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SEABIRD AND SEADUCK MOVEMENT THROUGH THE NORTHUMBERLAND STRAIT, 1990

C. M. MacKinnon
R. W. Daury
R. J. Hicks



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C.M. MacKinnon 1/
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& R.J. Hicks 1/

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ABSTRACT

In 1990, 22 hours of observation, spread equally over 22 days between March 13 to May 15 and September 7 to December 6 recorded 5,214 (237 birds/hour) seaducks and seabirds moving past the headland of Cape Jourimain and through the Northumberland Strait. A total of 25 bird species were enumerated in the spring, being predominantly Red-breasted Merganser (*Mergus serrator*), Surf Scoter (*Melanitta perspicillata*), Herring Gull (*Larus argentatus*), Black Scoter (*Melanitta nigra*), Canada Goose (*Branta canadensis*), Great Black-backed Gull (*Larus marinus*), Northern Gannet (*Sula bassanus*), Oldsquaw (*Clangula hyemalis*) and Common Eider (*Somateria mollissima*). In the autumn, movement was slightly different, being predominantly Common Eider, Red-breasted Merganser, Surf Scoter, Double-crested Cormorant (*Phalacrocorax auritus*), unidentified loons, Oldsquaw, Northern Gannet, Herring Gull, Red-throated Loon (*Gavia stellata*), Black Scoter, White-winged Scoter (*Melanitta fusca*) and unidentified terns.

Peak spring movements were on April 6 with 347 birds per hour while peak fall movement was 609 birds per hour on October 30. Directional movement in the spring was not well defined with relatively the same degree of overall movement both north and south. Fall movement was more obviously a southward migration by nearly all species with the peak southward movement on October 23.

Additional supporting information from regional authorities was gathered for certain species such as the scoters, Common Eider, Common Loon, Red-necked Grebe and Northern Gannet. For these species our understanding of their movements, in a regional context, has been enhanced.

RÉSUMÉ

En 1990, 22 heures d'observation réparties également sur 22 jours s'étendant du 13 mars au 15 mai et du 7 septembre au 6 décembre ont permis de recenser 5,214 canards et oiseaux de mer (237 oiseaux par heure) dans le détroit de Northumberland. En tout, 25 espèces d'oiseaux ont été recensées au printemps; les espèces prédominantes étaient le Bec-scie à poitrine rousse (*Mergus serrator*), la Macreuse à front blanc (*Melanitta perspicillata*), le Goéland argenté (*Larus argentatus*), la Macreuse à bec jaune (*Melanitta nigra*), Le bernache du Canada (*Branta canadensis*), le Goéland à manteau noir (*Larus marinus*), le Fou de Bassan (*Sula bassanus*), le Canard kakawaki (*Clangula hyemalis*), et l'Eider à duvet (*Somateria mollissima*). À l'automne, les mouvements étaient quelque peu différents; dominaient alors l'Eider à duvet, le Bec-scie à poitrine rousse, la Macreuse à front blanc, le Cormoran à aigrettes (*Phalacrocorax auritus*), des huards non identifiés, le Canard kakawi, le Fou de Bassan, le Goéland argenté, le Huard à gorge rousse (*Gavia stellata*), la Macreuse à bec jaune, la Macreuse à ailes blanches (*Melanitta fusca*) et des sternes non identifiées.

L'apogée des mouvements printaniers s'est produite le 6 avril où l'on a vu 347 oiseaux l'heure, tandis que l'apogée des mouvements de l'automne s'est produite le 30 octobre où l'on a recensé 609 oiseaux par heure. Au printemps, les mouvements dans une direction donné n'étaient pas bien définis puisque l'on noté dans l'ensemble autant de mouvements vers le nord que vers le sud. En automne, il s'agissait plus évidemment d'une migration vers le sud pour presque toutes les espèces, migration qui a atteint son apogée le 23 octobre.

Les autorités régionales ont fourni d'autres renseignements supplémentaires sur certaines espèces comme la macreuse, l'Eider à duvet, le Huard à collier, le Grèbe jougris et le Fou de Bassan. Nos connaissances sur les déplacements de ces espèces dans nos régions ont été ainsi accrues.

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1.0 INTRODUCTION

Cape Jourimain National Wildlife Area (CJNWA) was established in 1979 to conserve and protect important habitat for migratory birds, specifically waterfowl and shorebirds. The National Wildlife Area (NWA) supports a high habitat diversity thus making it especially attractive to a wide diversity of wildlife.

Cape Jourimain is also an area of high geographic importance as it is the most prominent coastal headland in the Northumberland Strait. Furthermore, this headland is the closest point between the mainland and Prince Edward Island (PEI), effectively constricting the Northumberland Strait from an average width of about 30 km to 14.5 km across.

The strategic importance of the Cape Jourimain headland also has been evident to developers. As far back as 1900, the site has been identified as the most logical location to build a connection, "fixed link", between New Brunswick (NB) and PEI. The first such "link" was initiated in 1966 when a road and railway bed was built from highway #16 out to Jourimain Island. This road/rail bed, known locally as the "causeway", created two large brackish ponds out of what was once intertidal saltmarsh and irrevocably changed the character of the area.

The mid 1960s attempt for a fixed link between NB and PEI was not to be and construction was halted before work on the actual over-water structure commenced. The mid 1980s has resulted in a renewed interest to build a fixed link and it may become a reality. The tentative plan is to use the old road bed, built in 1966, as

the new approach for the proposed bridge between NB and PEI. If the link is built according to this plan the NWA will be bisected by a major highway along the present Department of Public Works right-of-way.

To provide pre-disturbance baseline data regarding the NWA, an intensive field investigation was conducted in 1989 to document the flora and avifaunal use of the area (Harries et al. 1991, MacKinnon and Hicks 1991a, respectively). As little was known regarding seabird and seaduck movement through the Northumberland Strait, monitoring of this activity was also initiated on a small scale. Results, although preliminary, were encouraging and this aspect of the study was expanded in 1990.

The observations of seaducks and seabirds moving through the Northumberland Strait, as observed from CJNWA, should be viewed as a small part of a much larger story. In this report we have drawn on many authorities in an attempt to fill in the "stories", where possible, surrounding each species. We have not commented on the possible effects or mitigable measures regarding a fixed link; our focus has been solely on the birds.

Considering the volume of data collected, and the myriad of possible sources of additional information, we have attempted to be thorough without being redundant. This was not always possible and, where it happens, we apologize.

2.0 STUDY AREA

Cape Jourimain National Wildlife Area borders on the Northumberland Strait at the southeastern extremity of NB (Figure 1). The 600 ha (1500 acre) coastal site was established in 1979 following the transfer of 205 ha from the Federal Department of Public Works in 1977 and the purchase of additional properties in 1979.

The Cape Jourimain headland extends seaward 2.5 km northeast of the Cape Tormentine peninsula and at its extremity is only 14.5 km from PEI. The Northumberland Strait is a crescent shaped body of water separating mainland NB and Nova Scotia (NS), from PEI. The strait extends some 285 km, roughly, from Point Escuminac, NB, in the north to Cape George, Antigonish Co., NS, to the south and east (Figure 1). The coastline of the strait is undulating, resulting in a number of productive, shallow-water bays. This varied coastline also results in extremes in the width of the Northumberland Strait which usually varies from 20 to 40 km across.

The Northumberland Strait connects with the Gulf of St. Lawrence to the north and to the southeast. The effect of the topography is that any birds flying through the Northumberland Strait must pass the constriction between Borden, PEI, and the Cape Jourimain headland, NB. This is not only the best location in the Strait to observe bird movement, but also is the proposed site for the fixed link connecting PEI to the mainland.

The ice regime within the strait follows an annual, although

not always predictable, cycle. Ice build up in the strait, off CJNWA, is usually substantial by early January. Between January and early March, wind action has a significant effect on the large ice pans and, when combined with tides, can result in extensive build up along the shore. During the most severe winter months there are relatively few open leads in the strait and essentially no winter habitat for birds.

During late March and April the pan ice begins to break up, especially along the eastern portions of the strait, however, it is at this same time that pack-ice begins to enter from the north. In early April the center of the strait is usually open, although not necessarily ice free, while the coastal bays to the north of CJNWA are often still iced-in. By late April-early May the area is relatively ice-free.

