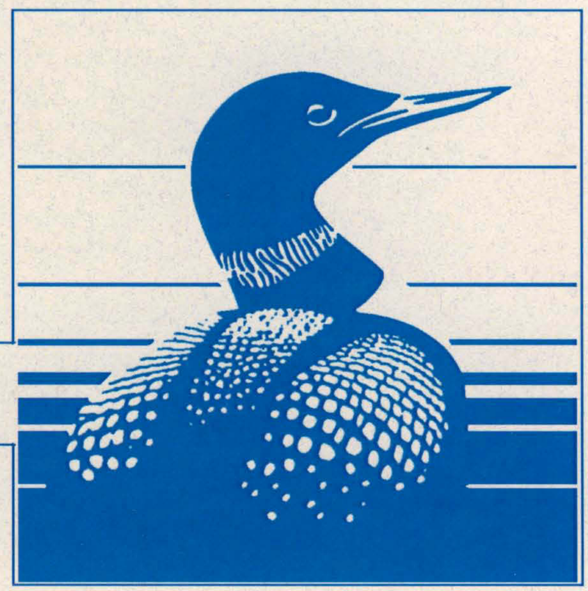
Evaluation of seabird observations collected from 2001-2003 by the Oil and Gas Observer Program

Sabina I. Wilhelm and Andrew W. Boyne

Atlantic Region 2006



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EVALUATION OF SEABIRD OBSERVATIONS COLLECTED FROM 2001-2003 BY THE OIL AND GAS OBSERVER PROGRAM

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SUMMARY

Between 2001 and 2003, 4315 separate observations of seabirds were documented from platforms (stationary and moving) on the edge and slope of the Scotian Shelf and in the Davis Strait by the Oil and Gas Observer Program Canada (OGOP) Ltd. Seabird data collected by OGOP observers are designed to assess abundance and distribution of seabirds at sea, and offer the potential to provide data for the edge and slope of the Scotian Shelf, where only limited information currently exists. The data were first analysed based solely on issues related to data collection. Subsequently, a more thorough evaluation was done to assess the reliability of the remaining data. In total, 2505 (58%) records were deemed inappropriate for reliability assessment. Most of these records (80%) were eliminated as a result of data collection issues (i.e., due to information missing about environmental conditions during the observation period or about the observation period itself). The remainder were discarded because observations did not abide to the standard survey design. Screened data were compared to previous reports documenting extensive surveys at sea in similar areas. With a few exceptions, observers seemed to reliably assign birds to the appropriate genus; however, assigning birds to the correct species appeared less reliable. In particular, observers appeared to have difficulties differentiating between Greater Shearwaters (*Puffinus gravis*) from other less abundant shearwater species. There was also concern that observers were not always distinguishing between Herring Gulls (*Larus argentatus*) and Northern Fulmars (*Fulmarus glacialis*). Overall, observers appeared to correctly differentiate between white-winged and black wing-tipped gulls, but may have misidentified immature Great Black-backed Gulls (*Larus marinus*) as immature Herring Gulls, and Iceland Gulls (*Larus glaucoides*) as Glaucous Gulls (*Larus hyperboreus*). Finally, very few murres (*Uria* spp.) and Dovekies (*Alle alle*) were observed, which does not concur with their known abundance and distribution on the edge and slope Scotian Shelf during the winter months and is likely linked to the skills of the observers. The under-representation of auks is of special concern, as these species are extremely vulnerable to oiling events at sea. Limitations related to data management, survey protocol, and observer training need to be addressed before these data can be used as a monitoring tool. We recommend that a training course provided by qualified personnel be taken on an annual basis by all observers to address the issues outlined in this report.

RÉSUMÉ

De 2001 à 2003, 4315 observations d'oiseaux marins ont été enregistrées par le personnel de l'Oil and Gas Observer Program Canada (OGOP) Ltd. à partir de plateformes (stationnaires et mobiles) installées au bord et sur le talus de la plateforme néo-écossaise ainsi que dans le détroit de Davis. Les données recueillies par les observateurs de l'OGOP visent à évaluer l'abondance et la répartition des oiseaux marins en mer et peuvent servir à enrichir les rares données qui existent sur les espèces d'oiseaux présentes dans ces secteurs. Une première évaluation des données a été réalisée; celle-ci ne touchait que les questions liées à la collecte des données et à la conception du recensement. Par la suite, un examen plus approfondi a été effectué dans le but d'évaluer la fiabilité des données. Au total, 2505 mentions (58%) ont été jugées inadéquates pour les besoins de cette évaluation. La plupart de ces mentions (80%) ont été éliminées en raison de problèmes liés à la collecte des données (c.-à-d. en raison de l'absence de renseignements sur les conditions ambiantes pendant la période d'observation ou sur la période d'observation proprement dite). Les autres données inadéquates ont été rejetées parce que les observations n'ont pas été faites selon les normes établies pour le recensement. Les données retenues ont été comparées à celles de rapports antérieurs sur de vastes recensements réalisés en mer dans des secteurs semblables. À quelques exceptions près, les observateurs semblaient classer les oiseaux sous le bon genre; cependant, l'identification de l'espèce paraissait plus problématique. En particulier, les observateurs semblent avoir eu de la difficulté à différencier le Puffin majeur (*Puffinus gravis*) des autres espèces moins communes de puffins. De plus, il n'est pas certain que les observateurs aient été en mesure de distinguer le Goéland argenté (*Larus argentatus*) du Fulmar boréal (*Fulmarus glacialis*). Dans l'ensemble, les observateurs semblaient capables de différencier les goélands à ailes blanches des goélands qui ont le bout des ailes noir, mais il se peut qu'ils aient pris des Goélands marins (*Larus marinus*) immatures pour des Goélands argentés immatures, et des Goélands arctiques (*Larus glaucoides*) pour des Goélands bourgmestres (*Larus hyperboreus*). Enfin, les résultats d'observation révèlent un très faible nombre de guillemots (*Uria* spp.) et de Mergules nains (*Alle alle*), ce qui contraste avec les données avérées sur l'effectif et la répartition de ces espèces au bord et sur le talus de la plateforme néo-écossaise pendant les mois d'hiver. Ces résultats sont probablement attribuables aux compétences des observateurs. La sous-représentation des Alcidés suscite des inquiétudes particulières, car ces espèces sont extrêmement vulnérables au mazoutage en mer. Il faudra remédier aux contraintes liées à la gestion des données, aux protocoles de recensement et à la formation des observateurs avant de pouvoir utiliser les jeux de données de l'OGOP comme outils de surveillance. Il est donc recommandé qu'un cours de formation annuel soit donné à tous les observateurs par un personnel qualifié afin de remédier aux problèmes exposés dans le présent rapport.

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1. INTRODUCTION

Since 1998, observers from the Oil and Gas Observer Program Canada (OGOP) Ltd. have been collecting seabird data on the edge and slope of the Scotian Shelf and in the Davis Strait. OGOP is owned and operated by representatives of the fisheries industry. The program was established to liaise and thereby minimize conflict between the fisheries and the hydrocarbon industries. Fisheries observers provided by OGOP are sent to offshore oil and gas facilities with the primary task of observing and reporting activities which may affect the fishing industry, and, as time permits, to collect seabird and marine mammal observations.

In light of the potential value that seabird data hold in supporting future environmental assessments and project-management needs, Canadian Wildlife Service (CWS) of Environment Canada has undertaken a review of seabird records collected by OGOP personnel between 2001 and 2003, on behalf of oil and gas operators. The intent of this review is to assist the industry in ensuring the adequacy and reliability of data collection efforts. It is important to note that this review should be seen as an initial exercise on assessing the quality of the data currently being collected, and does not reflect any wrong-doing of the observers who conducted the seabird surveys to the best of their abilities.

Initially the data was evaluated based solely on issues related to environmental conditions during data collection and study design. Subsequently, a more thorough evaluation was done on the remaining data to assess its reliability related to seabird identification and known distribution. We end this report with a list of recommendations to improve the data collection of observers from OGOP.

We wish to acknowledge the hydrocarbon industry for their effort in collecting seabird data, on a completely voluntary basis. We recognize that the OGOP dataset possesses great potential to update the knowledge on seabird distribution and abundance for the Scotian Shelf and the Davis Strait. This review would not have been possible without the collaboration of the various companies that kindly allowed us to use their seabird data, namely Canadian Superior Energy Inc., Chevron Canada Limited, EnCana, Marathon Canada Limited, and Shell Canada Limited.

2. METHODS

2.1 Study site

Between 2001 and 2003, 4315 separate observations of seabirds were documented from stationary and moving platforms on the edge and slope of the Scotian Shelf (Fig. 1 and Fig. 2). In addition, one survey was conducted in the Davis Strait in August 2001 (Fig. 3).

