-01-29	Simon Fournier 2018-01-23
CR250	Romain Bochard 2019-10-30	Niels Gins 2018-06-28	Romain Bochard 2019-10-30	Christian Lemarchand 2019-03-22
CR251	Niels Gins 2019-01-22		Niels Gins 2019-01-27	Luc Fargier 2018-11-04
CR252	Johan Lambelain 2020-02-09	Maxime Castro 2019-02-28	Maxime Castro 2019-02-27	
CR253	Hugues Vermande 2020-05-28	Hugues Vermande 2020-05-28	Marion Bourasseau 2020-01-29	Marion Bourasseau 2020-01-29
CR254	Hugues Vermande 2019-10-24	Hugues Vermande 2019-11-08	Niels Gins 2020-02-10	Hugues Vermande 2020-05-31
CR255	Nicolas Servera 2020-03-12	Hugues Vermande 2019-10-26	Nicolas Servera 2020-03-12	Hugues Vermande 2019-10-26
CR256	Nicolas Servera 2020-03-12			Hugues Vermande 2020-05-18
CR257	Johan Lambelain 2020-02-04	Johan Lambelain 2020-02-08	Johan Lambelain 2020-02-04	

Appendix 2

Killer whales infrequently encountered at Crozet

Photo-identification catalogue and distribution maps

Killer whales of the Crozet Archipelago and adjacent waters
Photo-identification catalogue, population status and distribution in 2020

Paul Tixier[1], Nicolas Gasco[2], Jared R. Towers[3], Christophe Guinet[1]

[1] Centre d'Etudes Biologiques de Chizé, UMR 7372 CNRS – La Rochelle Université, Villiers en Bois, France
[2] Muséum National d'Histoire Naturelle de Paris, France
[3] Bay Cetology, Alert Bay, BC, Canada

Summary table of the 14 killer whale groups (assumed to represent social units in this catalogue) considered as infrequently encountered in the Crozet EEZ. Summarized information includes the range and number of years that these units were encountered and photographed (overall and at Crozet), whether they were encountered in adjacent waters (Prince Edward/Marion EEZ, Kerguelen EEZ or international waters) as well as the full list and numbers of individuals identified per unit. Identification photographs of all individuals are presented in the catalogue because the status of all these individuals was assumed unknown in 2019/2020 due to insufficient numbers of encounters. * refers to an individual that was not photographed in the Crozet EEZ but was found associated with individuals known from Crozet. ** indicates a unit (CR100) that was only encountered at Crozet in 2003, and therefore was not included with the data of infrequently encountered individuals for the 2005-2020 period (13 social units in figure 4 and 5, see pages 15 & 16).

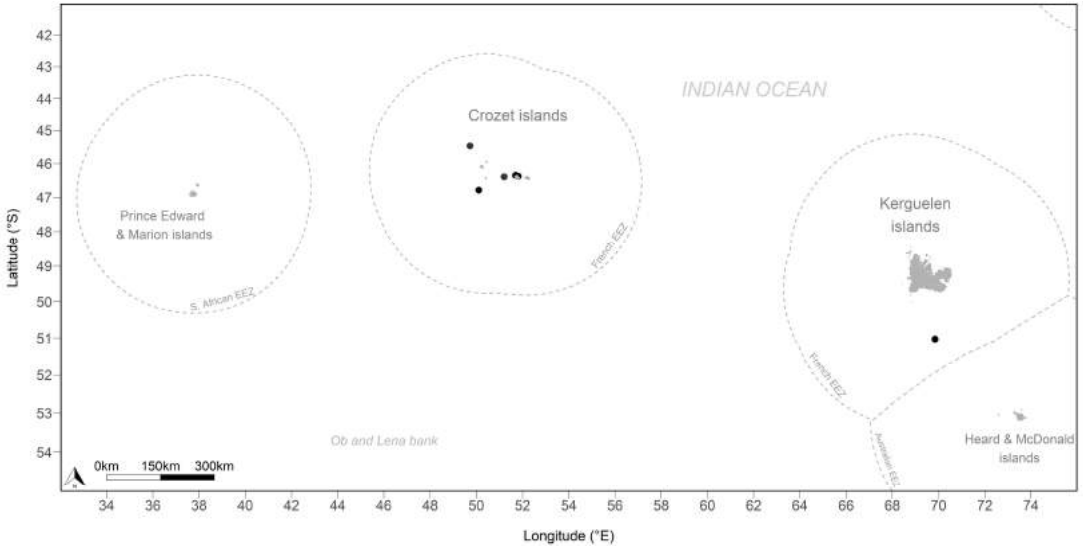
Social units	Range of years encountered	# of years encountered	Range of years encountered at Crozet	# of years encountered at Crozet	Other areas of encounter			Individuals	# of individuals identified
					Prince Edward / Marion	Kerguelen	International waters		
CR011	2003-2008	4	2003-2008	3		x		CR011	1
CR086	2006-2013	6	2006-2013	6				CR086	1
CR088	2007-2019	7	2007	1	x			CR088, CR089, CR090, PE009*	3
CR100**	2003-2016	4	2003	1	x			CR100, CR103, CR104	3
CR101	2003-2016	4	2008	1	x			CR101, CR162, CR163	3
CR129	2005-2007	2	2005-2007	2				CR129	1
CR147	2005-2009	4	2005-2009	4				CR147, CR150, CR152	3
CR160	2005-2018	4	2005-2008	2	x			CR134, CR159, CR160	3
CR171	2008-2013	6	2008-2012	5		x	x	CR164, CR171, CR172, CR176	4
CR197	2009	1	2009	1				CR197	1
CR203	2010-2011	2	2010-2011	2				CR203, CR205, CR208, CR209	4
CR217	2015	1	2015	1				CR217	1
CR242	2014-2018	4	2014-2018	4		x		CR242	1
OL011	2014-2018	3	2018	1	x		x	OL011, OL012, OL013, OL014, OL015	5

CR011 *2003-2008*

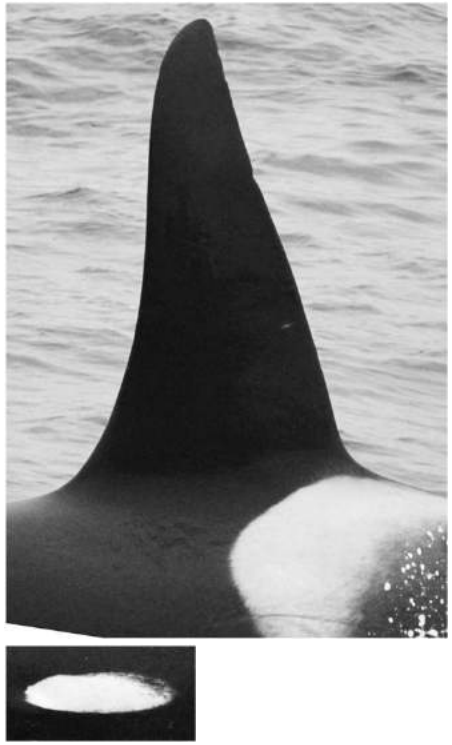
Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**2**
Ile de la Possession	**3**
Kerguelen EEZ	
Fishing vessels	**1**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

CR011 *2003-2008*



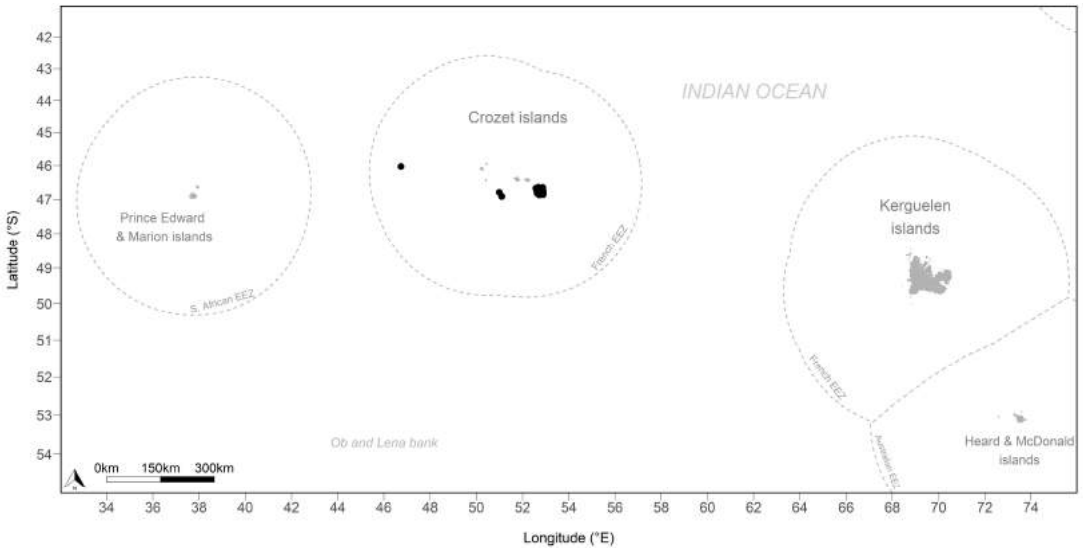
CR086 ♂ *1998-2013*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**28**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

CR086 ♂ *1998-2013*



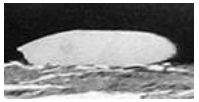
CR088 *2007-2016*

CR089 *2007-2016*

No image

PE008 *2014-2019*

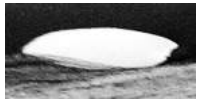
CR090 ♂ *2007-2016*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**1**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**11**
International waters	
Fishing vessels	0

CR088 *2007-2016*



CR089 *2007-2016*

No image

PE008 *2014-2019*

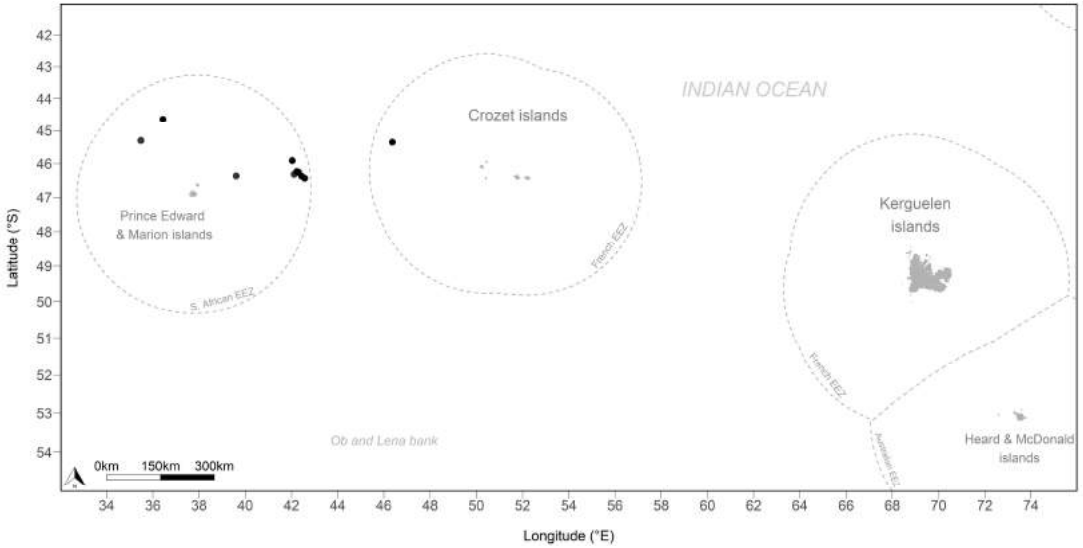
No image

No image

CR090 ♂ *2007-2016*

No image

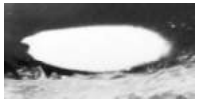
Right side



CR100 ♀ *2003-2016*

CR103 *2003-2014*

CR104 *2003-2016*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**5**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion	
Fishing vessels	**7**
International waters	
Fishing vessels	0