3.0 METHODS

Occasional seaduck and seabird watches by CWS staff in 1989 and work by P. Lane and Associates Ltd. (1989) provided some insight into the possible magnitude of bird movement through the Northumberland Strait. From this preliminary work a more complete series of surveys was conducted in 1990. Observations were conducted from the end of the road at the Cape Jourimain headland, weekly from March 13 to May 15 and from September 7 to December 6, 1990. The daily duration of each survey was one hour, this was

divided into six 10 minute observation blocks as in Brown *et. al.* (1975). Each daily observation was usually conducted between 08:00 and 11:00 hours.

One and sometimes two observers conducted the surveys. Observer(s) were equipped with 7x35 binoculars and 15-60x spotting scope. Effort was made to choose clear days for the weekly observations to maximize visibility. All bird movement was recorded by species (or genera) and the numbers observed, time and direction of flight was recorded. There were four "movement" categories; "NORTH" birds flying to the northwest ; "SOUTH" birds flying to the southeast; "ACROSS" birds flying to or from PEI, and "WATER" birds resting on the water immediately in front of the cape.

Observation conditions were usually extremely good and birds could be identified and enumerated at considerable distances. Obviously not all birds were seen; therefore the numbers recorded here are conservative.

When precise species identification was not possible, birds were classified to the next taxonomic level (e.g. scoters, gulls, loons). Data were separated by species or genera, and only the full hourly observations were summarized. The separate 10-minute blocks were not analyzed individually owing to insufficient or erratic sample size for most species at that level. Should readers be interested in the block observations and times, the raw data have been presented in Appendix 1.

Summarized data, by species, were distributed to regional

authorities (see acknowledgements) and compared to the existing literature to evaluate its significance.

Throughout this report, data have been presented in birds/hour. It should be emphasized that these values represent 1 hour of observation per survey date and do not express day averages or peak movement.

4.0 RESULTS AND DISCUSSION

4.1.a Preliminary seaduck and seabird observations, 1989

Preliminary observations from Cape Jourimain were conducted for six one-hour, sessions in April, May, and September 1989 (Table 1). The direction of flight was not recorded for the observations conducted in May. Seventeen species were noted utilizing the Northumberland Strait during these preliminary observations.

The largest number of birds observed in the spring was 135 birds/hour on May 2, 1989, and Great Black-backed Gull comprised 56% of these observations. In the autumn, 127 birds/hour were observed off the cape area on September 26, 1989. Approximately 56% of the birds recorded on this day were Black Scoter.

These observations demonstrated that further monitoring of seabird and seaduck movement through the Northumberland Strait was warranted.

4.1.1.b General observations and composition by species, 1989

Twenty-two hours of observation during the months of March to May and September to December of 1990 recorded 5214 birds, representing 25 species, moving through the Northumberland Strait past the CJNWA headland. The peak number of birds recorded in a one-hour observation period in the spring was on April 6 when 347 birds were observed. The largest number of birds observed in the autumn was 609 on October 30.

The timing of a northward migration in the spring appears less defined as compared with the southerly movement observed in the autumn (Figure 2). The southerly movement of birds past Cape Jourimain steadily increased from September 4, peaked October 23, and declined until November 27. In the spring, adverse environmental conditions such as severe weather may halt the northerly progress of these species to the breeding areas. However, in the autumn, migration to the south appears more directed as the birds move to their respective wintering areas.

Fewer birds were observed sitting on the water during the spring than the autumn. Prior to the autumn date when the largest number of birds were observed flying south, there was a substantial proportion of the seabirds sitting on the water or staging near the cape. In the autumn, staging behaviour was more pronounced as the seaducks and seabirds made their way south. Staging activity during the spring was not as evident from our observations as bird movement was nearly equal in both directions.

During the 1990 spring surveys, 18 avian species were identified. Red-breasted Merganser sightings comprised the largest percentage (23%) of observations (Figure 3). The three species of scoter accounted for 35% of the records. Surf Scoter represented 19% of the scoters, scoters of an unknown species 9%, Black Scoters 7%, and White-winged Scoters <1%. Herring Gulls, comprised 9% of the sightings, Canada Geese 6%, Great Black-backed Gulls 6%, Northern Gannets 4% and Oldsquaws 4%. Brant (*Branta bernicla*) and Iceland Gulls (*Larus glaucoides*), were incidental species.

During the autumn, 20 avian species were identified off Cape Jourimain. Common Eiders comprised 16% of the bird sightings in the autumn and 64% of these were observed sitting on the water near Gunners Point (Figure 1). All scoter species, including those not identified to species, represented 25% of the sightings (Figure 4). Surf Scoters were noted in 11% of the scoter sightings, unknown scoter species 8%, Black and White-winged Scoters each 3%. Red-breasted Mergansers, Double-crested Cormorants, unidentified species of loon, and Oldsquaws made up 16%, 10%, 7%, and 5%, respectively, of the total observations during the autumn. Some species, however, were observed sporadically, such as Bonaparte's Gull (*Larus philadelphia*), Great Blue Heron (*Ardea herodias*) and Northern Pintail (*Anas acuta*). To our knowledge the data obtained for these species did not reflect any pattern of movement through the strait.

4.2.1 Loons (all species)

Thirty percent of the 342 loons observed were identified as Red-throated Loon (Figure 5). Red-throated Loon was the only species identified as they often rafted close to the cape (Tables 2 and 3). Common Loon (*Gavia immer*) was expected to be present (Table 2), but the identification to species was difficult from long distances.

Of all the loons observed, a maximum of 190 birds/hour were flying south on October 30. Prior to this date, between 40 and 50 were sitting on the water in late September and early October. Godfrey (1986) noted that both Red-throated and Common Loons winter off the Atlantic coast. The Common Loon also breeds in the Maritimes.

4.2.2 Red-throated Loon

Red-throated Loons comprised most of the loons (92%) sitting on the water near the observation point (Figure 6). Many Red-throated Loons were also sighted in the area during avifaunal surveys in mid-November from 1973-1988 (Table 2). Records extracted from the NB Naturalist (NBN) (Table 5), NS Bird Society (NSB) (Table 6) and the PEI Natural History Society (PEINHS) (Table 4) indicate substantial fall numbers of Red-throated Loon in the strait between October and November with a maximum of 410 off CJNWA

on October 23, 1986 reported by the NBN (Table 5). Spring Red-throated Loon sightings along the strait are lacking with the exception of one noteworthy flock of 200 on April 28, 1972 well to the north at Dalhousie, NB (Table 5). Christmas bird counts, however, reported far fewer Red-throated Loons in the Cape Tormentine area in late December (Table 3). As small numbers of Red-throated Loons winter in the coastal waters off NS (MacKinnon and Hicks, 1991a) (Tufts 1962), as well as further south, it is possible that this species stages in the Northumberland Strait in the fall prior to moving to their wintering areas. Fall bird reports from the PEI Natural History Society (PEINHS) also support continued use by Red-throated Loons of the Northumberland Strait during the past 30 years (Table 4).

4.2.3 Common Loon

Common Loon was not identified during the surveys. However, supporting documents suggest that a number of the loons not identified to species were probably Common Loons. Mid-November surveys of the Cape Jourimain area by the Chignecto Naturalists Club and the Christmas bird count (Tables 2 and 3) indicate small number of Common Loons around the CJNWA.

A.D. Smith (pers. comm.) reported that large numbers of non-breeding Common Loons annually spend the summer in Baie Verte (a maximum of 136 on July 4, 1980). According to A.J. Erskine (pers.

comm.) other shallow water bays along the Northumberland Strait also contain summering Common Loons, however, these numbers are less than at Baie Verte. Of 34 records between 1960 and 1990, Erskine's largest reported flock outside of Baie Verte was 17 immature birds at Merrigomish, Big Is., NS. Additional records from the NSB indicate small numbers, 16-20 at Pictou and 10-45 at Tidnish centered around September and October (Table 6). The extent of use of the Northumberland Strait by Common Loons is largely unknown, but data suggests it may be substantial, and that it is an extremely important summering area for juvenile birds. Many juveniles from the Northeastern United States and Atlantic Canada may summer in the Northumberland Strait, but the importance of the shallow coastal bays is largely unknown.