2.2 Study design

Seabird data were collected by 17 OGOP observers, seven of whom received formal training either in 1998 or 2002 (S. Farwell-Scarfone, pers. comm.). Training typically consisted of an in-class component, which lasted 3-4 hours, followed by a 2-4 hour boat trip. Training focused almost exclusively on seabird identification (F. Lavender, pers. comm.). Observers who did not receive this training were given a sheet with a protocol provided by CWS, and a seabird identification manual (S. Farwell-Scarfone, pers. comm.). The protocol instructed observers to count all birds in a 180° field forward from the observation point of the platform, and record birds seen within 300 m from the platform separately from those seen beyond 300 m. Observations were to be conducted in blocks of 10-minute periods during daylight hours and suspended when visibility was poor and when the speed of the vessel was less than five knots. Birds following the moving vessel were to be recorded only once during the 10-minute period. No separate instructions were given for stationary platforms. In addition to recording information on seabirds, observers were asked to provide information related to the observation period itself and record the environmental conditions occurring during the observation period.

Observers recorded their observations on data sheets provided by the company for whom they were collecting the data. These completed data sheets were made available to CWS, who entered all records into a database.

2.3 Data analysis

2.4.1 Data screening

All records entered in the OGOP database were screened before being formally evaluated. Records were eliminated from future analyses if they lacked: 1) required information regarding data collection or 2) did not follow the standardized survey design as described below.

2.4.1.1 Data collection

Records were dismissed when the following fields were lacking regarding the observation period itself: 1) date and time of observation, 2) length of observation, 3) speed of moving platform, 4) activity of platform, and 5) angle of field of view. Records were also dismissed when the following environmental information was not recorded: 1) visibility and 2) sea state.

2.4.1.2 Survey design

In order to be able to use the data empirically (e.g., to assess seabird abundance or species composition), it is important to follow protocols. Data collected under a modified protocol are not comparable among surveys. The OGOP data were screened based on protocols currently in place and generally accepted in Canada (Montevecchi and Burke 2002, Baillie et al. 2005). Records were dismissed when data were not collected following the accepted protocol. Observers were supposed to record all seabirds seen during a 10-minute observation period within a 180° radius. However, observation periods lasting 20 minutes in length from stationary platforms were also deemed appropriate as this protocol was followed by observers collecting seabird data on the Grand Banks (Baillie et al. 2005). An observation was discarded if the birds seen within 300 m from the observation platform were not recorded separately from those beyond 300 m. Observations from moving vessels were not used in the reliability assessment if the speed of the vessel was not four knots or greater (Tasker et al. 1984).

2.4.1.3 Detectability

Environmental conditions can greatly influence the extent to which birds are detected on the ocean (Tasker et al. 1984, Van der Meer and Camphuysen 1996). Therefore, bird counts were plotted against the visibility, sea state, and wind speed that occurred during the watch. A visual inspection of the scatter plots revealed at which point bird counts were low in relation to certain environmental conditions, and hence unreliable; these data were omitted from future analyses. Wind speed was not available for all watches. However, because sea state and wind speed are closely related, it was assumed that records omitted due to rough seas would by default exclude those with high wind speeds.

2.4.2 Evaluation of Observations

2.4.2.1 Seabird abundance around stationary platforms

Surveys conducted from stationary platforms on the Grand Banks lasted 20 minutes in length with an unlimited observation radius (Baillie et al. 2005). For our analyses, we combined bird observations from within and beyond 300 m to ensure data were comparable to those collected on the Grand Banks. For surveys lasting 20 minutes in length, we used the maximum number of individuals of a given species seen within a 20-minute period for each day. When surveys were done in several 10-minute periods within a given day, the maximum number for each species in two consecutive 10-minute periods were combined for each day. Mean abundance was calculated by dividing the sum of the maximum number of birds seen per day by the total number of observation days. Due to the close proximity of the stationary platforms to one another (within an 80 km radius; Fig. 1), and because we were interested in assessing mean abundance by month, records from all four stationary platforms were pooled together. However, we also compared seabird abundance (using a two-sample t-test) and composition between platforms when observations occurred on the same day (Galaxy 2 and West Navion in the spring, and Drill Rig RG-5 and West Navion in summer). Abundance trends across months were analyzed using an ANOVA with month as the categorical factor. Relative abundance for each species (mean abundance multiplied by 100 and divided by sum of mean abundance of all species) was calculated by season: winter (Dec-Feb), spring (Mar-May), summer (Jun-Aug), and autumn (Sep-Nov).

2.4.2.2 Seabird abundance around moving platforms

Number of birds seen within a 10-minute period inside the 300 m boundary from the vessel was transformed into densities (birds/km^2). This was done by dividing the total number of birds seen within a 10-minute period by the total area surveyed during that period (i.e., distance traveled, determined in km within a 10-minute period based on ship speed, multiplied by 0.3 km). Surveys were conducted along the shelf edge (Fig. 2) between January 2002 and December 2003, and in the Davis Strait in August 2001 (Fig. 3). Density trends across months were analyzed for data collected on the edge and slope of the Scotian Shelf (all years combined) using an ANOVA with month as the categorical factor. Subsequently, relative density for each species was calculated by season: winter (Dec-Feb), spring (Mar-May), summer (Jun-Aug), and autumn (Sep-Nov).

3. RESULTS

3.1 Data screening

Of the 4315 records collected by OGOP observers, 2505 (58.1%) were dismissed during the screening process. Most of these records (79.6%) were eliminated because of missing data, especially environmental information (Table 1). Of the total records, 511 were dismissed because observations did not abide to the standard survey design (Table 1).

Scatter plots showed that the detection rates of birds varied little across changing environmental conditions, suggesting that observations were conducted primarily during good weather conditions. Hence, few records (< 5% of total screened data) were eliminated as a result of unfavorable environmental conditions from both stationary and moving platforms (Table 2).

3.2 Evaluation of Observations

3.2.1 Seabird abundance around stationary platforms

A total of 20 seabird species, two sea duck species, and one wading bird (Great Blue Heron (*Ardea herodias*)) were observed from the stationary platforms (Table 3). Greater Shearwaters (*Puffinus gravis*), Herring Gulls (*Larus argentatus*), and Black-legged Kittiwakes (*Rissa tridactyla*) were the most abundant species seen, comprising together 74% of all individuals observed. Mean daily abundance for all species combined differed significantly across months ($F_{9,99} = 2.92$, $P = 0.004$), with September having the highest counts (65.0 ± 16.6 birds) and May the lowest (19.00 ± 10.31 birds; Fig. 4).

Of the species with most sightings, Herring Gulls occurred in highest proportions (48%) during the winter while Greater Shearwaters dominated sightings during the summer (49%) and fall (60%; Fig. 5). Black-legged Kittiwakes, Herring Gulls, and Greater Shearwaters were observed in similar proportions during the spring (24-28%; Fig. 5). Less common species also showed seasonal variability. The relative abundance of Great Black-backed Gulls was lowest in spring (8%) and highest in summer (15%; Fig. 5). Northern Gannets (*Morus Bassanus*) were rarely seen during the summer months (< 1%) but were regularly sighted throughout the rest of the seasons (8-11%; Fig. 5). Northern Fulmars (*Fulmarus glacialis*) were in low proportions in winter (9%), spring (2%) and summer months (4%), and were completely absent during the fall (Fig. 5). Sooty Shearwaters (*Puffinus griseus*) were most abundant during the fall (10%) compared to the other three seasons (Fig. 5). Wilson's Storm-Petrels (*Oceanites oceanicus*) were completely absent during the winter but represented 3% of all species seen in the summer. Dovekies (*Alle alle*) were present only in the winter, making up 6% of all species observed during that time of year (Fig. 5). All other species listed in Table 3 had relative abundance estimates of < 1% in any given season.

3.2.2 Differences among platforms in 2002

The two platforms where observations occurred simultaneously during the spring of 2002 (Galaxy 2 and West Navion) reported similar number of birds within a 10-minute period ($t = 0.18$, $p = 0.87$, d.f. = 10; Fig. 6). The relative abundance of species recorded was also similar. Black-legged Kittiwakes dominated the sightings at both platforms, followed by Northern Gannets, and then by gull species (Fig. 6).

The number of birds recorded per 20-minute period differed significantly between the two platforms conducting surveys on the same days in August 2002, with bird abundance being more than twice as high on the Drill Rig RG-5 compared to the West Navion ($t = 5.57$, $p < 0.001$, d.f. = 18; Fig. 6). Greater Shearwaters were the most common species seen from both platforms (Fig. 6). However, higher species diversity was recorded around the West Navion compared to the Drill Rig RG-5 (10 and 4 species recorded respectively; Fig. 6).

3.2.3 Seabird abundance recorded from moving platforms

3.2.3.1 Data collected on the edge and slope of the Scotian Shelf

A total of 11 seabird species and one terrestrial species, the Cliff Swallow (*Petrochelidon pyrrhonota*), were observed from moving platforms on the edge and slope of the Scotian Shelf (Table 4). Greater Shearwaters and Northern Fulmars were the most abundant species seen within 300 m of the platforms, together comprising 95% of all individuals observed (Table 4). Mean daily abundance for all species combined differed significantly across months ($F_{7,321} = 6.70$, $P < 0.001$), with October densities notably higher compared to the other months, with a peak of 166 birds/km^2 (Fig. 7).