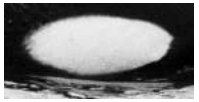
CR100 ♀ *2003-2016*

No image

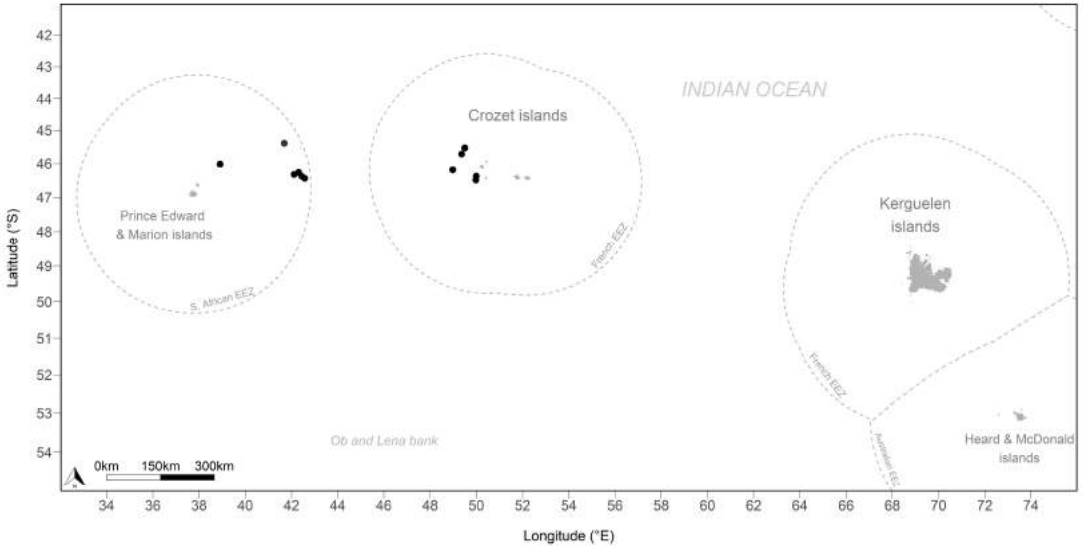
No image

CR103 *2003-2014*

No image



CR104 *2003-2016*

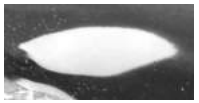


CR101 ♀ *2003-2016*

Left side

CR162 *2008-2016*

CR163 *2008-2016*

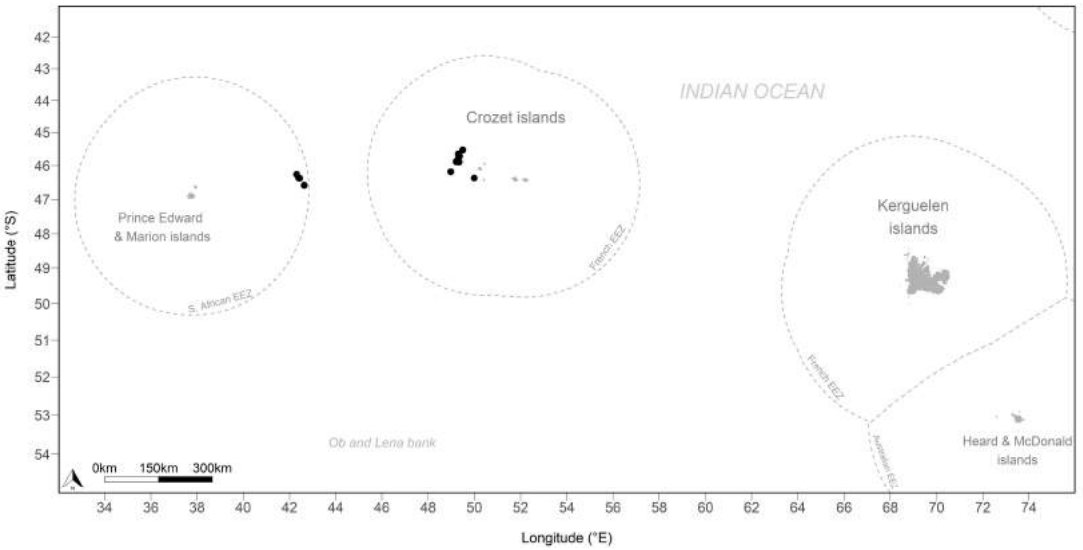


Number of encounters	
Crozet EEZ	
Fishing vessels	**9**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**10**
International waters	
Fishing vessels	0

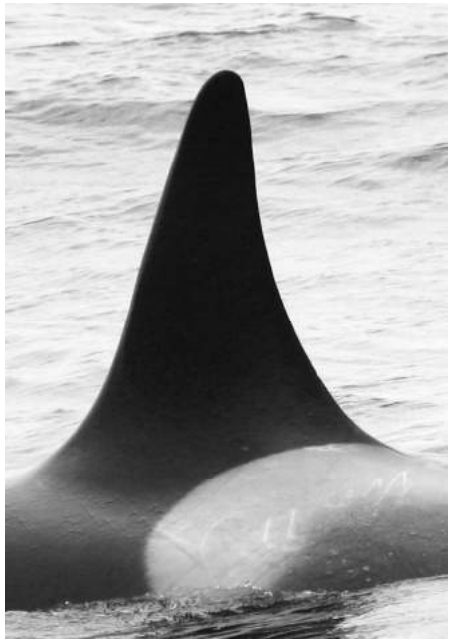
CR101 ♀ *2003-2016*

CR162 *2008-2016*

CR163 *2008-2016*



CR129 ♂ *2005-2007*

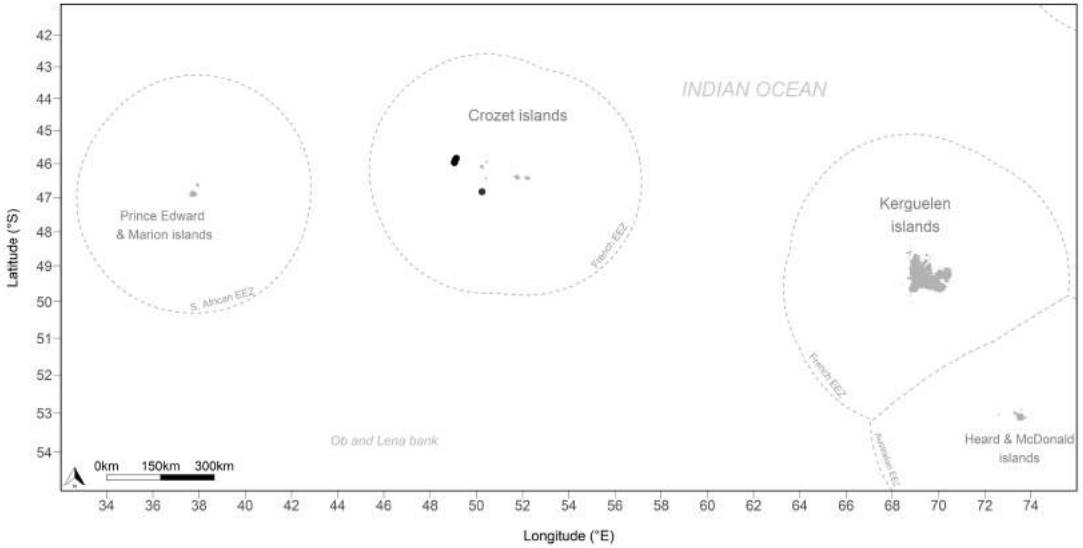


Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**6**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

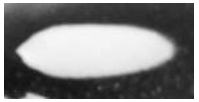
CR129 ♂ *2005-2007*

No image

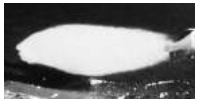


CR147 *2005-2009*

CR152 *2007-2009*



CR150 ♂ *2005-2009*

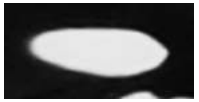


Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**11**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

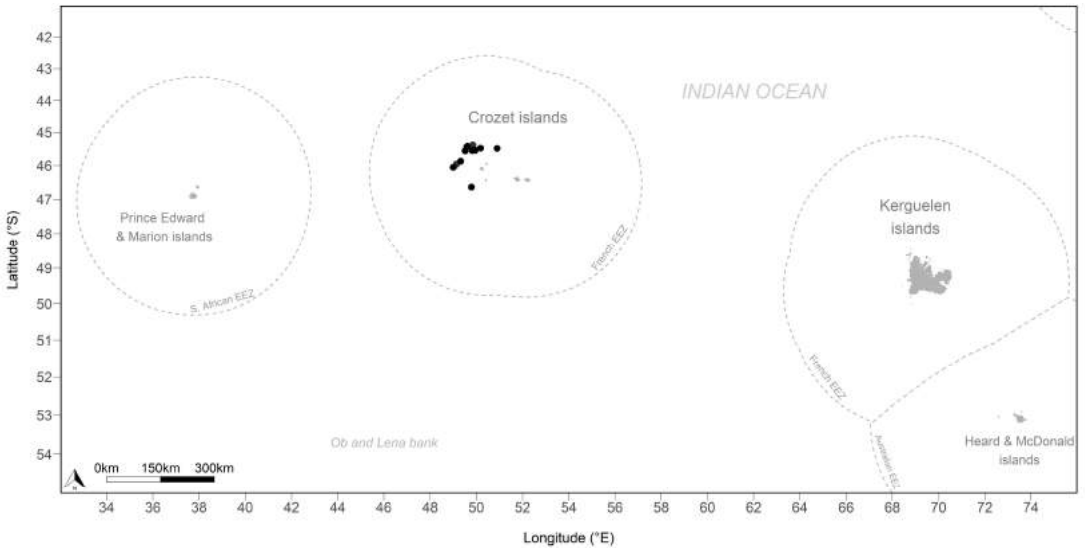
CR147 *2005-2009*

CR152 *2007-2009*

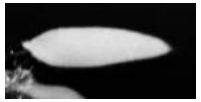


CR150 ♂ *2005-2009*

No image

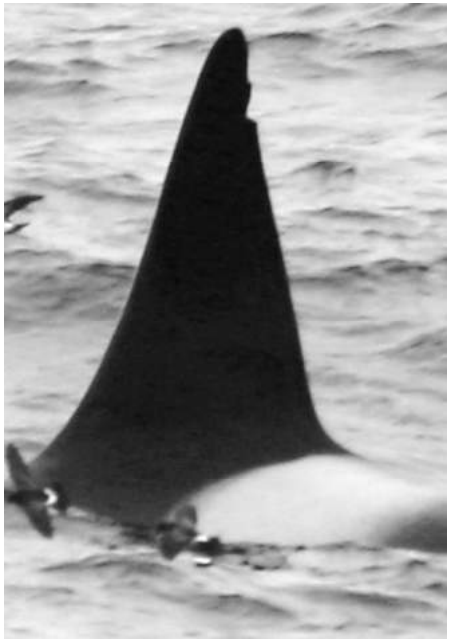


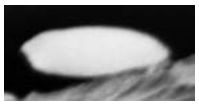
CR160 ♀ *2005-2008*



CR159 ♀ *2005-2018*

CR134 ♂ *2005-2016*





Left side

These individuals have also been photographed from the shore of Marion Island (catalogued as M033 for CR160, M009 for CR159 and M008 for CR134 by Jordaan *et al.* 2019).