4.3 Horned Grebe (*Podiceps auritus*)

There were no Horned Grebe sightings during the 1990 observations from Cape Jourimain. Although this species mostly breeds north and west of the Great Lakes (Godfrey 1986), there are small numbers that nest in the Gulf of St. Lawrence and sporadically in other locations in the Atlantic region. Mid-November surveys conducted at CJNWA document annual use by Horned Grebes during the past 15 years (a maximum of 24, on November 25, 1979, Table 2) and a few individuals (N = 5) sighted during the Christmas bird counts from 1960 until the present (Table 3).

Recent surveys indicate small numbers of wintering Horned Grebes off the coast of southwestern NS (MacKinnon and Hicks 1991a).

4.4 Red-necked Grebes (*Podiceps grisegena*)

The Red-necked Grebe, like the Horned Grebe, breeds almost exclusively north and west of the Great Lakes (Godfrey 1986). Although the Red-necked Grebe is commonly sighted on the mid-November surveys for Cape Jourimain NWA (Table 2) we did not observe any during our surveys. We suspect, however, that the Northumberland Strait may be an important moulting area for the Red-necked Grebe. During an oil spill from the tanker "Golden Robin" in Chaleur Bay, NB, on September 30, 1974, 26 oiled Red-necked Grebes were washed ashore (Smith 1975). Most birds were adults and undergoing full wing moult. A.D. Smith (pers. comm.) believes that the Red-necked Grebe may swim southward through the strait during this molt. Supportive of this are numerous sightings of Red-necked Grebes to the southwest of CJNWA, off Tidnish, NS, between september and December. A maximum of 225 birds were reported by S. Tingley on October 10, 1986 (Table 6). Birds flying to areas outside their normal breeding range, to molt, is a relatively common occurrence and this is believed to be what is happening with the Red-necked Grebe.

4.5 Northern Gannet

One hundred and eighty-three Northern Gannets were observed during the 22 hours of observation (Figure 7). Northern Gannet movements through the strait observed from CJNWA during 1990 were largely unidirectional, moving south both in the spring (55 birds/hour, April 16) and the autumn (61 birds/hour, October 30). The southward movement of Northern Gannets into the Northumberland Strait, observed on April 16, may have been adults (breeders) and juveniles (non-breeders) foraging. Brown et. al. (1975) reported that by May, most birds were observed either to the north of PEI or southward, east of Cape Breton. Supportive of this was an observation of over 1000 Northern Gannets off Miscou Island, NB by the "Chaisson's" on May 25, 1975 (Table 5). It is plausible that gannets enter the Gulf of St. Lawrence throughout April and then enter the strait from the north as ice cover diminishes. Few birds have been sighted during the mid-November surveys (Table 2). On the Cape Tormentine Christmas bird count, only nine individuals were sighted during two of the 30 years that counts were made (Table 3). However, at this time the strait can begin to ice in and observation is difficult. Reports of Northern Gannets from PEINHS are abundant but low in number (Table 4). Detailed observations by Captain E. Holdway (date unknown), of the Wood Island-Caribou ferry provides a source of numbers and timing of movement by Northern Gannet through the strait from 1956-1965. His maximum number of gannet sightings was 755 throughout October.

During no other month from 1956-1965 were this many Northern Gannets observed from the ferry.

Three important colonies in the Gulf of St. Lawrence (Anticosti, Bonaventure, and Bird Rock in Madeleine Islands) are located relatively near the Northumberland Strait (Brown et al. 1975). Brown (1986) also reported on the pelagic distribution of the Northern Gannet in the Gulf of St. Lawrence. It is likely that migration from these colonies partly occurs through the strait. Occasional summer observations (225 off Kouchibouguac Park on July 13, 1973, Table 5) indicate that the productive waters of the strait may also serve as important feeding habitat. R.G.B. Brown (pers. comm.) believes the data (Figure 7) suggests that movements by Northern Gannet through the strait occur suddenly, as a "wave", and does not build gradually.

4.6 Double-crested Cormorant

Identification to species was often difficult when observing offshore cormorants. Although nesting colonies of Great Cormorants (*Phalacrocorax carbo*) exist on northern PEI (Cape Tryon), and in the eastern part of the strait (C.W.S. colonial nesting bird registry). Great Cormorants were not observed on the watches.

Double-crested Cormorant usually arrived around PEI in late April or early May (Table 4). This corresponds with the timing of our first spring sightings. Colonies of Double-crested Cormorant

are numerous in the Maritimes and observations of these birds in the strait is a common occurrence. Three hundred twenty-one individuals were observed from CJNWA during the 1990 observations (Figure 8). Very few were sighted during the spring (a maximum of 8 birds/hour); however, staging and movement in the strait increased during the fall months. At this time a maximum of 113 birds/hour were observed travelling north (September 11) and from 18-80 were observed sitting on the water near Cape Jourimain (September 11 - October 12). Staging of cormorants likely occurs along the total length of the Northumberland Strait as the birds migrate toward wintering areas. Cormorant colonies, relatively close to the strait (eg. Courtin and Ram Island, Malpeque Bay, PEI numbering 3 to 5 thousand pairs) may account for some of the migrants observed in the autumn.

Mid-November surveys of CJNWA often recorded Great and Double-crested Cormorant in the area (Table 2). Sightings of these two species during Christmas bird counts at Cape Tormentine were limited to 1-6 individuals of either species per year in the late 1970s and early 1980s (Table 3).

4.7 Canada Goose

Although more than 200 Canada Geese were observed near Cape Jourimain during the observation periods, most (95%) birds were moving across the strait either to or from PEI (Appendix 1). As

well, substantial numbers of Canada Geese were observed from Cape Jourimain during the mid-November avifaunal surveys (Table 3). Although our data on Canada Goose movement across the strait is limited, we know that at some times it must be substantial. Aerial surveys conducted in the fall for Canada Geese on PEI regularly record 15 to 26 thousand birds (MacKinnon 1989). Many of these birds utilize the bays and inlets located along southern PEI and coastal NB and NS. Hence, the strait may not be an important migration route for Canada Geese flying through this body of water as it is to other seabirds. However, the many productive bays are very important for migrating Canada Geese and large numbers must cross at key times of the year.

Christmas bird counts in the Cape Tormentine area have documented between 0 and 1373 Canada Geese (Table 3). Variation in ice cover undoubtedly results in the large fluctuation of geese observed in the annual bird counts.

4.8 Common Eider

Six hundred and forty-one Common Eiders were observed from Cape Jourimain during the study. Very few Common Eiders were observed during the spring and 14% of those were sitting on the water near Gunner's Point. Common Eiders were observed predominantly (92%) during the autumn (Figure 9).

At the beginning of the autumn surveys (September 7), and

continuing on to approximately October 23, numerous Common Eiders were observed staging on the water near the cape. However, two weeks later, almost all of the Common Eiders were observed migrating south past Cape Jourimain.

Overland migration routes travelled by Common Eider between the Bay of Fundy and the Northumberland Strait have been discussed thoroughly by Erskine and Smith (1986). By combining the findings of band returns and the notes of many naturalists (D.S. Christie, K.H. Deichmann, R. McManus, and S.I. Tingley) they have well documented this overland migration of Common Eider. Numerous other observations support this northward migration route. During an eclipse of the sun in April of 1970, 7 Common Eider struck hydro-transmission lines during their overland migration through the Memramcook Valley (C.W.S. unpubl. data). As birds migrate south, they may pass overland along a broad front from Shediac, NB to Wallace, NS. The Chignecto Isthmus, however, is the area where most birds appear to cross overland to the Bay of Fundy.

Our data from observations off Cape Jourimain support these assumptions and indicate that although few birds are observed in the spring, substantial numbers of Common Eiders may pass by Cape Jourimain when moving south in the fall.