Of the most abundant species observed, Herring Gulls occurred in highest proportions on the edge and slope of the Scotian Shelf during the winter (74%) while Greater Shearwaters were the most abundant species during the summer (83%) and fall (86%; Fig. 8). Northern Fulmars were sighted in the fall (11%), but were rarely seen in the summer (2%) and not noted at all during the winter (Fig. 8). In contrast to surveys conducted at stationary platforms, abundance of Northern Gannets and Great Black-backed Gulls were low throughout the three seasons sampled (< 1%; Fig. 8). Wilson's Storm-Petrels occurred in relatively high densities in the winter (9%) but were virtually absent in the fall (< 1%), while Leach's Storm Petrels were observed in significant numbers only in the summer (9%; Fig. 8). Black-legged Kittiwakes were observed in low proportions (< 1%) in the fall only (Fig. 8). All other species listed in Table 4 had relative density estimates of less than 0.1% in any given season.

3.2.3.2 Data collected in the Davis Strait

Eight seabird species were observed during surveys conducted in the Davis Strait in August 2001 (Table 5). Within 300 m from the platform, Black-legged Kittiwakes were seen in highest densities at 29.6 ± 9.5 birds/km^2 (N = 37), followed by Northern Fulmars (22.7 ± 4.0 birds/km^2, N = 37). All other species listed in Table 5 occurred in low densities, with estimates of less than 0.3 birds/km^2.

4. DISCUSSION

4.1 Evaluation of abundance and species composition

4.1.1 Seabird observations on the edge and slope of the Scotian Shelf

4.1.1.1 Shearwaters and fulmars

The most common species recorded by observers on stationary and moving platforms during summer and fall was the Greater Shearwater. This is consistent with what is known about their pelagic distribution. Greater and Sooty Shearwaters breed in the Southern Hemisphere and many spend their non-breeding season (i.e., our summers) in North Atlantic waters. Greater Shearwaters reach eastern Canadian waters in May, increase in numbers in July, and can remain in the Bay of Fundy well into November before returning to the Southern Hemisphere (reviewed in Brown et al. 1975, Brown 1986). Data collected from moving platforms showed that overall bird densities peaked to over 150 birds/km^2 in October, with several observations of greater than 500 Greater Shearwaters driving this number; such high abundance of Greater Shearwater in October is also consistent with previous findings (Brown 1986). However, few sightings of Sooty Shearwaters were recorded by OGOP observers, although they are commonly seen in early summer on the edge and slope of the Scotian Shelf (Brown et al. 1975, Brown 1986). The highest proportion of Sooty Shearwaters was seen from stationary platforms in the fall, which is when they are expected to be in British waters (Brown et al. 1975, Brown 1986), but these sightings may mark the beginning of their southerly migration down the eastern Atlantic. A total of two Sooty Shearwaters were seen from moving platforms; both sightings occurred in August.

The Manx Shearwater is the only species of this family that breeds in the northwest Atlantic and is known to occur regularly in these waters during late summer (Brown 1986). This is not reflected in the OGOP data where very few Manx were seen from stationary platforms (14 observed in September) and none were recorded from moving platforms. No Cory's Shearwaters were recorded, although they too are considered regular visitors during the summer months on the outer edge of the Scotian Shelf (Brown et al. 1975, Brown 1977, 1986). Based on the previously observed abundances of the four shearwater species it is believed that the low numbers of Sooty, Manx and Corey's Shearwaters recorded by OGOP observers is due to misidentifying them as Greater Shearwaters.

Northern Fulmars were most commonly seen by OGOP observers in the fall from moving platforms, and during the winter and fall by observers from stationary platforms. Few were seen during the summer months. This seasonal pattern has previously been observed for the Scotian Shelf, although the highest abundance is expected during the winter months (Brown 1986). No fulmars were seen from moving platforms during the winter, although this may be due to low sampling effort as only two surveys conducted in December and January were included in the analyses. Alternatively, observers may have misidentified Northern Fulmars as Herring Gulls (see below).

4.1.1.2 Large gulls

The relative abundance of Herring Gulls reported by OGOP observers from both platform types seems unusually high in relation to Northern Fulmar and Great Black-backed Gull numbers. Herring Gulls are common on the Scotian Shelf in the winter, increase in numbers in the spring, but then move inshore in the summer and increase in densities on the Scotian Shelf again after the breeding season in the fall (Brown 1986). Great Black-backed Gulls follow a similar seasonal distribution as Herring Gulls, but are less abundant overall (Brown 1986).

Although Herring Gull numbers are expected to be high during the winter months, Herring Gulls and Northern Fulmars can be mistaken for one-another by inexperienced observers as they both are similar in size and have a gray mantle with a white underbelly, head, and tail. Immature Great Black-backed Gulls may also have been confused for immature Herring Gulls. Very few Great Black-backed Gulls were recorded overall by OGOP observers, with the only significant sighting occurring during the spring from moving platforms. Alternatively, Herring Gull numbers may have been overestimated if individuals were counted more than once during a survey. Some species, in particular Herring Gulls, are attracted to offshore platforms (Tasker et al. 1986) and individuals may become associated with a particular platform over a period of time.

White-winged gulls (i.e., Glaucous and Iceland Gulls) made up a small proportion of all birds seen on the Scotian Shelf by OGOP observers, consistent with previous findings. Iceland and Glaucous Gulls are expected to occur in very low numbers on the Scotian Shelf, with sightings taking place primarily in the winter and early spring (Brown et al. 1975, Brown 1986). Of the two white-winged gull species recorded, OGOP observers saw a higher proportion of Glaucous Gulls (95%) compared to Iceland Gulls (5%), although Iceland Gulls are more common (Brown et al. 1975). These two species visually differ in subtle ways and hence to the inexperienced observe, are easily confused, which may have been the case for OGOP observers.

4.1.1.3 Black-legged Kittiwakes

During the winter months, most of the Black-legged Kittiwakes seen in the northwest Atlantic are aggregated on the Grand Banks and further north, although some do over-winter on the Scotian Shelf (Brown 1986). Kittiwakes are virtually absent during the summer and return to Nova Scotian waters by the fall (Brown 1986). This seasonal pattern was reflected in the OGOP data from stationary platforms, although very few kittiwakes were seen overall (< 1% of all birds recorded) from moving platforms.

4.1.1.4 Storm-Petrels

Most of the Storm-Petrels recorded by OGOP observers were identified as Wilson's Storm-Petrels, with Leach's Storm-Petrels seen in significant abundance only in the summer from moving platforms. These observations are consistent with what is known about their pelagic distribution, as both species are abundant in the northwest Atlantic from May through September, with Wilson's Storm-Petrels being particularly plentiful in the warmer waters of the Gulf Stream (Brown et al. 1975, Brown 1977, 1986). The relative high densities of Wilson's Storm-Petrels observed from moving platforms during the winter seem unlikely, as these birds breed in the Antarctic and should have returned to their breeding grounds by November or December (reviewed in Brown 1986). Leach's Storm-Petrels also migrate south during the winter months and are therefore absent from our waters during this time (Brown 1986).

4.1.1.5 Jaegars and skuas

OGOP observers recorded only one jaeger on the slope of the Scotian Shelf. Low numbers are expected off the Scotian Shelf as Pomarine (*Stercorarius pomarinus*) and Parasitic (*S. parasiticus*) Jaegers occur only occasionally between May and October and are rare outside of these months. Long-tailed Jaegers (*S. longicaudus*) are seldom ever seen on the edge and slope of the Scotian Shelf (Brown et al. 1975).

Skuas are also only occasionally seen on the edge the Scotian Shelf, however, sightings may occur year round (Brown et al. 1975, Brown 1986). The most prevalent records are of the Great Skua (*Stercorarius skua*), although sightings of the South Polar Skua (*S. maccormicki*) are becoming more common (Brown 1986). Great Skuas typically are seen more consistently on the edge and slope of the Scotian Shelf at the end of April and are gone by the end of November. South Polar Skuas tend to arrive from their Antarctic breeding grounds later than Great Skuas (end of June). The number of skua records reported by OGOP observers is consistent with what is expected for the Scotian Shelf, although only Great Skuas were identified. It is recognized that skuas are challenging to identify at sea even by experienced observers (Brown 1986).

4.1.1.6 Dovekies and murres

Overall, OGOP observers saw very few Dovekies and murres despite their common occurrence on the edge of the Scotian Shelf during the winter (Brown et al. 1975, Brown 1986). This may be a result of observers biasing their attention to larger, more noticeable birds. Murres and Dovekies have a low detection rate compared to more conspicuous species, such as gulls and fulmars (reviewed in Gaston et al. 1987). These low detection rates are largely due to the birds' dark plumage and their behaviour of spending much of their time sitting calmly on the sea surface or foraging underwater. All of these characteristics make it challenging for the observer to detect all individuals, as these birds do not contrast well with the dark, dynamic surface of the ocean, and are undetectable while foraging. The low numbers of auks recorded by OGOP observers is a serious concern and a problem which has also been identified in data collected on the Grand Banks by the hydrocarbon industry (Baillie et al. 2005). Auks are extremely vulnerable when oiling events occur at sea. Accurate estimates of data on the distribution and abundance of auks are necessary to assess mortality estimates during such oiling events.