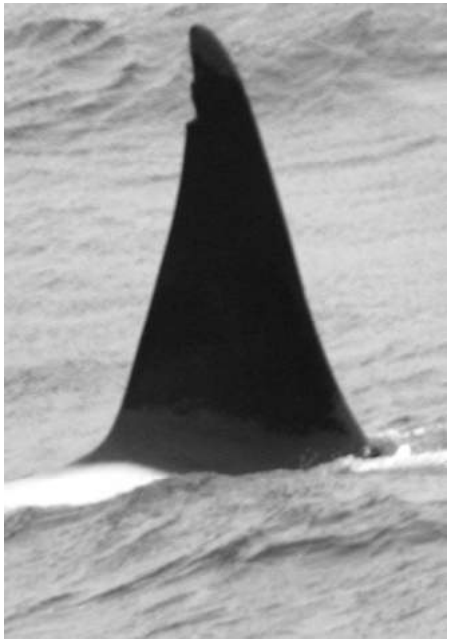
Number of encounters	
Crozet EEZ	
Fishing vessels	**6**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**3**
International waters	
Fishing vessels	0

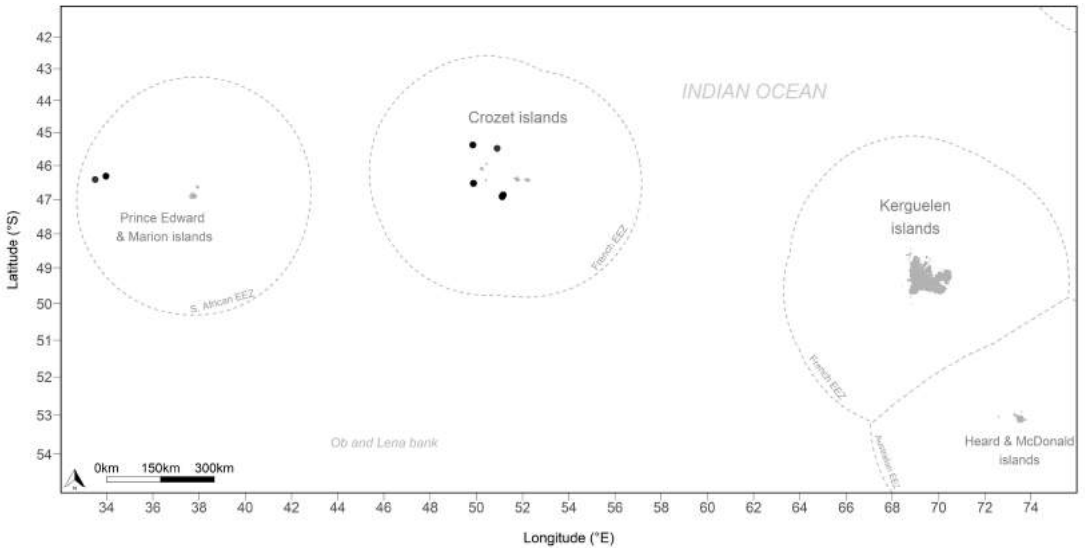
CR160 ♀ *2005-2008*

CR159 ♀ *2005-2018*

No image

CR134 ♂ *2005-2016*

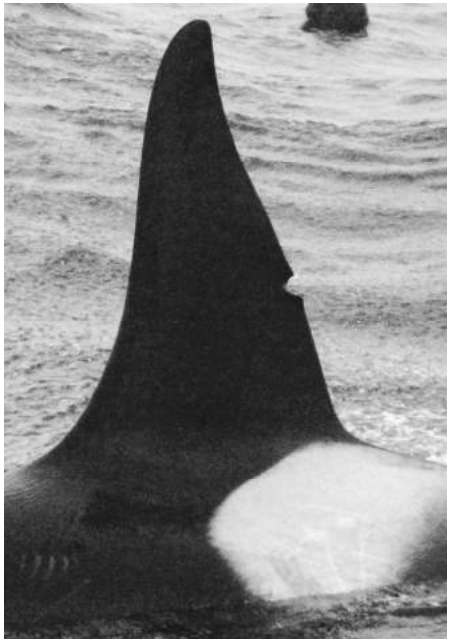


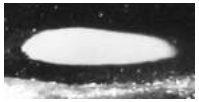


CR171 *2008-2012*

CR172 ♀ *2008-2013*

CR164 ♂ *2008-2011*





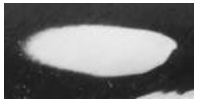
CR176 *2008-2011*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**65**
Ile de la Possession	**2**
Kerguelen EEZ	
Fishing vessels	**6**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

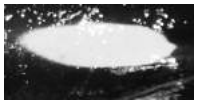
CR171 *2008-2012*

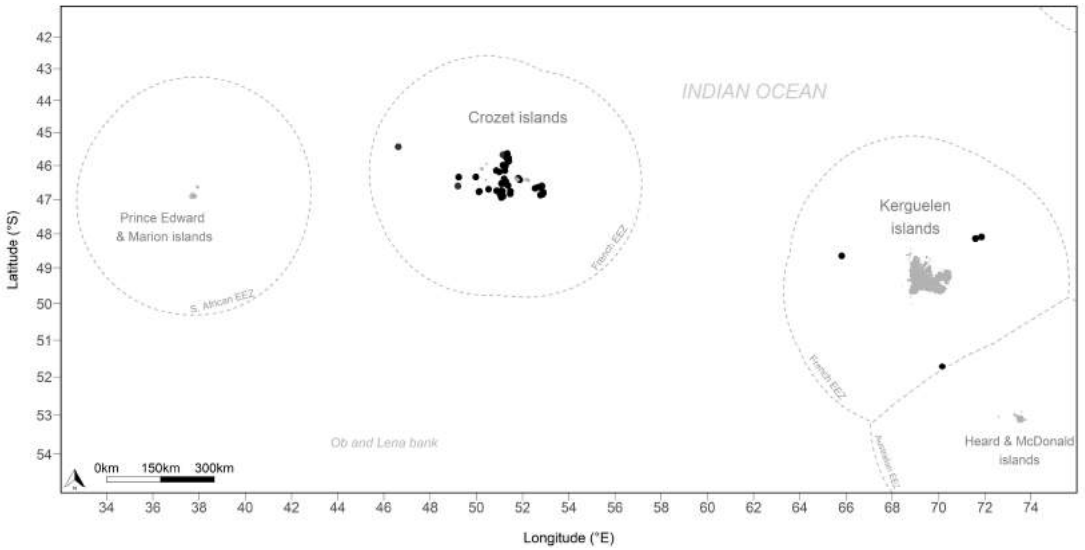
CR172 ♀ *2008-2013*



CR164 ♂ *2008-2011*

CR176 *2008-2011*





Right side

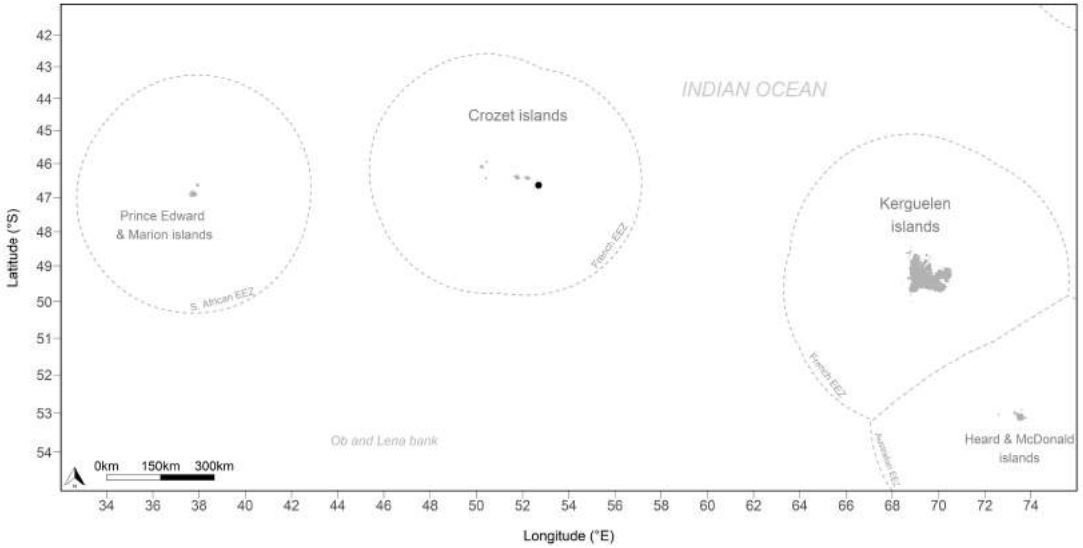
CR197 ♂ *2009-2009*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**1**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

CR197 ♂ *2009-2009*

No image

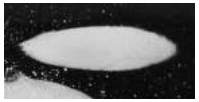


CR203 *2010-2011*

CR208 *2010-2010*

No image

CR209 *2010-2011*



CR205 ♂ *2010-2011*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**4**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