Northerly migration overland to the Northumberland Strait from the Bay of Fundy may follow two generalized routes: 1) eiders in the upper Bay of Fundy may stage and progress overland near Cape Enrage and Waterside (D.S. Christie, pers. comm.) (Table 5). They then proceed northeast overland to the head of the Petitcodiac

River and on to Shediac Bay or possibly farther north (see Figure 10, routes A and B for geographical presentation); or 2) by flying further up the Bay of Fundy into Shepody Bay and on to the mouth of the Petitcodiac and then Memramcook River. They then proceed up Memramcook River (Figure 10, route C) and progress northerly overland to the head waters of the Scoudouc River, then northeast towards Shediac Bay (Erskine and Smith 1986). Shediac Bay is approximately 50 km north of Cape Jourimain.

Undoubtedly, some Common Eider migrate along the entire length of the strait in the spring. Flying north from the Gulf of Maine they travel up the eastern shore of NS and through the Strait of Canso or around Cape Breton (or in the fall, vice versa, Figure 10, routes D, F, and G).

In the autumn, Common Eiders move in a southerly direction down the Northumberland Strait, and many pass Cape Tormentine. An overland migration ensues across the lowlands of the Isthmus of Chignecto, from Baie Verte (to the south of Cape Tormentine) overland across the Tintamarre NWA (Jolicure Lakes) and Missiquash marsh and onward to Chignecto Bay (Figure 10, route E). "Visible migration" of Common Eiders across the Isthmus of Chignecto has been documented by a number of people. Most recently, on October 13, 1990, R.J. Hicks observed approximately 500 Common Eiders flying west, low across Jolicure Lake toward the Bay of Fundy. A.D. Smith (pers. comm.) also has observed Common Eider movement overland in the same area and direction noted by Hicks. R. Thompson (pers. comm.) witnessed similar migration of smaller

numbers of Common Eiders crossing the Missiquash marsh in the direction of the Bay of Fundy during the third week of October, 1988. Adverse weather conditions also were noted by both Hicks and Thompson. A.D. Smith (pers. comm.) also collected a Common Eider in weakened condition on Tantramar Marsh during October 9, 1971. Common Eiders also were sighted in the Chignecto Bay and the Head of the Bay of Fundy on surveys of waterfowl during March to May in the late 1960's (Hughson 1972). Eiders may also use the Petitcodiac and Memramcook/Scoudouc River routes when migrating south (Table 5), D. Christie pers. comm.), however, these numbers are substantially less than what is observed in the spring.

Common Eiders were frequently reported in the mid-November surveys (Table 2) and Christmas bird counts at Cape Tormentine (Table 3). Common Eider sightings during Christmas counts, similar to those of Canada Goose, probably depend heavily on environmental conditions. Reports of small numbers of Common Eiders in the strait during spring and summer also were found in the news letters for the Natural History Society of PEI (Table 4).

4.9 Oldsquaw

Two hundred and forty-seven Oldsquaws were noted during the observations (Figure 11). Oldsquaws were not observed until March 26 which roughly corresponded with ice break up in the Northumberland Strait. Initially, many of the birds observed from

Cape Jourimain during the spring were sitting on the water. Then, as time passed, between April 9 and May 10, more Oldsquaws were observed flying north.

During autumn, a large percentage of Oldsquaws were observed flying south with a maximum of 40 birds/hour on October 30 and another peak of 25 birds/hour on November 27. As the birds continued to move south, until the end of the observation period (September 24 - December 6), the overall number of Oldsquaws staging in the area also increased.

Oldsquaws were commonly noted in both the mid-November surveys (Table 2) and the Christmas bird counts at Cape Tormentine (Table 3). They were frequently reported by members of the PEINHS (Table 4) and a substantial flock of 1000 birds was observed on April 9, 1966, off Jacquet River, NB (Table 5). Small numbers inhabit open leads in waters of the Northumberland Strait throughout the winter.

4.10 Scoters (all species)

A total of 1400 scoters were observed from Cape Jourimain during the 1990 surveys. Scoter sightings near Cape Jourimain were minimal until April 6 when 150 birds/hour were observed (Figure 12). Later numbers decreased progressively until a second peak of 114 birds/hour was sighted on May 10. During autumn, the number of scoters sighted per hour steadily increased from initiation of fall surveys, peaked on October 23 with 383 scoters per hour (mostly

Surf Scoter), then declined rapidly to less than 50/hour on November 21. This fall migration southward was amazingly uniform in that observations neatly fit a normal distribution (bell) curve.

Few of the scoters observed in March were identified to species. Initially, White-winged and Surf Scoters were the only species identified. As the number of sightings of Surf Scoters declined, the number of Black and White-winged Scoters increased. During the autumn, all three species were observed during the first survey. The largest number of sightings of Black Scoters was October 12 (18 birds/hour), White-winged Scoters - October 17 (39 birds/hour), and Surf Scoters - October 23 (237 birds/hour). Surf Scoters comprised more than half (237) of the peak number of scoters observed on October 23 (383 birds/hour). The remainder of the scoters observed on October 23 were not identified to species as positive identification can often be difficult.

The ratio of Surf to Black Scoter observed in this study was 5:2 (493:191). Erskine (1987) reported the same ratio for these species in Labrador; extracted from spring surveys. Christie (1980) also reported the ratio of Surf to Black Scoters staging near Fundy National Park (at Waterside) as 5:2 in late April. Having three separate studies report the same population ratios for Surf to Black Scoter is certainly interesting. Christie (1980), however, did not comment on the ratio of either of these species to that of White-winged Scoter. Erskine (1987) reported that the ratio of Black Scoter to White-winged Scoter as 5:2 for the fall

harvest of the Atlantic provinces. Our study found the Surf to White-winged Scoter ratio to be approximately 5:1.5 (493:140).

During our spring observations, the ratio of Surf to Black Scoter was approximately 3:2 and the ratio of Surf to White-winged Scoter was 3:1. The ratio of scoters observed during the autumn were marginally different from those observed in the spring. The Surf to Black Scoter ratio was approximately 4:1, and Surf to White-winged approximately 3.5:1. Roughly equal numbers of Black and White-winged Scoter were observed during this time.

Little has been documented regarding route(s) of scoter migration in relation to the Northumberland Strait, however, numerous observation records exist (Tables 4 to 6). It appears that, in the spring, scoters probably migrate in a manner similar to Common Eider, however, in fall they follow a separate route. Observations of scoters passing Cape Jourimain during spring are far more abundant than those for Common Eider. Also, spring scoter movement (of all species) was not in any single direction. Between March and May 53% were flying north, 39% flew south and still others (9%) were sitting on the water (staging) (Figure 13).

During the initial flurry of scoter activity on April 6, 1990, we observed 150 scoters/hour flying past the cape (110 north and 40 south). On that same morning, R. Jaillet (pers. comm.) reported that thousands of scoters had arrived, and were still arriving, along the coastal waters off Buctouche, NB; about 77 km north of CJNWA. These simultaneous observations suggest that the majority

of scoters migrating in the spring were somehow bypassing the cape and most likely following relatively the same northward route up the Bay of Fundy as the Common Eider. Of interest, Jaillet noted that generally, along the NB coast in the spring, the scoters arrived off Val Comeau in early April, Point Sapin in mid April and off Buctouche. This is noteworthy as Val Comeau is the farthest North of these locations followed by Point Sapin and then Buctouche. The only plausible explanation for this is the timing of ice out along the shore. In early April, Val Comeau is usually ice-free while the more southerly bays along the strait are still frozen over. It is not until later in April that the more southerly areas are clear of ice.

As we did observe some northward movement past the cape, some scoters must fly up the southeastern coast of NS and through the Strait of Canso (or around Cape Breton) and up the Northumberland Strait. This coastal migration along southeastern NS is not new and has been documented as early as the late 1800s (Gilpin 1882). Gilpin also suggested that some scoters may fly up the west coast of Cape Breton and depart directly from Cape North (see Tables 5 and 6 for comparison of numbers).

From our observations and circumstantial evidence, it would appear that the majority of scoters migrate north via the Bay of Fundy. Numerous sources support this theory. Peter Hicklin (pers. comm.) reported that while conducting his eider research in April of 1985 to 1987, on the "Wolves" at the mouth of the Bay of Fundy, he often observed scoters numbering in the thousands flying up the

bay. Furthermore, these flights would continue unabated throughout the morning. Hughson (1972) reported scoters at the Head of the Bay of Fundy during spring surveys with a peak of 500 in April between 1966 - 1971. Squires (1976) reported a large concentration of scoters (1400) near Waterside in the autumn of 1967 and more recently H. Deichmann (as cited in Christie 1980) observed large numbers of scoters moving north east past Cape Enrage.