4.1.2 Differences among platforms in 2002

Observations conducted simultaneously from the Galaxy 2 and West Navion platforms in the spring produced similar seabird data. However, despite their close geographic proximities, observations from West Navion and Drill Rig RG-5 yielded different seabird abundance and species composition when surveys were conducted simultaneously in the summer. The higher species diversity noted from West Navion may be attributed to its close proximity to the shelf edge, compared to the more inshore location of Drill Rig RG-5, situated within 25 kilometres from Sable Island (Fig. 1). The presence of Sable Island may have also influenced the higher numbers of seabirds seen within an observation period from Drill Rig RG-5, as birds breeding on Sable Island could be drawn to the drill rig as a potential food source.

4.1.3 Seabird observations during August in the Davis Strait

Black-legged Kittiwakes and Northern Fulmars were the most common species seen by OGOP observers during August in the Davis Strait. These observations are consistent with the pelagic distribution of these two species, as Black-legged Kittiwakes and Northern Fulmars occur in high densities in the Davis Strait in July and August (Brown et al. 1975, Brown 1986). Most sightings of other less common species recorded by OGOP observers also appeared reliable. Pomarine Jaegers are common in the Davis Strait in August, along with Parasitic Jaegers, although the latter are somewhat less abundant than Pomarine Jaegars (Brown et al. 1975). Glaucous Gulls concentrate in the Davis Strait by October (Brown 1986) but do occur in lower numbers in August (Brown et al. 1975). King Eiders (*Somateria mollissima*) are known to pass through the Davis Strait in August en route to their moulting grounds off Western Greenland (reviewed in Suydam 2000). However, the flock of Red-necked Phalaropes reported most likely consisted of Red Phalaropes (*Phalaropus fulicaria*), as Red-necked Phalaropes are rarely seen at sea (Brown 1975). Red Phalaropes, however, travel further offshore and are regularly seen in the Davis Strait in August (Brown 1986). Dovekies and Thick-billed Murres (*Uria lomvia*) are reported as quite common in the Davis Strait in July and August (Brown 1986). The low proportion of auks reported by OGOP observers may be attributed to their low detectability, which in turn is likely linked to the observers' experience, as mentioned earlier.

4.1.4 Summary

Data collected by OGOP observers were compared to previous survey data for the areas (Brown et al. 1975, Brown 1977, 1986). With a few exceptions, observers seemed to reliably assign birds to the appropriate genus; however, assigning the correct species appeared less reliable. In particular, observers appeared to have difficulties differentiating between Greater Shearwaters from other less abundant shearwater species. There is also concern that observers may not always be distinguishing between Herring Gulls and Northern Fulmars, two species that look similar based on plumage coloration, but otherwise are easily differentiated using behavioral indicators. Overall, observers appeared to correctly differentiate between white-winged and black wing-tipped gulls, but may have misidentified immature Great Black-backed Gulls as immature Herring Gulls, and Iceland Gulls as Glaucous Gulls. Finally, very few auks were observed, which may also be linked to the experience of the observers (Van der Meer and Camphuysen 1996). It is important to correctly identify and detect as many individuals as possible in order to obtain reliable estimates of the type and abundance of seabirds that travel through or utilize the waters where observations are being made. These estimates, in turn, can be used to monitor population trends, migration routes, and assess the impacts that an oil spill or any other event may have on the population of each species.

4.2 Recommendations for improvement

OGOP observers had the opportunity to collect data year round, covering a wide spatial area, particularly along the edge of the Scotian Shelf. Clearly, there is great value in having OGOP observers continue these observations, as seabird information from the offshore is logistically difficult to collect systematically in other situations. The value of data collected by volunteers increases greatly if they follow an established protocol (Dunn et al. 2005) and are well trained and skilled in the data collection techniques. Although OGOP observers are not volunteers per say, they are asked to put time aside to conduct seabird observation between other duties assigned to them. We recognize that OGOP observers are not first and foremost ornithologists, and that varying observer skills are to be expected. However, it is necessary to improve the data collection skills and reliability of seabird identification of observers before this dataset is to be used as a monitoring tool. Following are some recommendations to help improve the program.

4.2.1 Data collection

Recording sheets used by OGOP observers differed between companies, varying in format and information to be completed. To ensure that recording sheets contain all information essential for adequate data analysis, we recommend that all observers be provided with a standardized recording sheet developed by CWS (see *Standardized Protocols for Pelagic Seabird Surveys from Moving and Stationary Platforms for the Hydrocarbon Industry*, CWS publication).

Although the data were systematically entered electronically by OGOP observers, this was done in an unusable format for data analysis (i.e., as a text document). Consequently, all data had to be re-entered into a database, which took six full weeks to complete. In order to make the data quickly accessible and reduce transcription error, observers should enter their records at the end of each observation day (including days where no birds were seen) into a standardized database. Such a practice would ensure that all information related to the observation period is included and accurate. Original sheets should nonetheless be stored in a binder for future reference if needed. The setup of a suitable database should be done collaboratively with OGOP and CWS personnel to ensure that the chosen interface is appropriate and meets the needs of both parties.

4.2.2 Observer training

4.2.2.1 Species identification

It is apparent that some observers lacked proper training to conduct observations at sea. Observing seabirds at sea is not a trivial task, as birds are usually seen at a distance and can fly by very quickly, allowing the observer only a few seconds to make an identification. Inexperienced observers tend to rely on plumage coloration and other morphological traits to differentiate between species, which can lead to error as some species differ in this way only very slightly and distinguishing traits can be difficult to see at a distance. Therefore, it is essential that observers are taught what behavioural distinguishing characteristics can be used to differentiate between two closely related species.

As a priority, observers must be able to reliably distinguish between the most common species. Observers recording data on the edge and slope of the Scotian Shelf must be able to differentiate between: 1) the four shearwater species (Greater, Sooty, Manx, and Cory's), 2) the two large black wing-tipped gulls (Herring and Great Black-backed) in all their age classes, 3) Herring Gulls and Northern Fulmars, 4) Herring Gulls and Black-legged Kittiwakes, and 5) the two storm-petrel species (Wilson's and Leach's). If species identification is not possible then the bird should be assigned to the appropriate genus or family. As a second priority, observers should differentiate between the common (listed above) and rarer species. Only observers with considerable experience would be expected to differentiate between a South Polar Skua from a Great Skua, or an Audubon's Shearwater (*Puffinus lherminieri*) from a Manx Shearwater.

As a last priority, it is recommended that observers record additional information related to individual birds. Specifically, observers should record whether birds are on water or in flight, and for birds in flight, whether they are flying by the platform, feeding, or are somehow associated with the platform (i.e., circling, following, etc.). Such information would allow better understanding of bird distributions (e.g., attracted to platforms, migrating, foraging, etc.). Other information such as age and plumage (i.e., winter versus breeding plumage) should also be recorded whenever possible. OGOP observers occasionally recorded age (17% of all records), but no information on plumage was documented. This information would provide insight on a species' demography, such as migration routes, and important wintering and moulting grounds.

Training all observers on a regular basis is essential in aiding individuals to improve and fine-tune their skills. Training sessions are good venues to provide observers with feedback on their identification skills and supplement their knowledge with tips on how to differentiate between the rarer species once they feel comfortable identifying the more common ones. Observer training is also instrumental in providing previous knowledge on what species to expect in a given area at a given time of year, which in turn will increase the reliability of the data collected.

4.2.2.2 Species abundance

Another issue of concern involves the accuracy of number of individuals seen within a given observation period. Although many data sheets did have records with "no observations" when no birds were seen during an observation period, not all observers followed this practice (S. Farwell-Scarfone, pers. comm.). Furthermore, anecdotal information suggest that birds were seen but not recorded, especially when species identification was uncertain. The OGOP dataset contained very few records of birds that were not identified to species (< 1%) in comparison to seabird data collected on the Grand Banks (4%; Baillie et al. 2005). It is expected that not every bird will be identified to species due to various reasons (e.g., brief opportunity to view, lighting condition, etc.). However, it is important to record all unknowns, even if they are identified only as "gull" or "bird", in order to accurately assess temporal trends of bird abundance and their attraction to platforms.

4.2.2.3 Following standardized protocols

Some observers followed the survey protocol rather loosely, as shown with high inter-observer variability related to survey effort. Number of surveys conducted per day ranged from 0 to 4 surveys, with observation periods lasting anywhere between 10 minutes to an impressive 10 hours. Of course, it is unlikely that one observer spent the entire 10 hours dedicated to collecting seabird data. The length and frequency of surveys will depend on the platform type (i.e., stationary or moving). A detailed survey protocol has been designed by CWS specifically for observers conducting surveys for the hydrocarbon industry (*Standardized Protocols for Pelagic Seabird Surveys from Moving and Stationary Platforms for the Hydrocarbon Industry*, CWS publication) and it is recommended that observers be trained to follow this protocol. We would like to note that some companies are already working closely with CWS to ensure that standardized protocols are being followed by trained observers, and we are already seeing a marked improvement in the quality of the seabird data collected.