CR203 *2010-2011*

CR208 *2010-2010*

No image

CR209 *2010-2011*

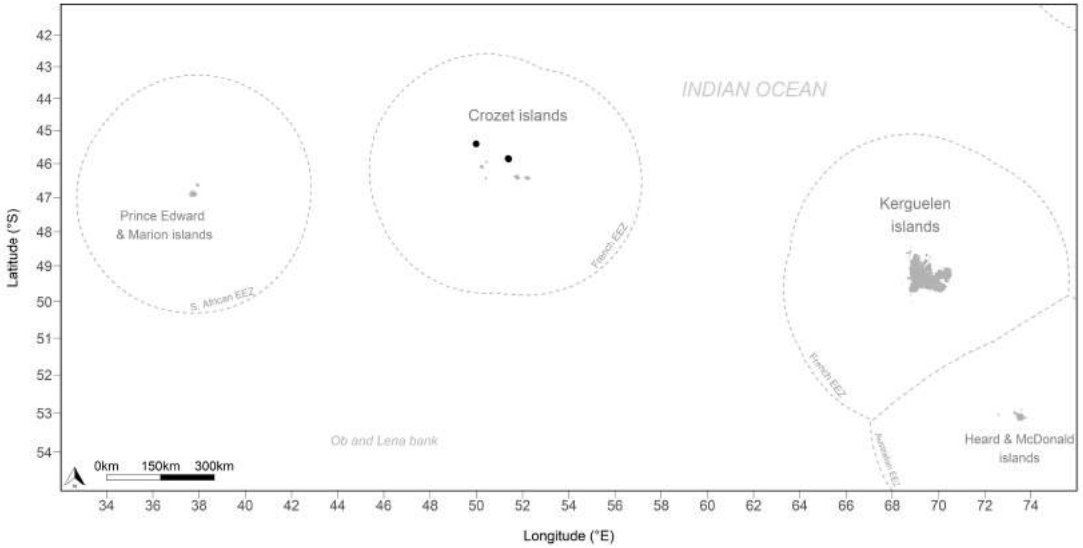
No image

CR205 ♂ *2010-2011*

No image

No image

Right side



CR217 ♂ *2015-2015*

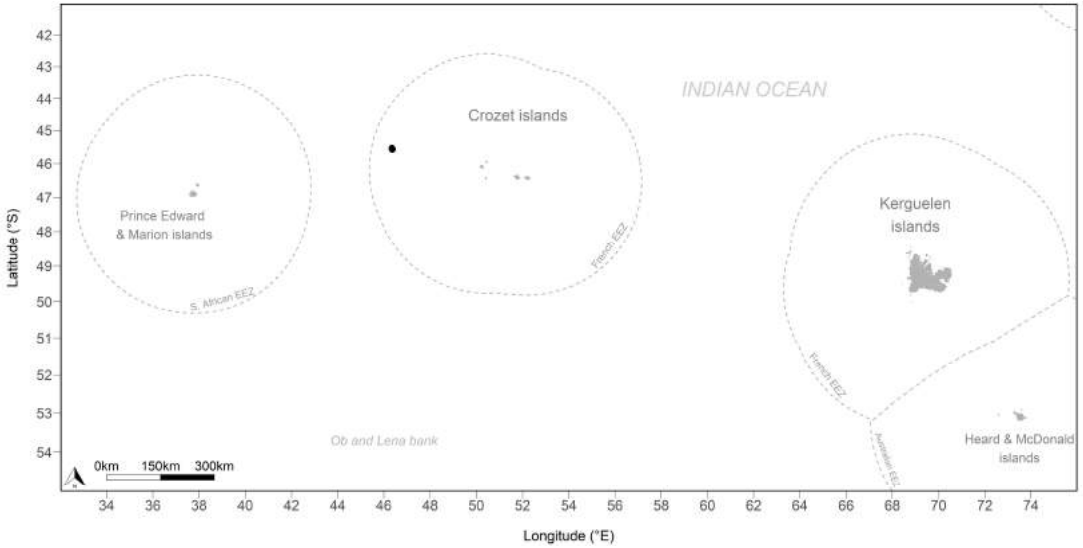
Left side

No image

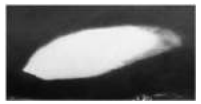
Number of encounters	
Crozet EEZ	
Fishing vessels	**2**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

CR217 ♂ *2015-2015*

No image



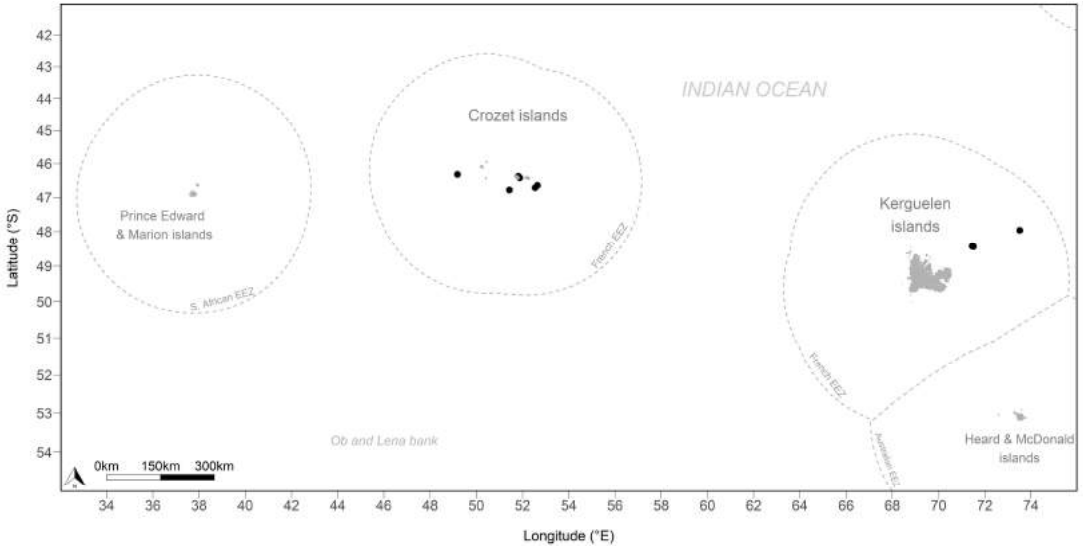
CR242 *2014-2018*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**4**
Ile de la Possession	**12**
Kerguelen EEZ	
Fishing vessels	**3**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

CR242 *2014-2018*

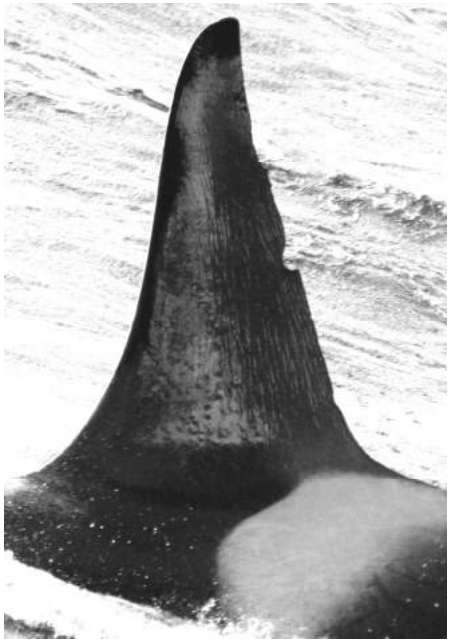


OL011 ♀ *2014-2018*

OL012 *2014-2018*

No image

OL014 ♂ *2018-2018*



OL013 *2014-2018*

OL015 *2018-2018*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	**4**
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**1**
International waters	
Fishing vessels	**2**

OL011 ♀ *2014-2018*

No image

No image

OL012 *2014-2018*

No image

No image

OL013 *2014-2018*

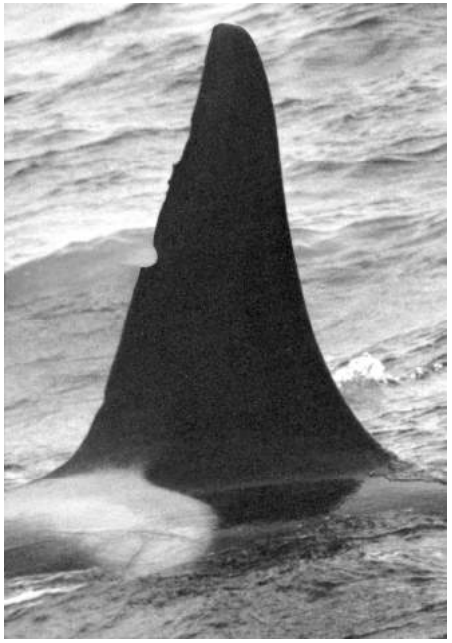
No image

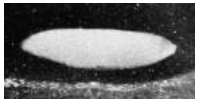
No image

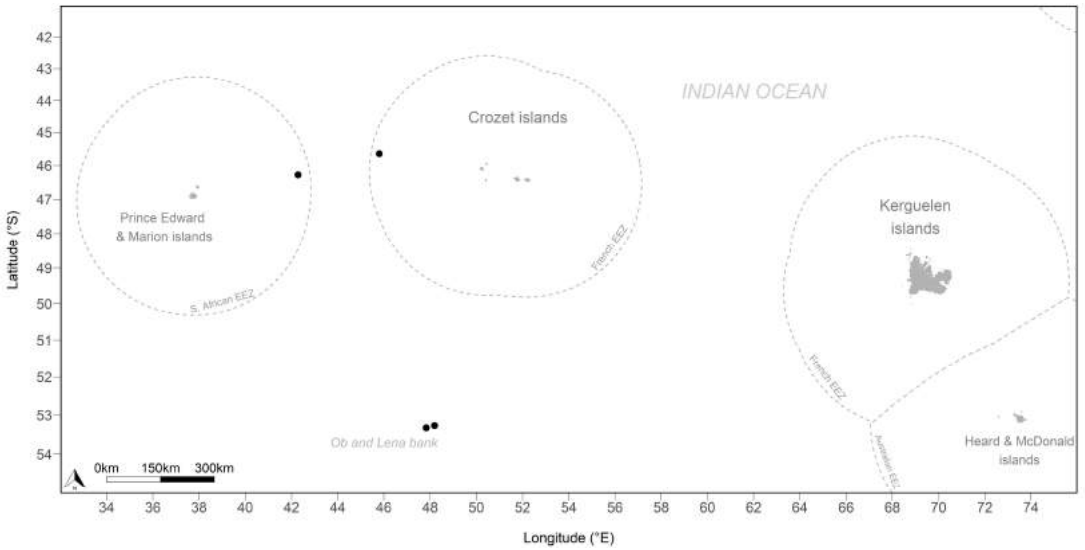
OL015 *2018-2018*

No image

OL014 ♂ *2018-2018*







Right side

Table of photographers and dates for every image in Appendix 2

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
CR011	Jean-Luc Aubert 2008-11-04	David Beaufils 2008-04-18	Jean-Luc Aubert 2008-11-08	David Beaufils 2008-04-18
CR086	Hugues Vermande 2011-02-24	Hugues Vermande 2011-02-19	Hugues Vermande 2011-02-24	Hugues Vermande 2011-02-19
CR088	Ryan Aylward 2014-04-05	Ryan Aylward 2014-04-05	Ryan Aylward 2014-04-05	Eric Hoarau 2007-07-01
CR089	Ryan Aylward 2014-03-14	Ryan Aylward 2014-04-05		
CR090	Ryan Aylward 2014-04-05		Eric Hoarau 2007-07-01	Ryan Aylward 2014-04-05
CR100	Nicolas Gasco 2003-09-18		Nicolas Gasco 2003-09-18	
CR101	Paul Tixier 2008-12-17	Paul Tixier 2008-12-17	Paul Tixier 2008-12-17	Paul Tixier 2008-12-20
CR103	Nicolas Gasco 2003-09-18	Ryan Aylward 2014-04-07	Nicolas Gasco 2003-11-09	Ryan Aylward 2014-04-07
CR104	Philip Robyn 2016-06-04	Nicolas Gasco 2003-09-18	Philip Robyn 2016-05-28	Nicolas Gasco 2003-09-18
CR129	Nicolas Gasco 2007-02-26	Nicolas Gasco 2007-02-27	Nicolas Gasco 2007-02-26	
CR134	Emilie Richard 2008-02-24	Jean-Luc Aubert 2005-02-15	Jean-Luc Aubert 2005-02-15	Jean-Luc Aubert 2005-02-15
CR147	Hugues Vermande 2008-07-12	Nicolas Gasco 2007-02-25	Nicolas Gasco 2007-02-25	Christian Lemarchand 2009-01-24
CR150	Hugues Vermande 2008-07-12		Antoine Dervaux 2009-04-21	David Beaufils 2008-05-12
CR152	Nicolas Gasco 2007-02-25	Nicolas Gasco 2007-02-25	Nicolas Gasco 2007-02-25	David Beaufils 2008-05-12
CR159	Sivuyile Elvis Mbambalala 2018-06-23	Sivuyile Elvis Mbambalala 2018-06-23	Emilie Richard 2008-02-24	
CR160	Emilie Richard 2008-02-24	Emilie Richard 2008-02-24	Emilie Richard 2008-02-24	Emilie Richard 2008-02-24
CR162	Paul Tixier 2008-12-20	Paul Tixier 2008-12-20	Paul Tixier 2008-12-17	Paul Tixier 2008-12-17
CR163	Paul Tixier 2008-12-17	Paul Tixier 2008-12-18	Paul Tixier 2008-12-17	Paul Tixier 2008-12-18
CR164	Paul Tixier 2010-03-02	Paul Tixier 2010-03-04	David Beaufils 2011-03-25	Paul Tixier 2010-03-04
CR171	Paul Tixier 2010-02-28	Maud Berlincourt 2008-01-02	Jean-Luc Aubert 2011-02-09	Jean-Luc Aubert 2011-02-16
CR172	Paul Tixier 2011-02-21	Ewen Corouge 2012-02-05	Paul Tixier 2010-02-28	Ewen Corouge 2012-02-05
CR176	Paul Tixier 2011-02-21	Jean-Luc Aubert 2011-02-13	Paul Tixier 2011-02-21	Jean-Luc Aubert 2011-02-13
CR197	Hugues Vermande 2009-02-11	Hugues Vermande 2009-02-11	Hugues Vermande 2009-02-11	
CR203	Paul Tixier 2010-03-10	Jean-Luc Aubert 2011-02-07	Jean-Luc Aubert 2011-02-07	Paul Tixier 2010-03-10
CR205	Jean-Luc Aubert 2011-02-07		Jean-Luc Aubert 2011-02-07	