Most of these scoters are believed to follow the Memramcook/Scoudouc River route north, however, some birds may miss the fork at the mouth of the Petitcodiac River as birds have been observed in Cumberland Basin; just outside of Sackville, N.B. Bateman and McLennan (1973) and Bateman and Turner (1974) both reported small flocks of scoters (<20) during their spring surveys of the Tintamarre NWA.

Reports of large numbers of scoters in the Northumberland Strait are well documented. Tufts (1962) reported rafts containing thousands of White-winged Scoter in the Northumberland Strait in June of 1934. More recently, aerial waterfowl surveys conducted by Bill Barrow (pers. comm.) on April 16 and May 15, 1975, reported 38,158 and 31,695 scoters, respectively, between Shediac and New Carlisle, NB. The largest flocks on April 16 were at Kouchibouguac (16,130), Mirimichi (6,495), Tabusintac (4,472) and Dalhousie (3,939).

These thousands of scoters have long been known to occur along the Northumberland Strait, and eastern and northern shores of NB every spring during their northward migration. This migration

is significant and predictable and it forms the basis of an illegal spring hunt that takes place along the north shore every year.

The largest flock of scoters on record is by D. Christie (pers. comm.) on May 1, 1973. At Dalhousie, NB, he observed a flock of scoters (mostly Black Scoters) estimated to be about 8.5 miles long and containing somewhere in the vicinity of 150,000 birds. Godfrey (1986) speculates on an overland migration of scoters from the Atlantic Coast to James Bay. Chaleur Bay (Escuminac Bay), immediately north of Dalhousie, may well be the staging area for this migration.

During fall migration, data suggests that the scoters fly in a southerly direction, passing entirely through the Northumberland Strait and either fly through the Strait of Canso (or possibly around Cape Breton) then proceed down the eastern seaboard of NS.

As scoters begin making their way south past CJNWA, few birds (5% of all scoters) were observed staging near the cape. The number of southward migrating scoters steadily increased with a peak of 383/hour on October 23. By late October, no individuals were observed sitting on the water and very few (<5/hour) moving north.

It is clear that during the scoters southward migration through the strait, they do not cross overland to the Bay of Fundy; as do the eiders. Compared to the numerous fall eider reports, any "visible" evidence of scoters flying southwest across the Isthmus of Chignecto is completely lacking.

4.10.1 Unidentified scoters

Identification of scoters to species was sometimes difficult (Figure 14). Often White-winged Scoters would stand out at a distance while Surf and Black Scoters could not easily be separated. Five hundred and seventy-six scoters (41% of all scoters observed) were not identified to species. These birds, like those identified, exhibited a more concise, unidirectional flight in the autumn as compared to the spring.

Unidentified scoters were often sighted on mid-November avifaunal surveys with highs of 15 sighted in 1975 (Table 2), Christmas bird counts, maximum of 12 in 1986 (Table 3), and 5 birds reported in the PEINHNS newsletter in 1981 (Table 4).

4.10.2 Black Scoter

One hundred and ninety-one (14% of all scoter sightings) were identified as Black Scoters. Northward movement of Black Scoters (Figure 15) comprised the majority of spring observations. Northerly migration of Black Scoters peaked on May 10, though Black Scoter were observed on only two of nine previous counts (March 26 and April 22). The largest numbers migrating south during autumn were 18 birds/hour on October 12.

Black Scoters were also sighted on the mid-November surveys (Table 2), Christmas bird counts (Table 3), and from observations

reported by the members of the PEINHS (Table 4). Small numbers of Black Scoters have been noted from inland NB during spring and autumn (Squires 1976, Christie 1980) with a large flock of 500 Black Scoters near Fredericton in early May of 1967 being the largest recorded (Squires 1976). Christie (1980) categorized the Black Scoter as an abundant spring migrant along the coast of Fundy National Park in the Bay of Fundy.

4.10.3 Surf Scoters

Four hundred and ninety-three (35%) Surf Scoters were identified from CJNWA. Very few Surf Scoters were observed migrating north during the spring observations (Figure 16). Most individuals were observed either flying south or staging in the area. During the autumn, the peak number observed per hour flying south occurred on October 23 (237 birds/hour). The peak number of Surf Scoters migrating south was two weeks later than that observed for Black Scoter moving in the same direction.

As with the Black Scoter, Surf Scoters were noted from mid-November avifaunal surveys (Table 2), Christmas counts (Table 3), and incidental observations worthy of note by PEINHS (Table 4). Christie (1980) also stated that, like the Black Scoter, Surf Scoters are an abundant spring migrant. Inland sightings of Surf Scoters have been noted at Fredericton (Squires 1976) and scattered lakes in NB (Squires 1976, Christie 1980).

4.10.4 White-winged Scoter

One hundred and forty (10% of all scoters) were White-winged. During spring, more than half of the White-winged Scoters were observed travelling south (Figure 17). The remainder of the White-winged Scoters were observed flying north with a peak in numbers of 7 birds/hour on May 3. As soon as the autumn surveys began (September 7), most White-winged Scoters were either flying south or sitting on the water. The largest number observed flying south was 39 birds/hour on October 17. This peak was approximately one week earlier than that for Surf Scoters migrating south and approximately one week later for Black Scoters.

Interestingly, unlike the frequent reports of Black and Surf Scoter off Fundy National Park, White-winged Scoter were rarely observed in the Upper Bay of Fundy in the spring whereas in the fall it was a frequent migrant (Christie 1980). But similar to local reports of Black and Surf Scoters, Christie (1980) and Squires (1976) have records of individuals or small flocks inland.

White-winged Scoters were frequently identified in the mid-November surveys of CJNWA (Table 2), during Christmas bird counts (Table 3), and in sightings by PEI naturalists (Table 4).

4.11 Common Goldeneye (*Bucephala clangula*)

Fifty-five Common Goldeneyes were sighted from Cape Jourimain

during the spring and autumn. Common Goldeneyes often winter in the coastal waters of NB, PEI and NS. They were not, however, sighted in the early spring counts through the Northumberland Strait (Figure 18). The lack of Common Goldeneye sightings during early March observations is attributed to the lack of open water in the area. Between late December and mid-March, Common Goldeneyes frequently congregate in the open waters of narrow channels, rip currents, and ice-free areas associated with causeways and bridges along coastal PEI (MacKinnon 1989).

It appears that as ice moves out of the strait, Common Goldeneyes rapidly leave their wintering areas and begin utilizing the ice-free areas of the strait. As most of the flight observed at the end of March was in a southerly direction, these birds may have been heading for areas of more open water. Pack ice usually enters the strait from the north while to the southeast, past Wood Island-Caribou ferry, there is less ice. Common Goldeneyes may move farther north during the spring (6 birds/hour on April 18) as the ice breaks up from the northerly end of the strait.

In the autumn, Common Goldeneye sightings were sporadic until late November when small flocks were observed flying both north and south along the strait and staging (sitting) on the water. During late autumn to early winter, Common Goldeneye movement throughout the strait may continue as they move to and from their coastal wintering areas.

Sightings of Common Goldeneyes during mid-November avifaunal surveys (Table 2) and Christmas bird counts (Table 3) were often

substantial with 216 on November 20, 1988 and 706 in 1981, respectively (Table 2).

4.12 Red-breasted Merganser

Eight hundred and fifty-eight Red-breasted Mergansers were sighted during observations from CJNWA. Initially, small flocks (<15) of Red-breasted Mergansers were observed from Cape Jourimain (Figure 19); However, after the beginning of April, movement of Red-breasted Mergansers near the cape peaked at 113 birds/hour. After this date, Red-breasted Mergansers were recorded only in small numbers for each hour of observation. During the spring, Red-breasted Mergansers flew south and north, and sat on the water. Flights of Red-breasted Mergansers heading north peaked on April 6 (21 birds/hour), the same date as peak numbers of Red-breasted Mergansers were sighted (113 birds/hour).