In summary, it is essential to have staff properly trained to identify subtle differences that could differentiate rare species from more common ones, in order to reliably document seabird abundance, species composition, and temporal trends. Furthermore, close to 60% of records were omitted from the evaluation process due to data sheets not being filled in properly or observers not following the standardized protocol. Therefore, we recommend a mandatory training course, provided by qualified personnel using CWS protocols, that involves both classroom and field training, to be taken on an annual basis by all observers. This training session will ensure that all observers are: 1) following a standardized protocol, 2) filling in the data sheets correctly and completely, and 3) improving their bird identification skills.

4.3 Recommended data use

Notwithstanding continuing data gaps with respect to sampling (i.e., temporal and spatial), the OGOP dataset is recognized as a considerable contribution to seabird monitoring efforts on the Scotian Shelf and slope. As with any monitoring effort, OGOP data will increase in value and utility as more observations are collected over time and as survey methods and training are improved. Data collected on the slope edge will be of particular value, given the distance from shore and the logistical difficulties associated with its collection.

For the purposes of future environmental assessments, it is recommended that companies use reliable data records that have been screened through the protocol described in Section 4. A database with screened records will be returned to OGOP, who in turn will distribute the data to interested parties upon request, pending permission from industry. It is recommended that OGOP data collected after 2003 be screened, following the same process described in this report. As a general rule, OGOP data should be considered as one source of information on marine bird distribution on the edge and slope of the Scotian Shelf. OGOP data should be supplemented by other available sources (e.g., Brown et al. 1975, Brown 1986) or by additional surveys if they are needed to fill data gaps important to the assessment. The more information collected for any given location, the better. When referencing data in future, this should be done in conjunction with the limitations described in Section 4.1 (e.g., identification to the genus level generally accurate, non-occurrence of a species cannot be inferred by its absence, scarcity of information on auks, etc.).

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Table 1. Summary of records dismissed during data screening.

Type	Reason for dismissal	No. records dismissed	% of total records
Data collection: Information missing related to observation period	- activity of platform unknown - observation length unknown - vessel speed unknown - date or time unknown - angle of field of view unknown	657	15.2
Data collection: Information missing related to environmental conditions during observation period	- visibility unknown - sea state unknown	1337	31.0
Survey design	- moving platform travelling < 4 knots - length of observation period not appropriate	511	11.8
TOTAL		2505	58.0

Table 2. Data filters used to assess good observation conditions from stationary and moving platforms on the Scotian Shelf. Records were removed when visibility and sea state scale numbers (1 being best visibility and calmest sea state) and wind speed exceeded those deemed unfavorable based on visual inspection of scatter plots.

Platform	Year	visibility (scale 1-9)	sea state (scale 1-9)	wind speed (km/hr)	% of records removed (N)
Galaxy 2	2001	1	<= 4	N/A	0% (0)
West Navion	2001	1	<= 3	< 30	0% (0)
M/V Zephir 1	2001	1	< 4	N/A	2.7% (3)
Deep Water Millenium	2002	1	<= 4	N/A	0% (0)
Drill Rig RG-5	2002	<= 2	<= 3	< 35	5.2% (15)
Galaxy 2	2002	1	<= 4	N/A	0% (0)
West Navion	2002	<= 2	<= 4	<= 50	< 1% (2)

N/A = data not available

Table 3. Seabird and waterfowl species recorded by OGOP observers from stationary platforms on the Scotian Shelf (2001-2002).

Species name	Latin name	Alpha code	No. birds (%)
Greater Shearwater	*Puffinus gravis*	GRSH	2025 (33.6)
Herring Gull	*Larus argentatus*	HERG	1243 (20.6)
Black-legged Kittiwake	*Rissa tridactyla*	BLKI	1215 (20.2)
Great Black-backed Gull	*Larus marinus*	GBBG	599 (9.9)
Northern Fulmar	*Fulmarus glacialis*	NOFU	242 (4.0)
Northern Gannet	*Morus bassanus*	NOGA	234 (3.9)
Wilson's Storm-Petrel	*Oceanites oceanicus*	WISP	158 (2.6)
Sooty Shearwater	*Puffinus griseus*	SOSH	117 (1.9)
Glaucous Gull	*Larus hyperboreus*	GLGU	56 (0.9)
Dovekie	*Alle alle*	DOVE	50 (0.8)
Long-tailed Duck	*Clangula hyemalis*	LTDU	19 (0.3)
Great Skua	*Stercorarius skua*	GRSK	17 (0.3)
Leach's Storm-Petrel	*Oceandroma leucorhoa*	LHSP	14 (0.2)
Manx Shearwater	*Puffinus puffinus*	MASH	14 (0.2)
Black Scoter	*Melanitta nigra*	BLSC	6 (0.1)
Common Murre	*Uria aalge*	COMU	4 (< 0.1)
Common Tern	*Sterna hirundo*	COTE	4 (< 0.1)
Iceland Gull	*Larus glaucoides*	ICGU	3 (< 0.1)
Lesser Black-backed Gull	*Larus fuscus*	LBBG	2 (< 0.1)
Razorbill	*Alca torda*	RAZO	2 (< 0.1)
Atlantic Puffin	*Fratercula arctica*	ATPU	1 (< 0.1)
Great Cormorant	*Phalacrocorax carbo*	GRCO	1 (< 0.1)
Unknown murre species	*Uria* spp.		1 (< 0.1)
TOTAL			6027

Table 4. Seabird species recorded by OGOP observers from moving platforms on the edge and slope of the Scotian Shelf (2001-2003).

Species name	Latin name	Alpha code	No. birds < 300 m (%)	No. birds > 300 m (%)
Greater Shearwater	*Puffinus gravis*	GRSH	4807 (85.6)	4214 (90.3)
Northern Fulmar	*Fulmarus glacialis*	NOFU	548 (9.8)	357 (7.7)
Herring Gull	*Larus argentatus*	HERG	56 (1.0)	21 (0.5)
Northern Gannet	*Morus bassanus*	NOGA	55 (1.0)	22 (0.5)
Black-legged Kittiwake	*Rissa tridactyla*	BLKI	47 (0.8)	2 (< 0.1)
Leach's Storm-Petrel	*Oceandroma leucorhoa*	LHSP	37 (0.7)	0 (0)
Wilson's Storm-Petrel	*Oceanites oceanicus*	WISP	29 (0.5)	33 (0.7)
Great Black-backed Gull	*Larus marinus*	GBBG	16 (0.3)	12 (0.3)
Unknown shearwater species	*Puffinus* species		12 (0.2)	3 (< 0.1)
Dovekie	*Alle alle*	DOVE	2 (< 0.1)	0 (0)
Sooty Shearwater	*Puffinus griseus*	SOSH	2 (< 0.1)	0 (0)
Pomarine Jaeger	*Stercorarius pomarinus*	POJA	1 (< 0.1)	0 (0)
Unknown murre species	*Uria* spp.		0 (0)	1 (< 0.1)
TOTAL			5612	4665

Table 5. Seabird species recorded by OGOP observers from moving platforms in the Davis Strait (August 2001).

Species name	Latin name	Alpha code	No. birds < 300 m (%)	No. birds > 300 m (%)
Black-legged Kittiwake	*Rissa tridactyla*	BLKI	484 (55.2)	169 (42.6)
Northern Fulmar	*Fulmarus glacialis*	NOFU	382 (43.6)	197 (49.6)
Pomarine Jaeger	*Stercorarius pomarinus*	POJA	4 (0.5)	0 (0)
King Eider	*Somateria mollissima*	KIEI	3 (0.3)	0 (0)
Parasitic Jaeger	*Stercorarius parasiticus*	PAJA	2 (0.2)	6 (1.5)
Thick-billed Murre	*Uria lomvia*	TBMU	2 (0.2)	4 (1.0)
Red-necked Phalarope	*Phalaropus lobatus*	RNPH	0 (0)	20 (5.0)
Glaucous Gull	*Larus hyperboreus*	GLGU	0 (0)	1 (0.3)
TOTAL			877	397