Table of photographers and dates for every image in Appendix 2 (continued)

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
CR208	Paul Tixier 2010-03-10	Paul Tixier 2010-03-10		
CR209	Paul Tixier 2010-03-10	Paul Tixier 2010-03-10	Jean-Luc Aubert 2011-02-07	
CR217	Gwenaël Bodiger 2015-11-01	Gwenaël Bodiger 2015-11-01		
CR242	David Beaufils 2017-11-09	Jean-Luc Aubert 2014-11-06	David Beaufils 2017-11-09	Anaïs Rameau 2015-04-27
OL011	Niels Gins 2018-07-24	Niels Gins 2018-07-24	Brandon Scott 2014-07-25	
OL012	Niels Gins 2018-07-23			
OL013	Niels Gins 2018-07-23		Niels Gins 2018-07-23	
OL014	Niels Gins 2018-07-24	Niels Gins 2018-07-20	Niels Gins 2018-07-22	Niels Gins 2018-07-20
OL015	Niels Gins 2018-07-23		Niels Gins 2018-07-22	Niels Gins 2018-07-24
PE008	Philip Robyn 2016-06-04		Ryan Aylward 2014-04-05	

Appendix 3

Killer whales encountered in adjacent waters only

Photo-identification catalogue and distribution maps

Killer whales of the Crozet Archipelago and adjacent waters
Photo-identification catalogue, population status and distribution in 2020

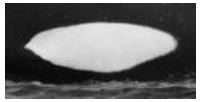
Paul Tixier[1], Nicolas Gasco[2], Jared R. Towers[3], Christophe Guinet[1]

[1] Centre d'Etudes Biologiques de Chizé, UMR 7372 CNRS – La Rochelle Université, Villiers en Bois, France
[2] Muséum National d'Histoire Naturelle de Paris, France
[3] Bay Cetology, Alert Bay, BC, Canada

Summary table of the 12 killer whale groups (assumed to represent social units in this catalogue) only encountered in waters adjacent to Crozet (never in the Crozet EEZ). Summarized information includes the range and number of years that members of these units were encountered and photographed, whether they were encountered in the Prince Edward/Marion EEZ, the Kerguelen EEZ or international waters, as well as the full list and numbers of individuals identified per unit. Identification photographs of all known individuals are presented in the catalogue as their status was unknown in 2019/2020 due to insufficient numbers of encounters.

Social units	Range of years encountered	# of years encountered	Areas of encounter			Individuals	# of individuals identified
			Prince Edward / Marion	Kerguelen	International waters		
PE003	2006-2019	8	x			PE001, PE002, PE003, PE006	4
PE004	2006-2013	3	x			PE004	1
PE010	2014	1	x			PE007, PE010	2
PE011	2011-2016	3	x			PE011, PE012	2
PE014	2011-2015	2	x			PE005, PE009, PE014	3
PE015	2017-2018	2	x			PE015, PE016, PE017	3
OL001	2012	1			x	OL001, OL002, OL003, OL004, OL005, OL006, OL007, OL008, OL009, OL010	10
IN001	2010	1			x	IN001, IN002, IN003	3
IN004	2010	1			x	IN004	1
IN006	2013	1			x	IN005, IN006, IN007	3
KE001	2008	1		x		KE001	1
KE002	2013	1		x		KE002, KE003, KE004, KE005, KE006, KE007, KE008	7

PE003 ♀ *2006-2015*



PE006 *2011-2015*

PE001 ♂ *2010-2019*

No image

PE002 ♂ *2010-2019*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**20**
International waters	
Fishing vessels	0

PE003 ♀ *2006-2015*

No image

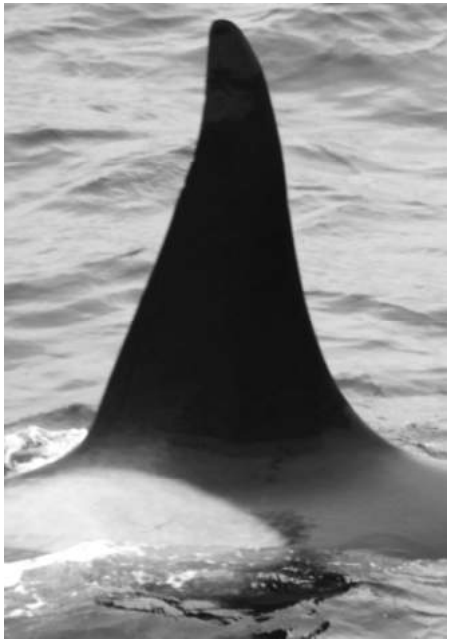
No image

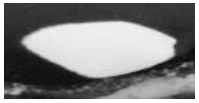
PE001 ♂ *2010-2019*

No image

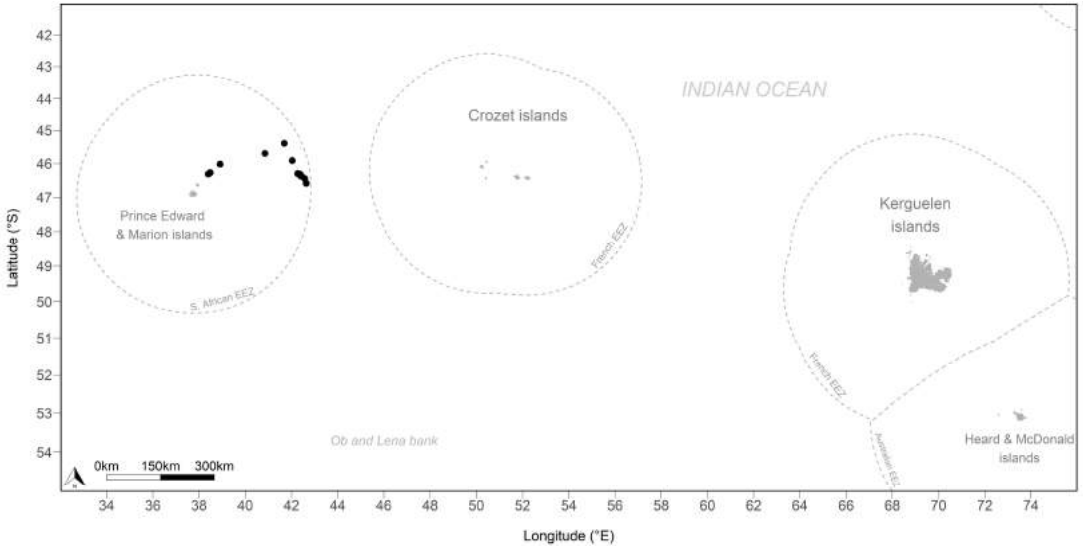
No image

PE002 ♂ *2010-2019*





PE006 *2011-2015*



Right side

PE004 ♂ *2006-2013*

Left side

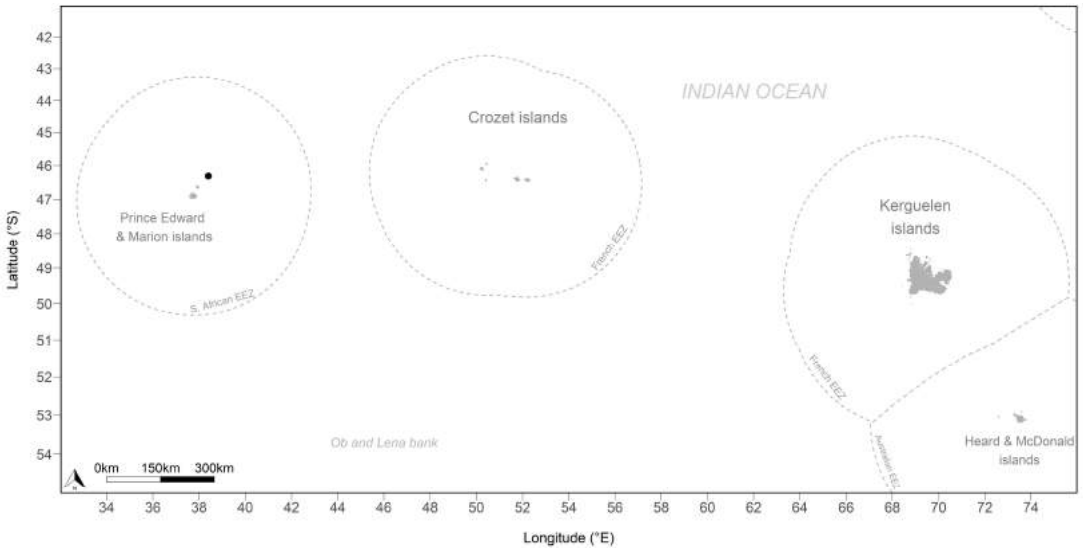
No image

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**3**
International waters	
Fishing vessels	0

PE004 ♂ *2006-2013*

No image

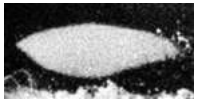
No image



PE010 *2014-2014*

No image

PE007 ♂ *2014-2014*



Left side

These individuals have also been photographed from the shore of Marion Island (catalogued as M004 for PE010 and M007 for PE007 by Jordaan *et al.* 2019).