The number of Red-breasted Mergansers flying south during the autumn peaked with 53 birds/hour on October 23. Prior to this date, when the maximum number of Red-breasted Mergansers was recorded flying south, they often were noted sitting on the water. On October 17 a large number (156 birds/hour) were flying north. Travelling north by such a large number of Red-breasted Mergansers during this time of year is unexplained. During the last two observation periods (November 27 and December 6) Red-breasted Mergansers were only observed flying south. A second high of 46

birds/hour was observed flying south on the final date of investigation, December 6.

Many Red-breasted Mergansers were also observed on the mid-November surveys of CJNWA (Table 2) and during Christmas bird counts with a peak of 274 in 1981 (Table 3). Large numbers of Red-breasted Mergansers are frequently observed in the strait with highs of 1000 and 1500 at Tidnish, NS, on November 15, 1979 and April 21, 1984 (Table 6).

4.13 Gulls (all species)

Four hundred and eighty-two gulls were sighted. Most of the gulls observed were either Great Black-backed Gulls (23%), Herring Gulls (59%) or gulls not identified to species (18%) (Figure 20). A single Iceland Gull was spotted on April 2 and a Bonaparte's Gull on October 23.

Not surprisingly, as gulls are extremely opportunistic, there were no obvious trends when analyzing the total number of gull observations (Figure 20) or the direction in which they were flying (Figure 21). In the spring, large numbers of gulls were observed April 18-May 15. On April 18, there was a peak in the number of gulls flying north (31 birds/hour). These individuals may have been moving north to breeding colonies or feeding areas. The largest number of gulls sighted during the autumn was 48 birds/hour on October 17.

A number of species of gulls also were noted on mid-November surveys (Table 2) and Christmas bird counts in the Cape Tormentine area (Table 3). The compiler of the Christmas counts, A.D. Smith, recorded almost 8,000 gulls in 1979 when a large number of squid were washed up on the beaches. As gulls are opportunistic the squid provided an easy and quick source of food for the gulls, hence their abundance.

4.14 Miscellaneous seaducks

Seven Brant were sighted during the spring observations (Appendix 1). Five brant were also spotted in 1984 during Christmas bird counts in the Cape Tormentine area (Table 3). Although Brant were once an abundant coastal migrant, the eelgrass die-off during the 1930s resulted in a decline of their numbers. Presently, small flocks of brant still use their traditional coastal route, flying over the Isthmus of Chignecto (Erskine 1988). Flocks numbering in the low hundreds recently have been observed on PEI in spring (MacKinnon 1989).

Two sightings of Common Mergansers (*Mergus merganser*) during the study totalled eight individuals (Appendix 1). Mid-November surveys often recorded Common Merganser in the area (Table 2) as did Christmas bird counts nearby at Cape Tormentine (Table 3), however, these numbers were often small. The majority of wintering Common Mergansers on PEI tend to favour the eastern portion of the

island. As substantial numbers of Common Mergansers also winter in Pictou Harbour (700 on January 10, 1975, Table 6) which is also well east of CJNWA, these birds apparently use a route other than through the strait, either during migration or staging on the way to their wintering areas. Although the number of Common Mergansers wintering on PEI is fairly large (in the low thousands) (Curley and MacKinnon 1988), very few were observed during our surveys.

Thirteen scaup (species not identified) were sighted on March 23 and April 18 (Appendix 1). Greater Scaups (*Aythya marila*) occasionally were sighted on mid-November surveys of CJNWA while both species of scaup were reported on Christmas bird counts at Cape Tormentine (Table 3). Large numbers of Greater Scaups in the range of 4-5 hundred are reported on PEI in the fall. However, this species is neither an abundant migrant or local breeder, except for 85 pairs of Greater Scaup on Grassy Island, NB (A.J. Erskine, pers. comm.).

4.15 Miscellaneous seabirds

One hundred Common Terns (*Sterna hirundo*) were observed on three different survey dates during the autumn (Appendix 1). Although there are breeding colonies of Common Terns numbering over 10,000 pairs (CWS Colonial Waterbird Registry) not far to the north of Cape Jourimain, no observations of terns were recorded during spring.

One Great Blue Heron was sighted travelling south during autumn on September 7 (Appendix 1). Great Blue Herons frequently use the intertidal waters around Cape Jourimain throughout the summer and have been observed in mid-November during the annual avifauna survey (Table 2). Sightings of this species later than November are rare.

5.0 CONCLUSIONS

This study, as well as documenting seaduck and seabird movement through the strait, gathers current information from a variety of sources. Its publication is a timely result of the possibility of the proposed fixed link between NB and PEI. As full day (dawn-dusk) surveys were not conducted, we can not speculate on the actual number, by species, utilizing the Northumberland Strait.

It is obvious from the timing and peak number of seabirds and seaducks observed moving through and utilizing the Northumberland Strait that it is important to a number of species. Further, it may be crucially important for some species such as scoters who migrate south past the Cape Jourimain headland in large numbers.

This paper stands as a resource document. We do not try to propose mitigative measures should a connection between NB and PEI be built. Should the structure be built in the near future and with an expected completion time of approximately 5 years, this data set can be used to document any changes in bird use over time

by duplicating the methodology in the future.

The seasonal peak in the number of birds observed immediately seaward of Cape Jourimain occurred on April 6 during the spring and on October 30 during the autumn. Summer and winter surveys were not conducted. Fluctuations in bird numbers moving through the strait were species dependant. Peak numbers of movement for individual species are noted within.

At present, parts of the Northumberland Strait (such as coastal bays e.g. Baie Verte), may be important summer habitat for non-breeding Common Loon and moulting Red-necked Grebe. The highly productive waters of the strait are important feeding areas for species such as the Northern Gannet, Great and Double-crested Cormorant and Common Tern. Waterfowl, such as Canada Goose, Common Goldeneye, and Common Merganser, may depend on the strait for staging, roosting, feeding, and loafing during the spring and autumn. Seaducks, such as scoters and eiders, also migrate through the strait in large numbers.

Although the long-term effect of a fixed link is unknown, many aquatic birds are hesitant to fly overland and over man-made structures. Surprisingly, this includes eiders despite their willingness to migrate overland. Erskine and Smith (1986) reported that, although the Canso causeway is a short and low structure, eiders have been reported to fly through the Strait of Canso, follow along the causeway to meet land, gain altitude of at least 100 m, and only then pass over the man-made structure.

Although dawn to dusk counts were not conducted, from our

observations we can extrapolate to predict the approximate number of birds migrating through the strait. Our surveys do not include the summer or winter months, nor can we predict nocturnal bird movement. It is true, however, that our observations represent minimum bird numbers for the representative hourly surveys. Thus, our very conservative estimate of spring and fall bird movement through the Northumberland Strait during the day (based on average daylight hours between initiation and ending of surveys) are 125 and 300 thousand birds respectively, totalling 425 thousand birds. The approximation of these numbers must be stressed. However, they are very definitely conservative estimates that are provided to give some insight into the importance of the Northumberland Strait to seaducks and seabirds.