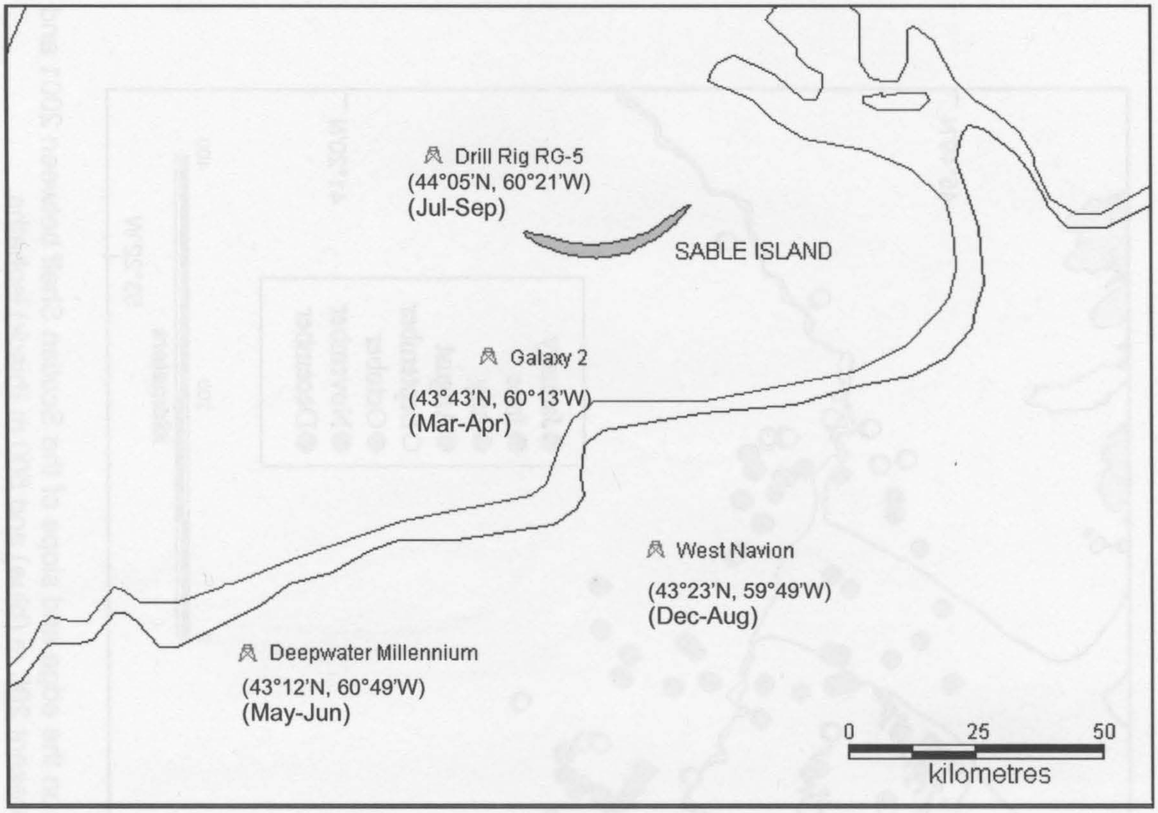

Figure 1. Location and month in which seabird observations were conducted by OGOP observers from stationary platforms on the Scotian Shelf (2001-2002). Contour lines represent 200 m (blue) and 500 m (black) isobaths.

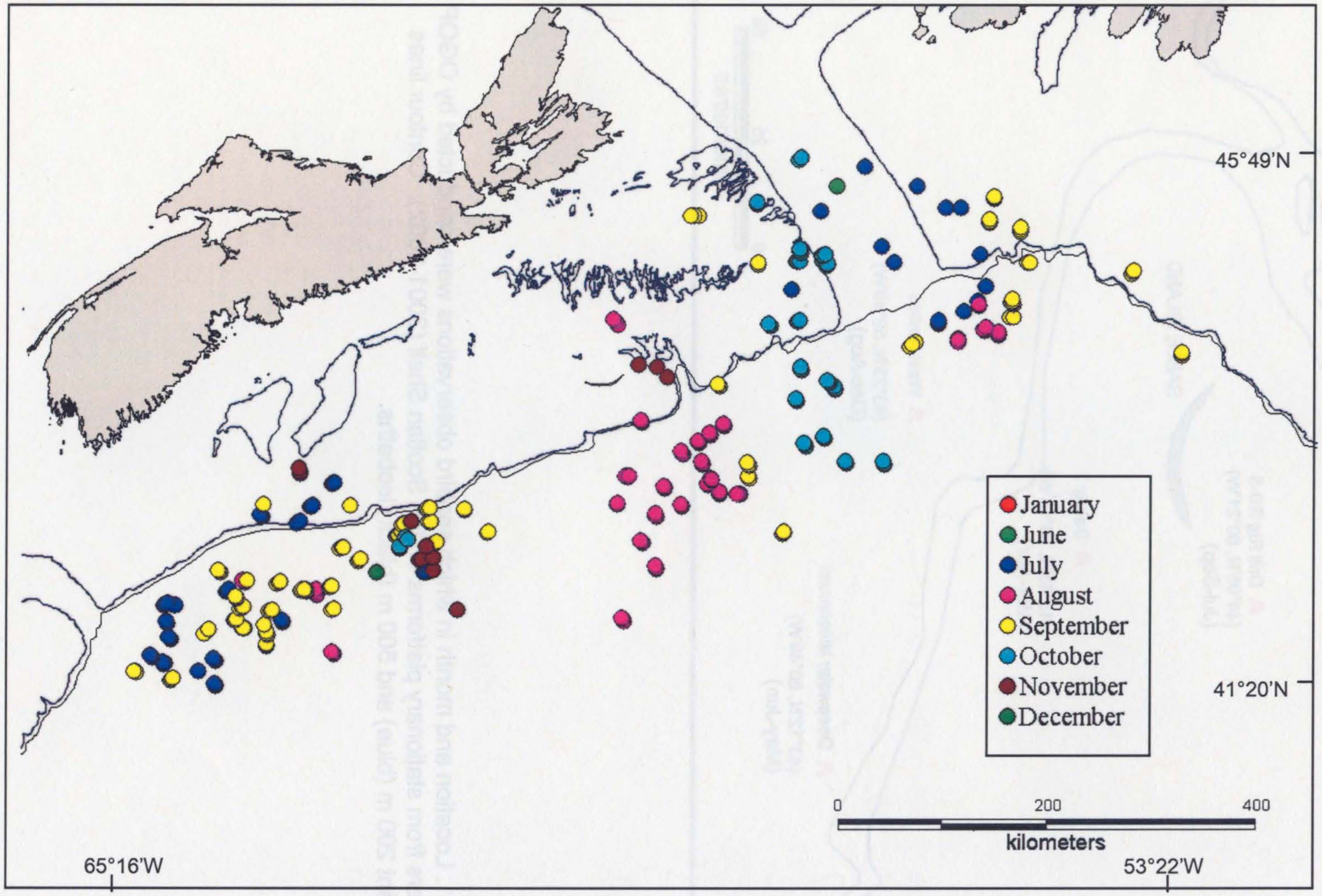

Figure 2. Area surveyed by OGOP observers from moving platforms on the edge and slope of the Scotian Shelf between 2001 and 2003. Each dot represents one 10-minute survey. Contour lines represent 200 m (blue) and 500 m (black) isobaths.

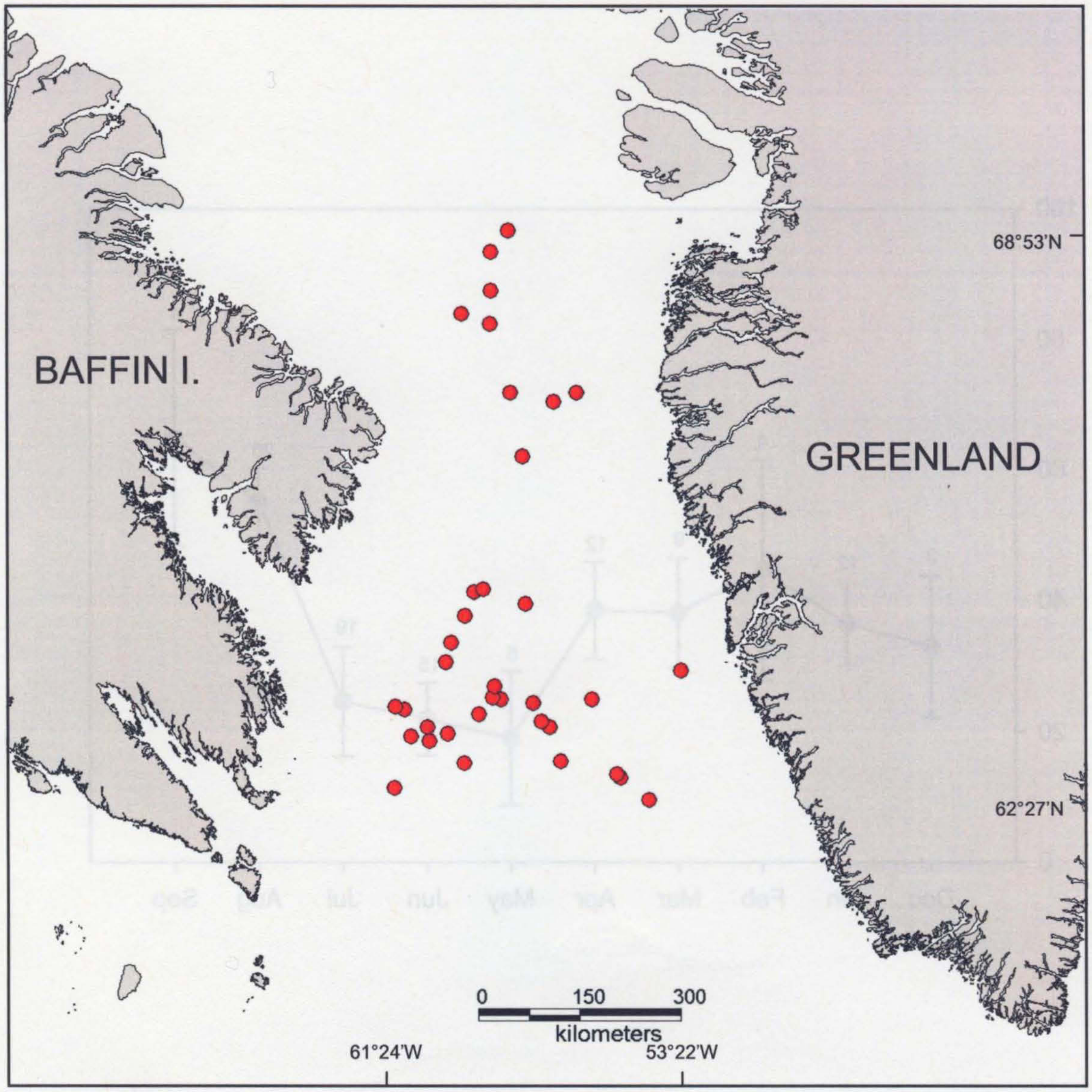

Figure 3. Area surveyed by OGOP observers from a moving platform in the Davis Strait in August 2001. Each dot represents one 10-minute survey.