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**1**
International waters	
Fishing vessels	0

PE010 *2014-2014*

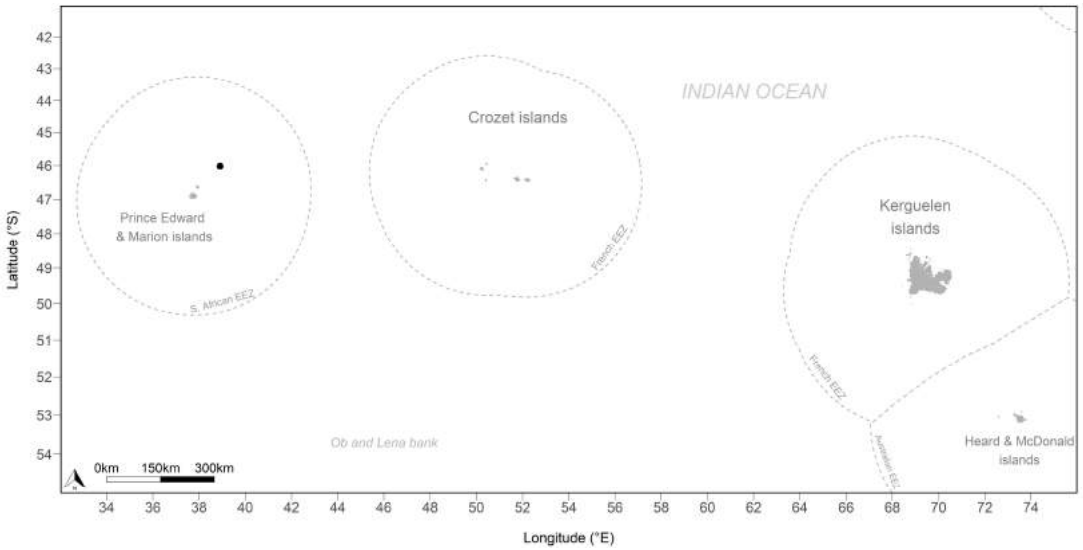
No image

No image

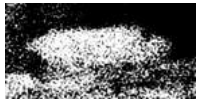
PE007 ♂ *2014-2014*

No image

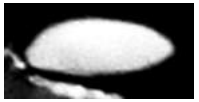
No image



PE011 *2011-2014*



PE012 *2011-2016*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**5**
International waters	
Fishing vessels	0

PE011 *2011-2014*

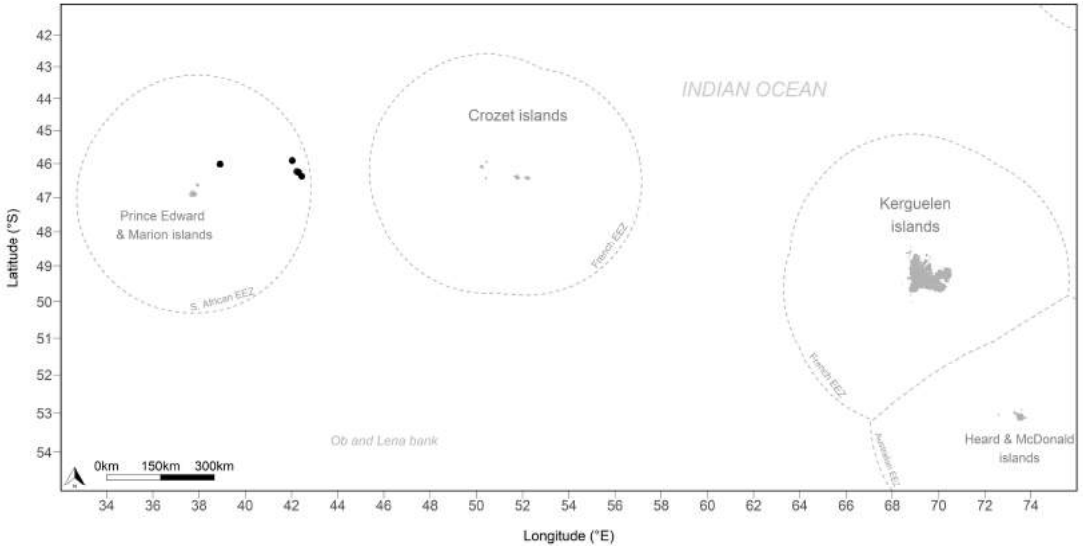
No image

No image

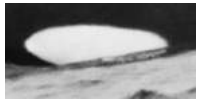
PE012 *2011-2016*

No image

No image

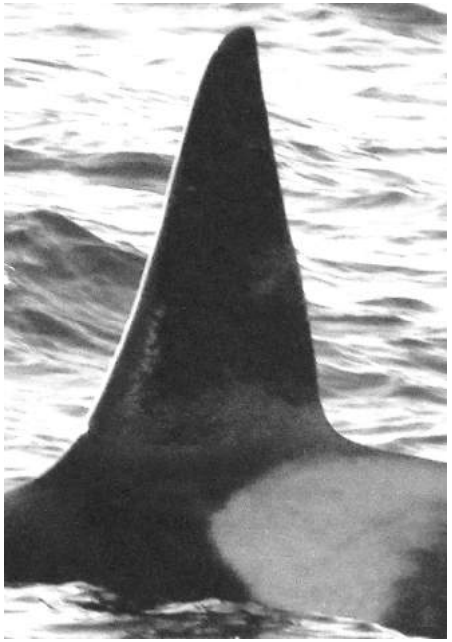


PE014 *2011-2015*



PE005 ♂ *2011-2015*

PE009 ♂ *2011-2015*



PE009 has also been photographed from the shore of Marion Island (catalogued as M057 by Jordaan *et al.,* 2019).

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**7**
International waters	
Fishing vessels	0

PE014 *2011-2015*

No image

No image

PE005 ♂ *2011-2015*

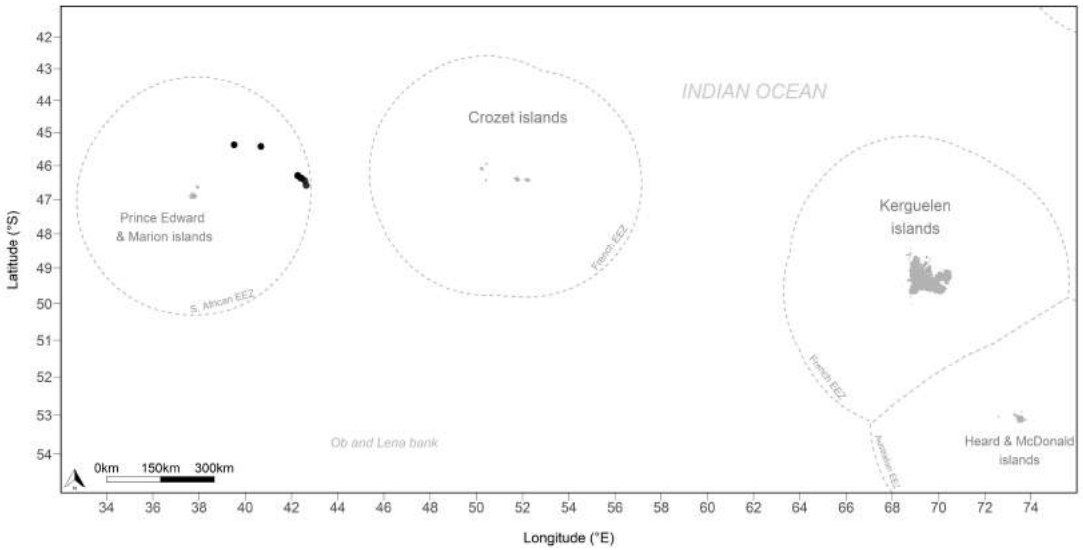
No image

No image

PE009 ♂ *2011-2015*

No image

No image



PE015 *2011-2015*

No image

PE016 *2011-2015*

No image

PE017 *2011-2015*

Left side

These individuals have also been photographed from the shore of Marion Island (catalogued as M035 for PE015, M046 for PE016 and M045 for PE017 by Jordaan *et al.* 2019).

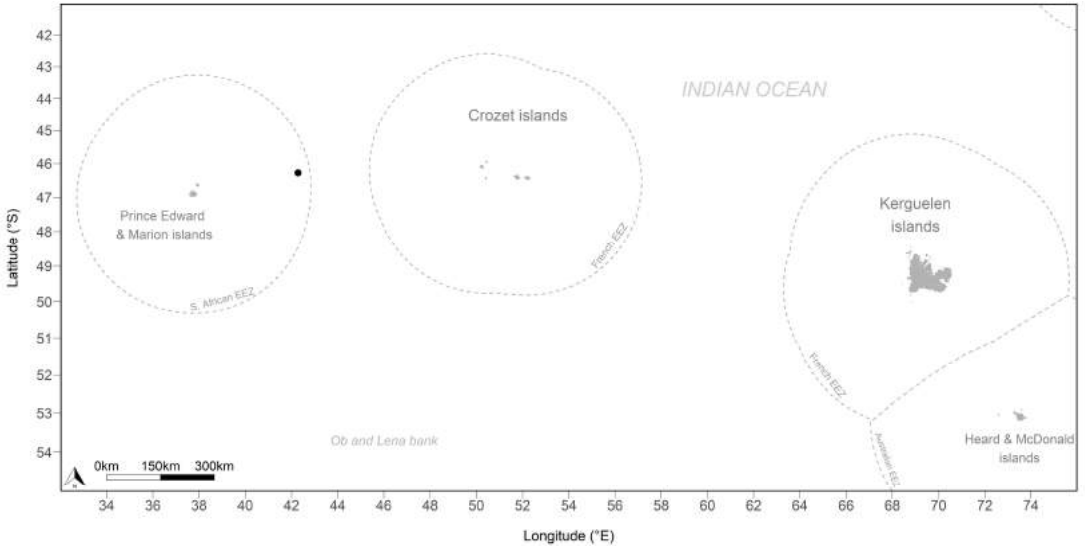
Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**4**
International waters	
Fishing vessels	0

PE015 *2011-2015*

PE016 *2011-2015*

PE017 *2011-2015*

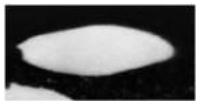
No image



OL001 ♀ *2012-2012*

OL004 ♀ *2012-2012*

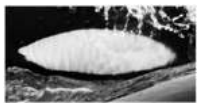
OL002 *2012-2012*



OL003 *2012-2012*

OL006 *2012-2012*

OL008 *2012-2012*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	**8**

OL001 ♀ *2012-2012*

No image

OL004 ♀ *2012-2012*

No image

OL002 *2012-2012*

No image

No image

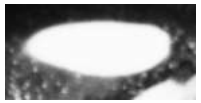
OL003 *2012-2012*

No image

No image

OL006 *2012-2012*

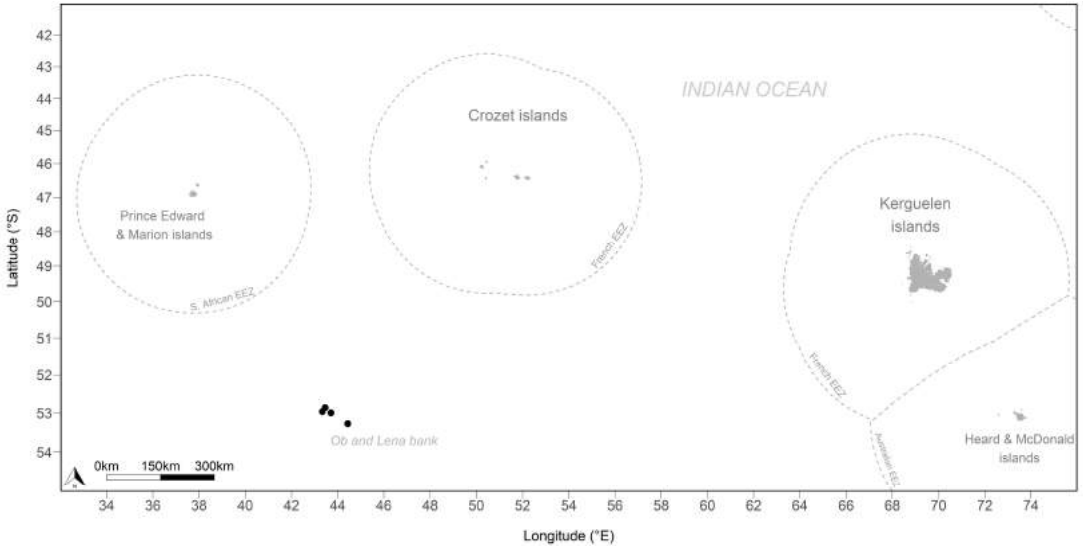
No image



OL008 *2012-2012*

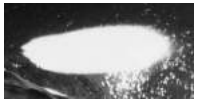
No image

Right side



OL005 *2012-2012*

OL010 ♀ *2012-2012*



OL007 *2012-2012*

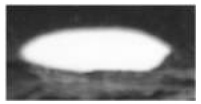
OL009 *2012-2012*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	**8**