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Table 1. Observations of bird movements immediately seaward of Cape Jourimain MWA, 1989. Values recorded are in number of birds observed per hour of observation (from MacKinnon and Hicks, 1991b).

| Species | April 12 | | | | April 20 | | | | OBSERVATION DATES | | Sept. 14 | | | | Sept. 26 | | | |
|-------------------------|----------|----|----|----|----------|----|---|----|-------------------|---------|----------|----|----|-----|----------|----|----|-----|
| | N | S | W | T | N | S | W | T | May 2* | May 16* | N | S | W | T | N | S | W | T |
| Northern Gannet | - | - | - | - | 1 | - | - | 1 | - | - | - | - | - | - | - | - | - | - |
| Great Cormorant | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| D.C. Cormorant | - | - | - | - | - | 4 | - | 4 | - | 1 | - | - | - | - | 2 | 3 | - | 5 |
| Cormorant sp. | 2 | - | - | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Great Blue Heron | - | - | - | - | - | - | - | - | 3 | - | - | - | 1 | 1 | - | - | - | - |
| Brant | - | 11 | - | 11 | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Black Duck | - | - | - | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - |
| Common Eider | - | - | 8 | 8 | - | - | - | - | 2 | 1 | - | - | 18 | 18 | - | - | 31 | 31 |
| Oldsquaw | - | - | 8 | 8 | - | - | 2 | 2 | 9 | - | - | - | - | - | - | - | - | - |
| Black Scoter | - | 10 | - | 10 | - | 13 | - | 13 | 10 | - | - | - | - | - | 2 | 70 | - | 72 |
| Surf Scoter | - | - | - | - | - | - | - | - | - | - | - | 32 | 19 | 51 | - | - | - | - |
| White-winged Scoter | 30 | - | - | 30 | - | - | - | - | 1 | - | 4 | - | - | 4 | - | - | - | - |
| Scoter sp. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Common Goldeneye | - | - | - | - | 1 | - | - | 1 | - | - | - | 22 | - | 22 | - | - | - | - |
| Common Merganser | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Red-breasted Merganser | 9 | 2 | 6 | 17 | 15 | 4 | 4 | 23 | 29 | 38 | - | - | - | - | 4 | 5 | - | 9 |
| Merganser sp. | - | - | - | - | - | - | - | - | - | - | - | 4 | - | 4 | - | - | - | - |
| Waterfowl sp. | - | - | - | - | - | 2 | - | 2 | - | - | - | - | - | - | - | - | - | - |
| Herring Gull | - | - | - | - | - | 2 | - | 2 | 5 | - | 4 | - | - | 4 | 4 | 4 | - | 8 |
| Great Black-backed Gull | - | - | - | - | 2 | - | - | 2 | 75 | - | - | - | - | - | 2 | - | - | 2 |
| Gull sp. | - | - | - | - | - | - | 1 | 1 | - | - | - | - | - | - | - | - | - | - |
| Common Tern | - | - | - | - | - | - | - | - | - | - | 2 | - | - | 2 | - | - | - | - |
| Total | 41 | 23 | 22 | 86 | 19 | 25 | 7 | 51 | 135 | 40 | 10 | 58 | 38 | 106 | 14 | 82 | 31 | 127 |

*North/south movement not segregated

N = Flying Northwest S = Flying Southeast W = Sitting on water T = Totals

Table 2 - Avifaunal observations conducted by the Chinecto Naturalist Club at Cape Jourimain Natural Wildlife Area and bordering communities, Mid-November, 1973-1988 (Modified from MacKinnon and Hicks 1991b).

| Species | Nov 18 1973 | Nov 17 1974 | Nov 15 1975 | Nov 21 1976 | Nov 20 1977 | Nov 19 1978 | Nov 25 1979 | Nov 16 1980 | Nov 15 1981 | Nov 13 1983 | Nov 18 1984 | Nov 24 1985 | Nov 16 1986 | Nov 15 1987 | Nov 20 1988 |
|-------------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| Common Loon | - | 1 | - | - | - | 3 | 4 | 1 | - | 12 | 1 | 3 | - | 6 | - |
| Red-throated Loon | - | 3 | 9 | 1 | - | 76 | 46 | 6 | 55 | 1 | 9 | 4 | 21 | 12 | 16 |
| Horned Grebe | 1 | 4 | 4 | 4 | 3 | 3 | 24 | 7 | 1 | 1 | - | - | 3 | - | 4 |
| Red-necked Grebe | - | 3 | - | - | 1 | 18 | 29 | 42 | 4 | 1 | 4 | 6 | 2 | 2 | - |
| Northern Gannet | 1 | - | 1 | - | - | - | 1 | - | - | - | - | - | - | 2 | - |
| Great Cormorant | - | - | - | - | 1 | 1 | 2 | - | - | - | - | 3 | 2 | 1 | - |
| DC Cormorant | - | - | - | - | - | - | - | - | - | 3 | - | - | 2 | - | 9 |
| Great Blue Heron | 1 | 1 | 1 | - | - | 1 | 4 | 1 | 4 | 2 | - | 3 | 13 | 4 | 9 |
| Canada Goose | 60 | 125 | 56 | 140 | - | 118 | 110 | 94 | 2 | 18 | 196 | 340 | 605 | 450 | 380 |
| Black Duck | - | 5 | 1 | 6 | - | 43 | 12 | 82 | 20 | 29 | 104 | 61 | 83 | 87 | 70 |
| Greater Scaup | 46 | - | 43 | - | 3 | 9 | - | 7 | 6 | - | 10 | 7 | - | - | - |
| Common Goldeneye | 15 | 10 | 28 | 13 | 4 | 61 | 66 | 4 | 10 | 8 | 1 | 156 | 65 | - | 216 |
| Oldsquaw | 63 | 85 | 39 | 26 | 130 | 84 | 50 | 175 | 30 | 78 | 57 | 33 | 28 | 70 | 34 |
| Common Eider | 4 | 6 | - | 5 | 33 | 7 | 19 | 9 | 5 | 5 | 14 | 2 | 34 | 2 | 4 |
| White-winged Scoter | - | - | 8 | 4 | - | 19 | 45 | 15 | 3 | 2 | 4 | 4 | 5 | - | 10 |
| Surf Scoter | 13 | 1 | 23 | 1 | 13 | 5 | 20 | 9 | 10 | 1 | 9 | - | - | - | 1 |
| Black Scoter | 4 | 7 | - | 1 | 2 | - | - | 9 | 5 | - | 1 | - | - | - | 2 |
| Scoter sp. | - | - | 15 | - | - | - | - | - | - | - | - | - | - | 7 | - |
| Common Merganser | - | - | 50 | - | - | 18 | 1 | - | - | - | 7 | - | - | 12 | - |
| Red-breasted Merganser | 8 | 21 | 51 | 57 | 32 | 142 | 43 | 200 | 92 | 28 | 51 | 13 | 16 | 32 | 70 |
| Glaucous Gull | - | 1 | - | - | - | - | - | 2 | - | - | - | - | - | - | - |
| Iceland Gull | 2 | - | 1 | 1 | 30 | 138 | 7 | 4 | - | 5 | 86 | 21 | 4 | 40 | 40 |
| Great Black-backed Gull | 15 | 5 | 20 | 7 | 24 | 83 | 51 | 38 | 17 | 20 | 17 | 10 | 10 | 14 | 36 |
| Herring Gull | 60 | 75 | 60 | 57 | - | 1045 | 199 | 317 | 26 | 92 | 30 | 36 | 52 | 47 | 48 |
| Ring-billed Gull | 142 | 16 | 61 | 163 | 136 | 234 | 161 | 350 | 350 | 54 | 79 | 73 | 380 | 73 | 6 |
| Bonaparte's Gull | 302 | 25 | 7 | 5 | 120 | 21 | 25 | 27 | 126 | 100+ | 6 | - | 7 | 1 | 1 |
| Black Guillemot | - | - | - | - | - | 1 | - | - | - | - | - | - | - | - | - |

Table 3. Observations of selected seabird/seaduck species from Christmas bird counts* at Cape Tormentine, 1961-1990.

[illegible]

Table 3. (cont'd)