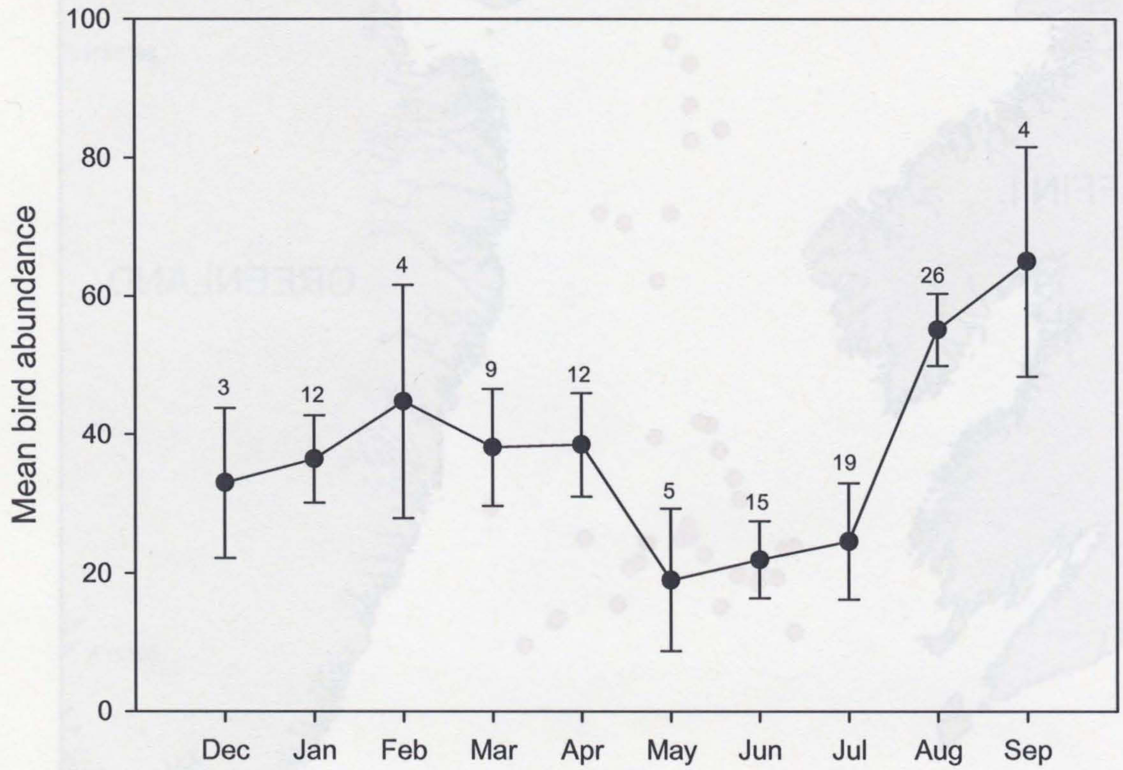

Figure 4. Mean number of birds seen (± SE) within a 20-minute period recorded by OGOP observers (Dec 2001 – Sep 2002) from stationary platforms on the edge and slope of the Scotian Shelf. Numbers above SE represent days sampled.

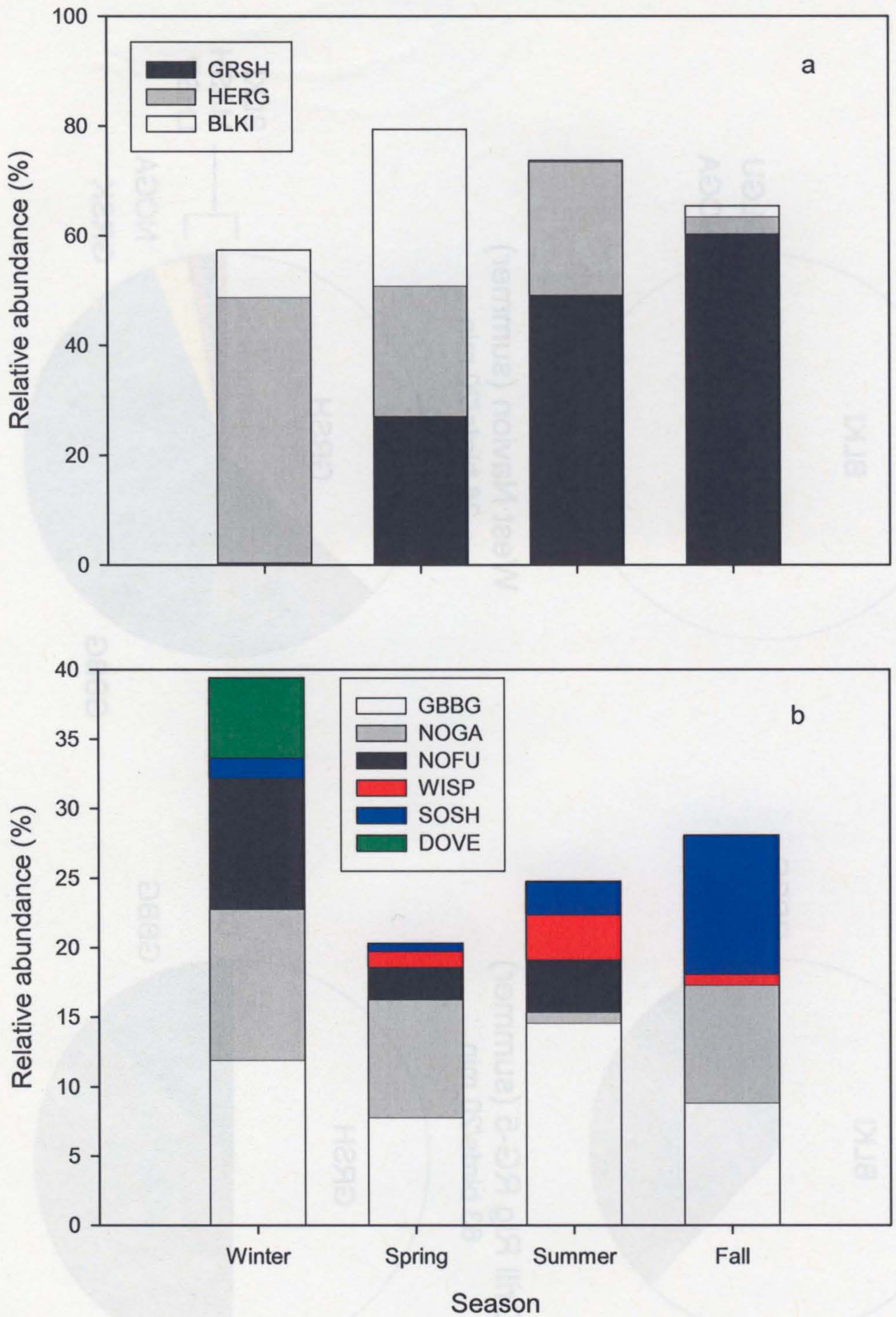

Figure. 5. Relative abundance of seabirds recorded by OGOP observers from stationary platforms on the edge and slope of the Scotian Shelf in winter 2001 and spring, summer, and fall 2002. Panel a represents the three most common species while panel b illustrates in more detail the less common species.