OL005 *2012-2012*

No image



OL010 ♀ *2012-2012*

No image

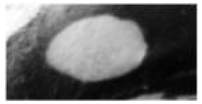
No image

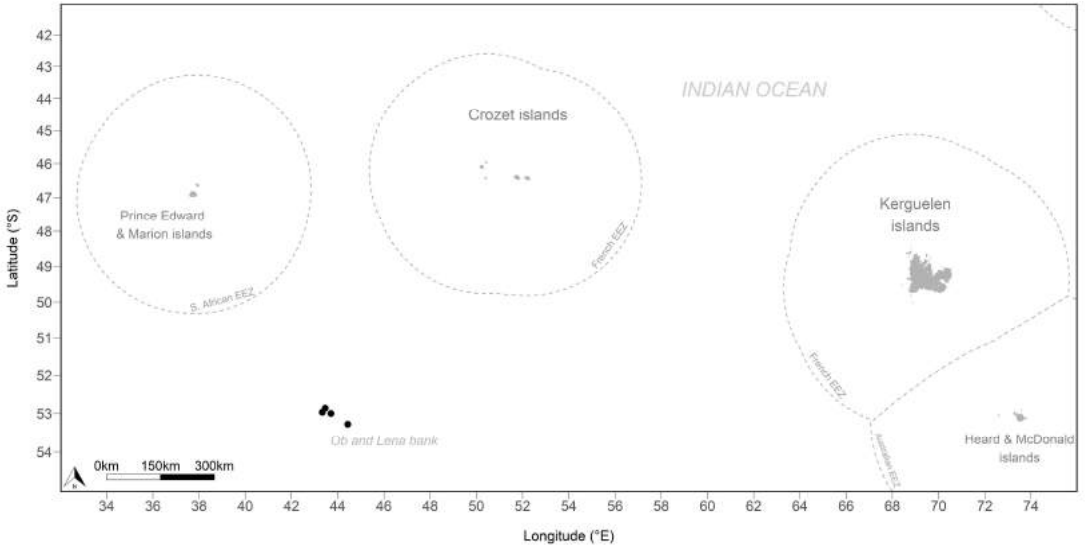
OL007 *2012-2012*

No image

OL009 *2012-2012*

No image

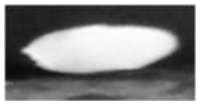




IN001 *2010-2010*

IN002 *2010-2010*

IN003 *2010-2010*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	**1**

IN001 *2010-2010*

No image

No image

IN002 *2010-2010*

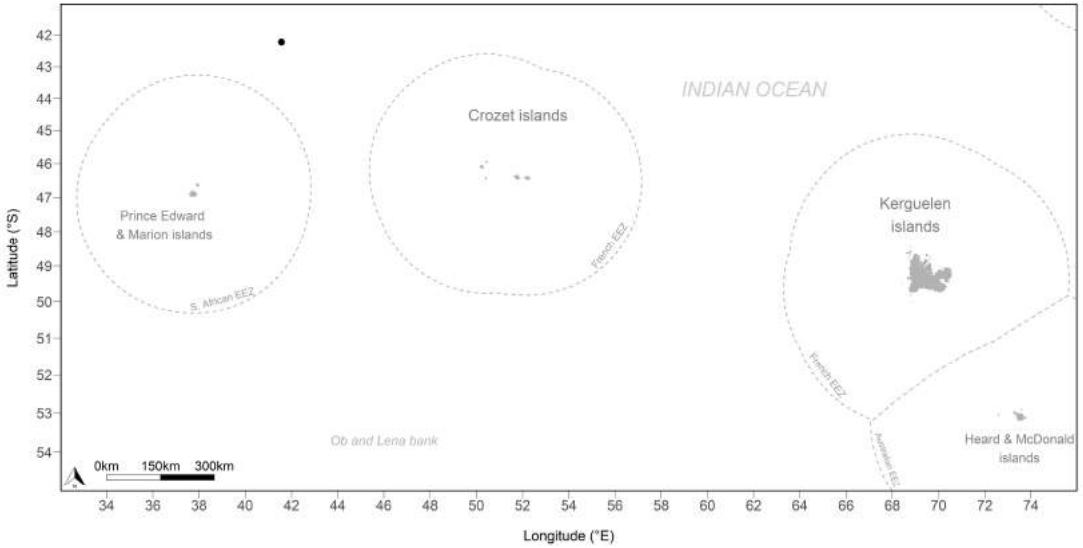
No image

No image

IN003 *2010-2010*

No image

No image

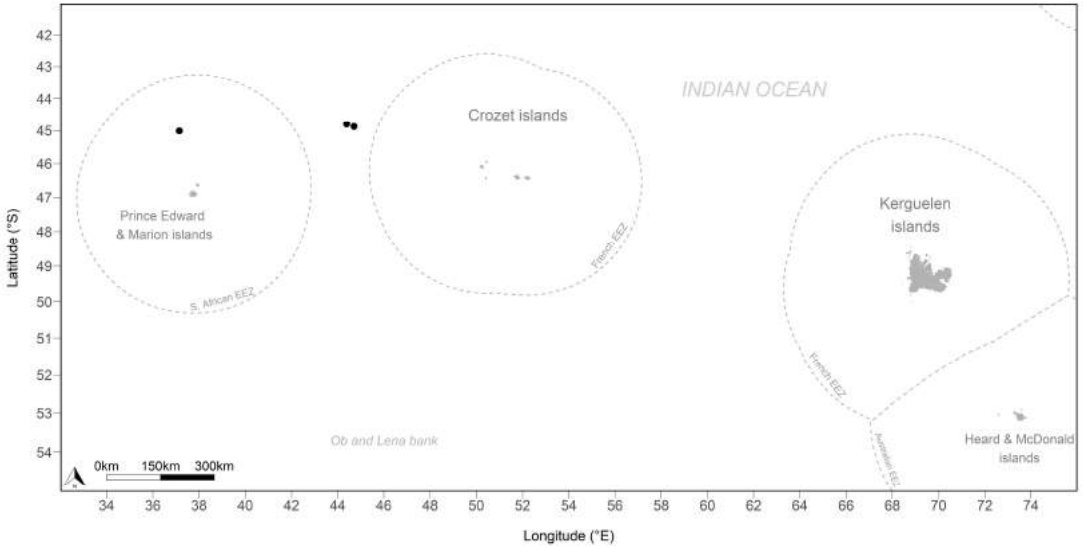


IN004 *2010-2010*

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	**1**
International waters	
Fishing vessels	**2**

IN004 *2010-2010*

No image



IN006 *2013-2013*

IN007 *2013-2013*

IN005 ♂ *2013-2013*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	**1**

IN006 *2013-2013*

No image

No image

IN007 *2013-2013*

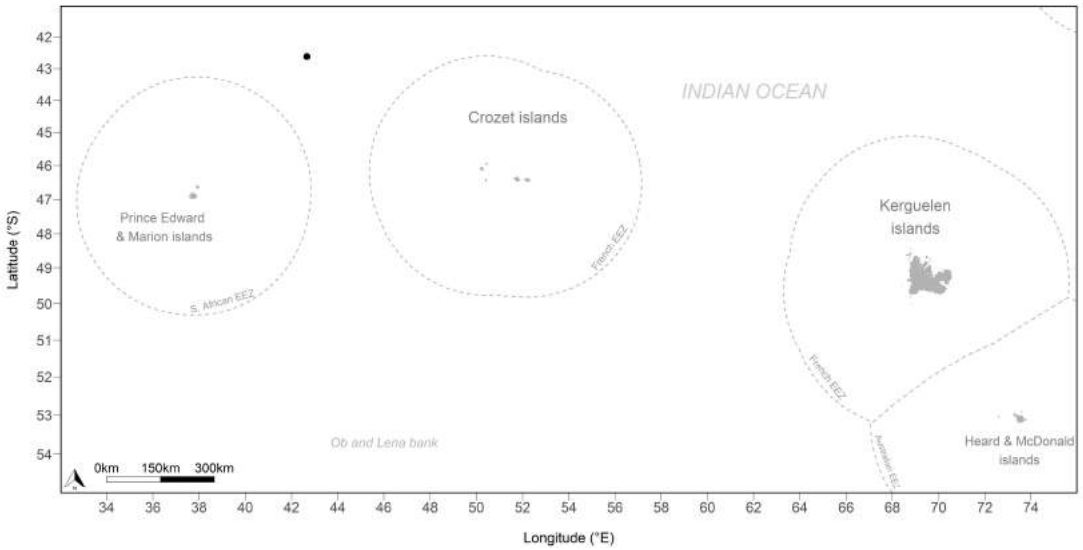
No image

No image

IN005 ♂ *2013-2013*

No image

No image



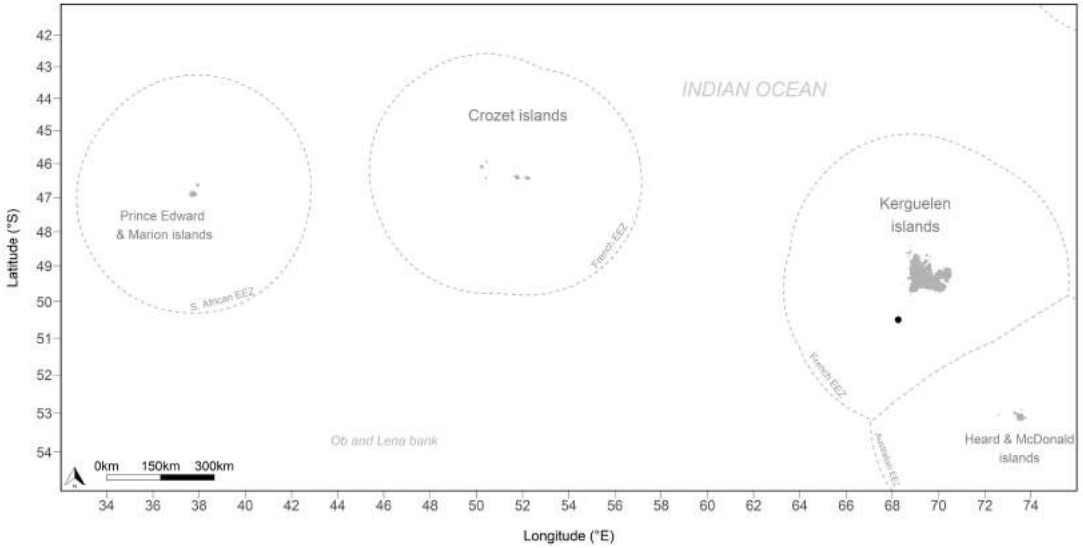
KE001 *2008-2008*

No image

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	**1**
Other	0
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

KE001 *2008-2008*



KE002 *2013-2013*

KE003 *2013-2013*

KE004 *2013-2013*

KE005 *2013-2013*

Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	**1**
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