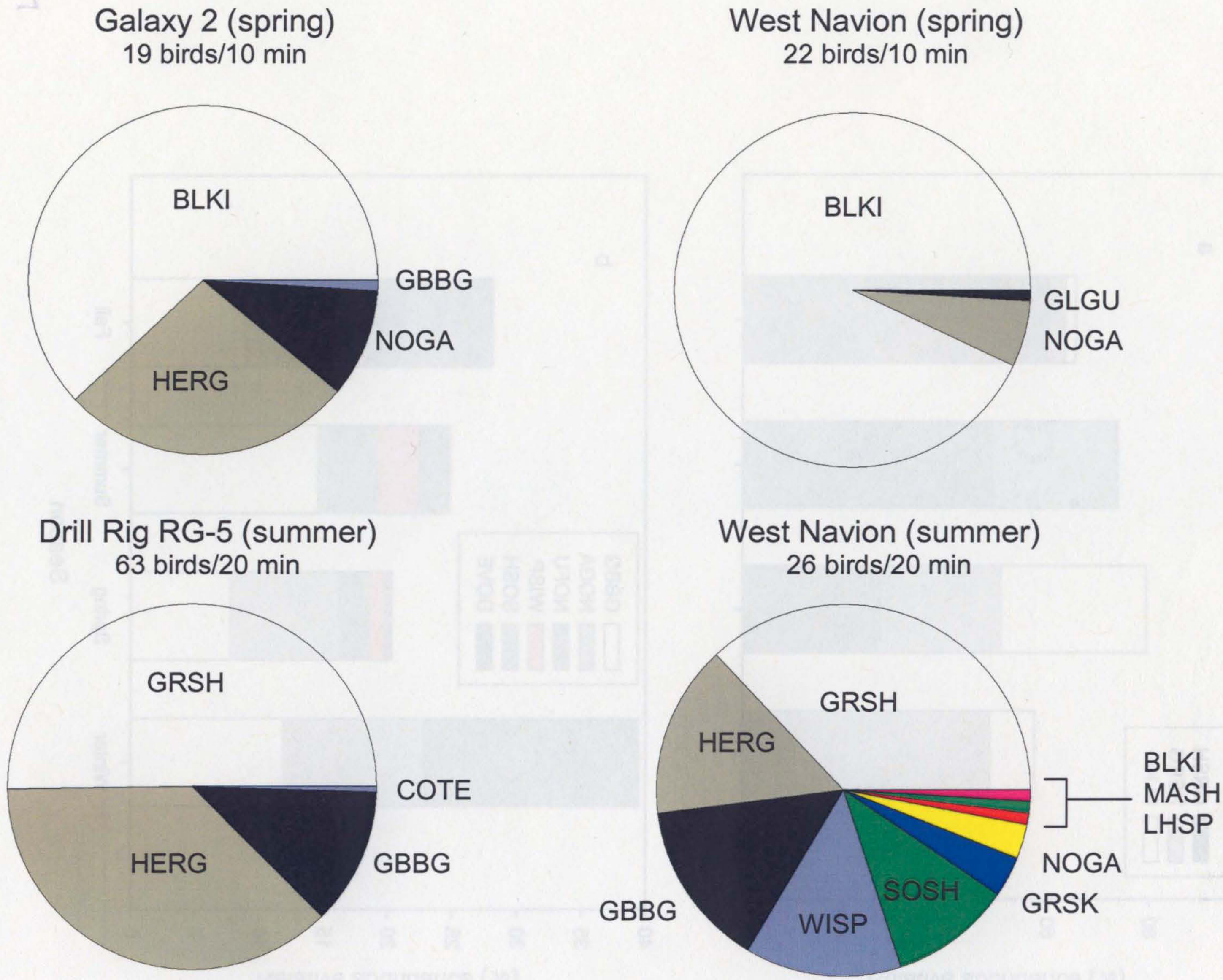

Figure 6. Relative abundance of seabirds among platforms where observations occurred simultaneously in spring and summer 2002.

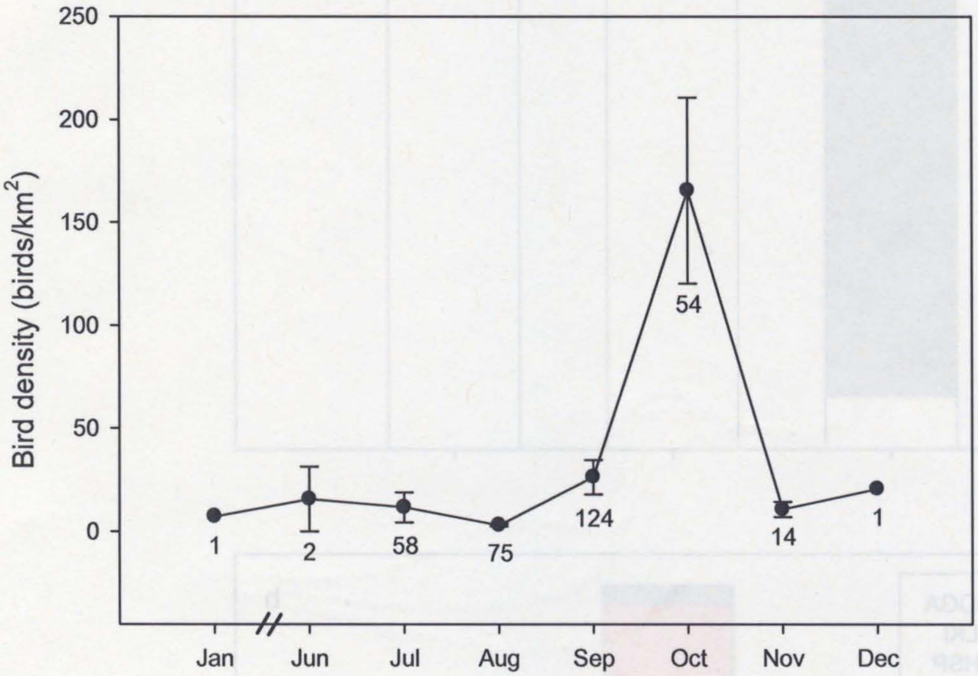

Figure 7. Density of birds (± SE birds/km^2) seen by OGOP observers from moving platforms on the edge and slope of the Scotian Shelf. Numbers below SE represent frequency of 10-minute observation periods conducted in each month.

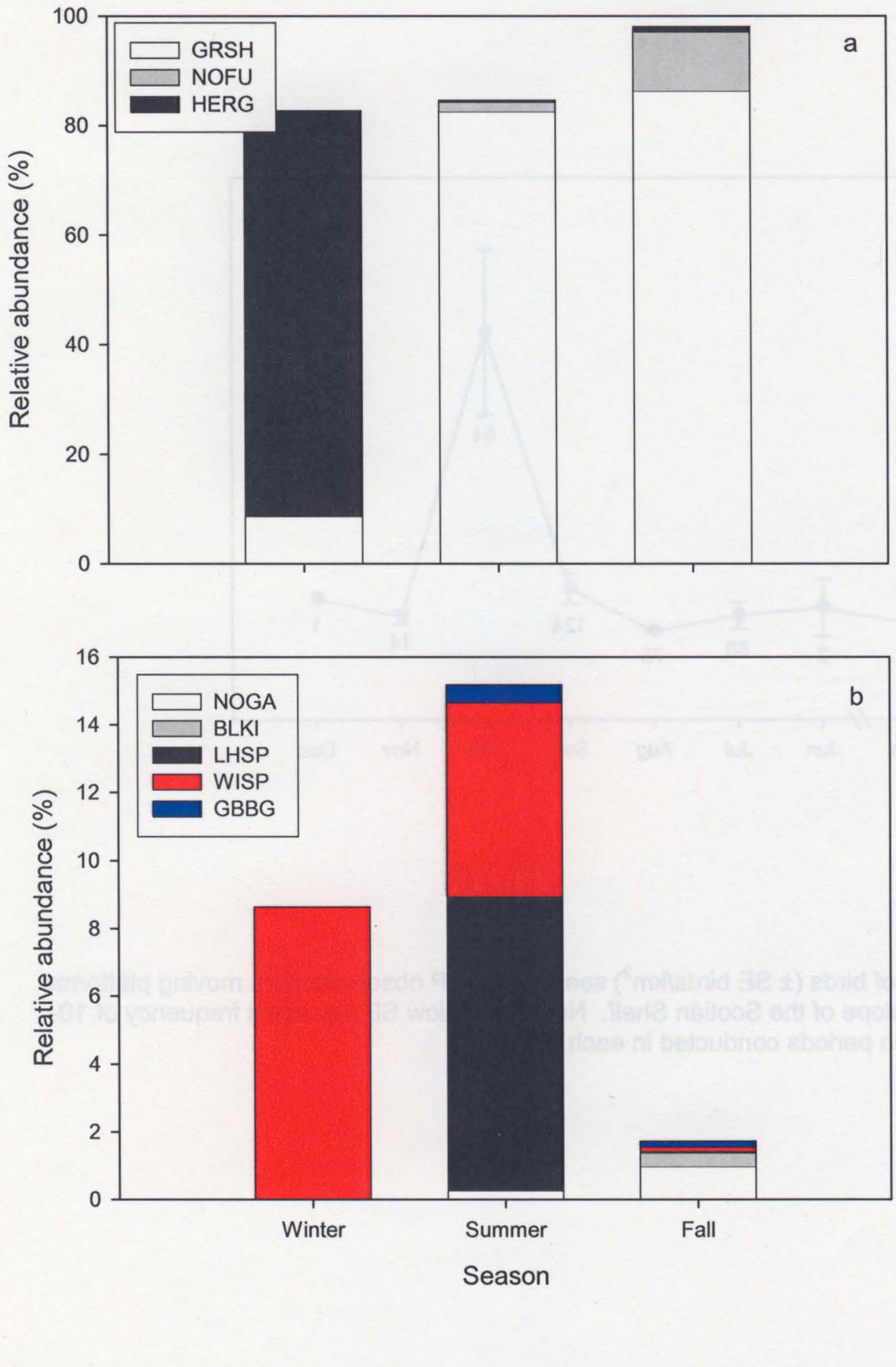

Figure 8. Relative density of seabirds recorded by OGOP observers from moving platforms on the edge and slope of the Scotian Shelf between 2001 and 2003. Panel a represents three most common species while panel b illustrates in more detail the less common species.