KE002 *2013-2013*

No image

No image

KE003 *2013-2013*

No image

No image

KE004 *2013-2013*

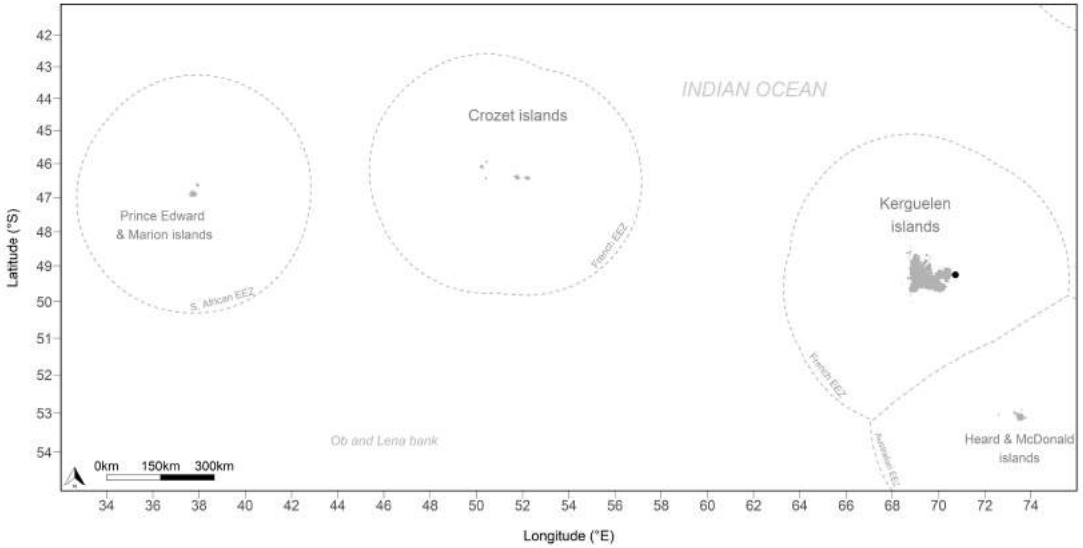
No image

No image

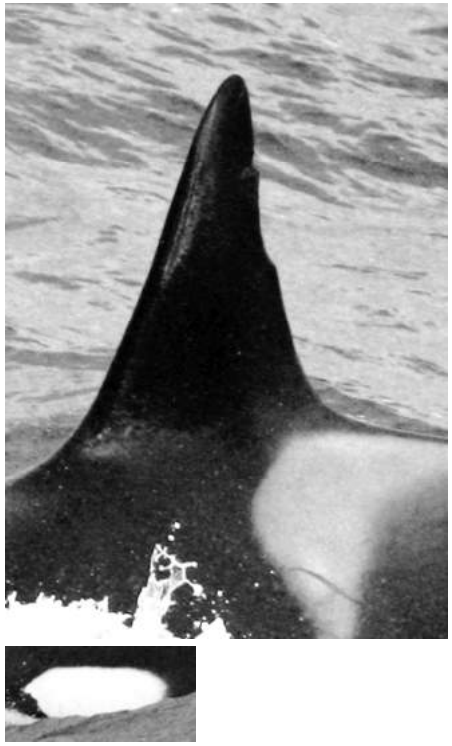
KE005 *2013-2013*

No image

No image

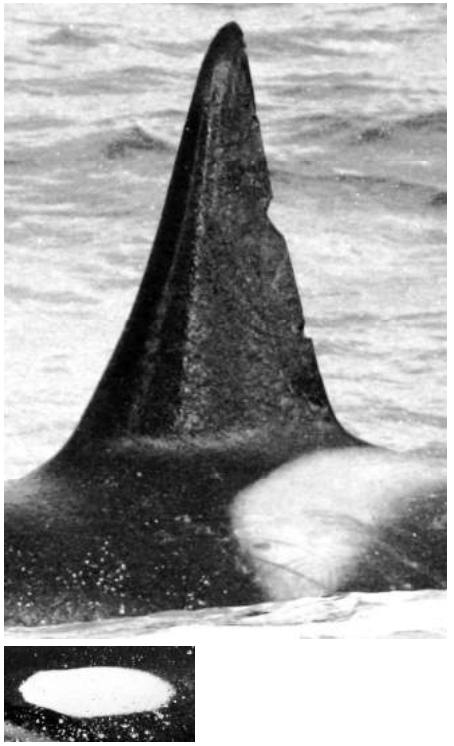


KE006 ♂ *2013-2013*



KE008 ♂ *2013-2013*

KE007 ♂ *2013-2013*



Left side

Number of encounters	
Crozet EEZ	
Fishing vessels	0
Ile de la Possession	0
Kerguelen EEZ	
Fishing vessels	0
Other	**1**
Prince Edward / Marion EEZ	
Fishing vessels	0
International waters	
Fishing vessels	0

KE006 ♂ *2013-2013*

No image

No image

KE008 ♂ *2013-2013*

No image

No image

KE007 ♂ *2013-2013*

No image

No image

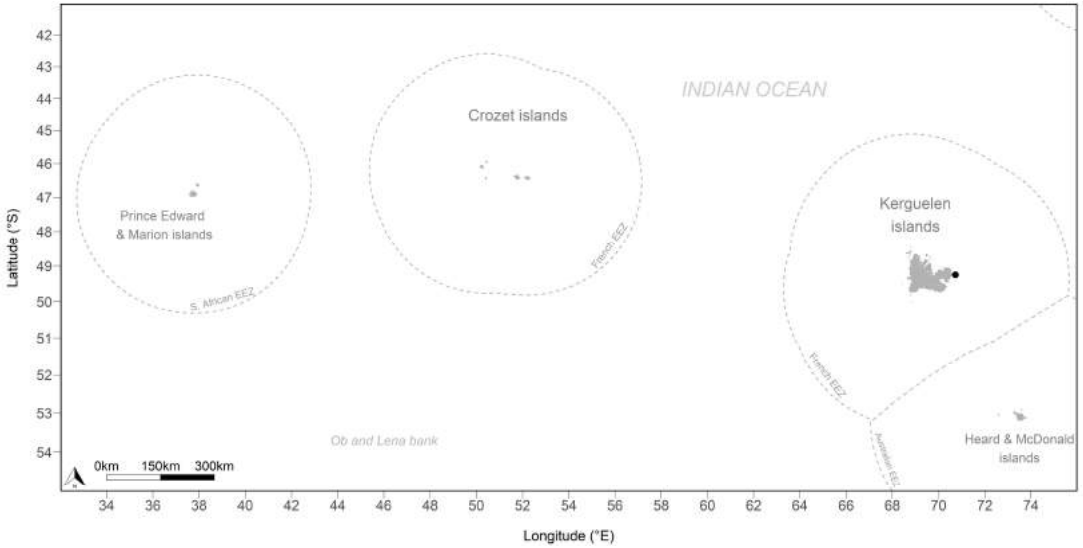


Table of photographers and dates for every image in Appendix 3

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
IN001	Eric Vicinati 2010-11-05		Eric Vicinati 2010-11-05	Eric Vicinati 2010-11-05
IN002	Eric Vicinati 2010-11-05		Eric Vicinati 2010-11-05	
IN003	Eric Vicinati 2010-11-05		Eric Vicinati 2010-11-05	
IN004	Eric Vicinati 2010-10-27	Eric Vicinati 2010-10-28	Eric Vicinati 2010-10-27	
IN005	Thibaut Thellier 2013-11-02		Thibaut Thellier 2013-11-02	
IN006	Thibaut Thellier 2013-11-02		Thibaut Thellier 2013-11-02	
IN007	Thibaut Thellier 2013-11-02		Thibaut Thellier 2013-11-02	
KE001	David Beaufils 2008-10-19	David Beaufils 2008-10-19		David Beaufils 2008-10-19
KE002	Julien Ringelstein 2013-10-01		Julien Ringelstein 2013-10-01	Julien Ringelstein 2013-10-01
KE003	Julien Ringelstein 2013-10-01		Julien Ringelstein 2013-10-01	
KE004	Julien Ringelstein 2013-10-01		Julien Ringelstein 2013-10-01	Julien Ringelstein 2013-10-01
KE005	Julien Ringelstein 2013-10-01		Julien Ringelstein 2013-10-01	
KE006	Julien Ringelstein 2013-10-01		Julien Ringelstein 2013-10-01	
KE007	Julien Ringelstein 2013-10-01		Julien Ringelstein 2013-10-01	
KE008	Julien Ringelstein 2013-10-01		Julien Ringelstein 2013-10-01	
OL001	Philip Augustyn 2012-04-22	Philip Augustyn 2012-04-27	Philip Augustyn 2012-04-22	
OL002	Philip Augustyn 2012-04-27		Philip Augustyn 2012-04-27	
OL003	Philip Augustyn 2012-04-27		Philip Augustyn 2012-04-27	
OL004	Philip Augustyn 2012-04-27	Philip Augustyn 2012-05-04	Philip Augustyn 2012-04-27	
OL005	Philip Augustyn 2012-05-04		Philip Augustyn 2012-04-27	Philip Augustyn 2012-05-04
OL006	Philip Augustyn 2012-04-27		Philip Augustyn 2012-04-29	Philip Augustyn 2012-05-04
OL007	Philip Augustyn 2012-04-22			Philip Augustyn 2012-04-22
OL008	Philip Augustyn 2012-04-27		Philip Augustyn 2012-04-27	Philip Augustyn 2012-04-27
OL009	Philip Augustyn 2012-04-27		Philip Augustyn 2012-04-27	Philip Augustyn 2012-04-27
OL010	Philip Augustyn 2012-05-04		Philip Augustyn 2012-05-04	
PE001	Nel Lock 2011-08-18			

Table of photographers and dates for every image in Appendix (continued)

Individual	Left Side	Right Side	Left Eyepatch	Right Eyepatch
PE002	Nel Lock 2011-08-18	Nel Lock 2011-08-18	Nel Lock 2011-08-18	Nel Lock 2011-08-18
PE003	Nel Lock 2015-07-18		Nel Lock 2015-07-18	
PE004	Jerry Burski 2010-10-01			
PE005	Nel Lock 2015-07-18		Nel Lock 2015-07-18	
PE006	Nel Lock 2015-07-18	Nel Lock 2015-07-24	Nel Lock 2015-07-24	Nel Lock 2015-07-24
PE007	Ryan Aylward 2014-04-07		Ryan Aylward 2014-04-07	
PE009	Nel Lock 2015-07-19		Nel Lock 2015-07-19	
PE010	Ryan Aylward 2014-04-07			
PE011	Nel Lock 2011-08-18		Ryan Aylward 2014-04-07	
PE012	Philip Robyn 2016-05-31		Philip Robyn 2016-05-29	
PE014	Nel Lock 2015-07-19		Nel Lock 2015-07-18	
PE015	Xolisile Ngqokotya 2018-06-22	Sivuyile Elvis Mbambalala 2018-06-23		Sivuyile Elvis Mbambalala 2018-06-23
PE016	Xolisile Ngqokotya 2018-06-22	Sivuyile Elvis Mbambalala 2018-06-23		Sivuyile Elvis Mbambalala 2018-06-23
PE017	Xolisile Ngqokotya 2018-06-21	Xolisile Ngqokotya 2018-06-22	Andy Smith 2017-06-26	