| Species | Year of count | | | | | | | | | |
|---------------------------|---------------|------|-----|------|----|------|-----|-----|-----|-----|
| | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| Red-throated Loon | - | - | 2 | - | - | - | - | - | - | - |
| Common Loon | - | 1 | 1 | 1 | - | - | - | - | - | 1 |
| Horned Grebe | 1 | - | 3 | - | - | - | - | - | - | - |
| Red-necked Grebe | 1 | - | - | - | - | - | - | - | - | 1 |
| Northern Gannet | - | 7 | - | - | - | - | - | - | - | - |
| Great Cormorant | 6 | - | 1 | - | - | - | - | - | - | - |
| D.-c. Cormorant | - | - | - | - | - | - | - | - | - | - |
| cormorant (spp.) | - | - | - | - | - | - | - | - | - | - |
| Brant | - | - | - | 5 | - | - | - | - | - | - |
| Canada Goose | 295 | 15 | 159 | 1373 | - | 15 | 94 | - | 325 | 13 |
| Black Duck ⁴⁶⁸ | 365 | 359 | 486 | 1 | - | 22 | - | 1 | 20 | - |
| Greater Scaup | 3 | 1 | - | 2 | - | - | - | - | 26 | 2 |
| Lesser Scaup | - | - | - | - | - | - | - | - | - | 3 |
| Common Eider | 14 | 24 | 36 | 12 | 8 | 11 | 20 | 41 | 24 | 14 |
| Oldsquaw | 177 | 1153 | 109 | 207 | 99 | 1184 | 298 | 320 | 773 | 362 |
| Black Scoter | - | 1 | 1 | 14 | - | - | - | 1 | - | 2 |
| Surf Scoter | 2 | 1 | 3 | 4 | - | - | 1 | - | - | 1 |
| White-w. Scoter | 25 | - | 5 | 16 | 4 | - | 1 | - | - | 3 |
| scoter (spp.) | - | - | - | - | - | 12 | - | - | - | - |
| Common Goldeneye | 706 | 147 | 257 | 523 | 52 | 260 | 159 | 42 | 30 | 96 |
| Bufflehead | - | 2 | - | - | - | - | - | - | - | 1 |
| Common Merganser | 10 | 25 | 10 | 8 | 10 | 44 | - | 20 | 4 | 11 |
| Red-b. Merganser | 274 | 228 | 54 | 92 | 76 | 255 | 27 | 80 | 77 | 187 |
| duck (unk. spp.) | 14 | - | 147 | 20 | 38 | - | - | 1 | - | - |
| C. B.-headed Gull | - | - | - | - | - | - | - | - | - | - |
| Bonaparte's Gull | - | - | - | - | - | - | - | - | - | - |
| Ring-billed Gull | 252 | 25 | 61 | 70 | 3 | 3 | 18 | - | 3 | 67 |
| Herring Gull | 162 | 165 | 179 | 419 | 59 | 90 | 128 | 81 | 111 | 508 |
| Iceland Gull | 128 | 161 | 54 | 103 | 56 | 84 | 97 | 80 | 45 | 226 |
| Glaucous Gull | - | - | 1 | - | - | - | - | - | 2 | 5 |
| G. B.-backed Gull | 116 | 90 | 157 | 122 | 87 | 48 | 139 | 295 | 153 | 508 |
| B.-leg Kittiwake | - | - | - | - | - | - | - | - | - | - |
| Ivory Gull | - | - | - | - | - | - | - | - | - | - |
| gull (unk. spp.) | - | 19 | - | - | - | 1 | - | - | - | - |
| Dovekie | - | - | - | - | - | - | - | - | - | 1 |
| Thick-b. Murre | - | - | - | - | - | - | - | - | - | 1 |

* - Christmas bird counts conducted from December 14 to December 28, all observations were conducted within a 12 km radius centered 1.8 km east of Melrose post office, Botsford County, New Brunswick.

Table 4. Selected seabird observations along the Northumberland Strait that were noted in the Prince Edward Island Natural History Society newsletter, January 1978-January 1990.

| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|-------------------------|-------------------|---------------|-------------------------------------|
| 6 Red-throated Loon | Borden Ferry | Oct. 23, 1982 | G. Hogan |
| 3 " | Wood Island Ferry | Oct. 13, 1984 | J. Burton, G. Hogan et al. |
| 1 " | Brae Harbour | Aug. 24, 1988 | A. Clements |
| 2 " | Hebron | Aug. 30, 1988 | " |
| 1 Common Loon | West Point | May 17, 1980 | G. Hogan & J. Alway |
| 15 " | Argyle Shore | May ?, 1981 | A. MacPhail |
| 9 " | " | June 11, 1981 | " |
| 1 " | Enmore | June 4, 1982 | U.P.E.I. students |
| 1 " | Borden Ferry | Oct. 23, 1982 | G. Hogan |
| 16 " | Wood Island Ferry | Oct. 13, 1984 | J. Burton, G. Hogan et al. |
| 7 " | Hebron sandspit | Aug. 14, 1986 | A. Clements |
| 1 " | Guernsey Cove | Oct. 4, 1988 | B. Peripoli |
| 12 " | Seacow Head | Aug. 1, 1990 | D. MacAskill, M. Smith |
| 12 loon (unk. spp.) | Borden Ferry | Oct. 17, 1981 | ? |
| 9 " | Tormentine Ferry | " | " |
| 2 " | West Point | Nov. 22, 1981 | G. Hogan, W. Cairns & S. Stephenson |
| 1 " | Borden Ferry | Aug. 12, 1984 | V. Beer & G. Hogan |
| 1 Red-necked Grebe | Borden Ferry | Oct. 17, 1981 | ? |
| 1 Greater Shearwater | Borden Ferry | Aug. 21, 1978 | Dr. M. Edwards |
| 1 Wilson's Storm Petrel | Wood Island Ferry | Oct. 4, 1981 | G. Hogan |
| 1 Leach's Storm Petrel | Borden Ferry | Oct. 17, 1981 | ? |
| 1 storm petrel | Wood Island Ferry | Oct. 13, 1984 | J. Burton G. Hogan et al. |

Table 4. (cont'd)

| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|------------------------|-----------------------|---------------|-------------------------------------|
| ? Northern Gannet | Wood Island Ferry | Oct. 18, 1979 | A. Godfrey, F.R. Curley et al. |
| 1 " | " | Nov. 17, 1979 | D. Cairns |
| 1 " | " | May 11, 1980 | G. Hogan & J. Alway |
| 5 " | Borden Ferry | Oct. 27, 1980 | F.R. Curley |
| 9 " | " | Sep. 23, 1981 | G. Hogan |
| 2 " | Wood Island Ferry | Oct. 4, 1981 | " |
| 12 " | Borden Ferry | Oct. 17, 1981 | ? |
| 12 " | Cape Tormentine Ferry | Oct. 17, 1981 | ? |
| 1 " | Borden Ferry | Oct. 23, 1982 | G. Hogan |
| 1 " | Wood Island Ferry | May 22, 1983 | D. Cairns? |
| 5 " | Borden Ferry | Aug. 12, 1984 | V. Beer & G. Hogan |
| ? " | Wood Island Ferry | Oct. 13, 1984 | J. Burton |
| 3 " | " | Oct. 14, 1984 | G. Hogan et al. |
| | | | C. & M. Willms |
| 2 D.-crested Cormorant | Wood Island Ferry | Sep. 16, 1984 | F.R. Curley & L. Townsend |
| ? " | " | Oct. 13, 1984 | J. Burton |
| | | | G. Hogan et al. |
| 30 " | North River | Apr. 24, 1985 | M. Copplestone & T. Reddin |
| 20 " | Point Prim | May 18, 1986 | T. Murchison |
| 10 " | Charlottetown harbour | May 3, 1990 | D. MacAskill |
| 1 " | North River | Dec. 13, 1990 | Burka family |
| 5 C. Eider | Point Prim | Nov. 14, 1981 | G. Hogan |
| 4 " | Borden Ferry | Apr. 21, 1983 | E. Tull |
| 2 " | " | July 25, 1990 | D. Sabine |
| 25 Oldsquaw | Point Prim | Nov. 14, 1981 | G. Hogan |
| 1 " | West Point | Nov. 22, 1981 | G. Hogan, W. Cairns & S. Stephenson |

Table 4. (cont'd)

| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|--------------------------|-----------------------|---------------|---------------------------|
| 3 Oldsquaw | Borden Ferry | Apr. 9, 1982 | G. Hogan |
| 24 " | " | Oct. 23, 1982 | " |
| 15 " | " | Apr. 21, 1983 | E. Tull |
| 1 Black Scoter | Borden Ferry | Apr. 9, 1982 | G. Hogan |
| 6 " | " | Oct. 23, 1982 | " |
| 1 " | Hillsborough Bridge | Feb. 7, 1986 | B. Dalzell |
| 6 Surf Scoter | Point Prim | Nov. 14, 1981 | G. Hogan |
| 1 " | Borden Ferry | Oct. 23, 1982 | " |
| 15 " | " | Apr. 21, 1983 | E. Tull |
| 16 " | Wood Island Ferry | Oct. 13, 1984 | J. Burton |
| | | | G. Hogan et al. |
| 8 " | " | Aug. 10, 1990 | D. Sabine & S. Makepeace |
| 4 White-winged Scoter | West Point | May 17, 1980 | G. Hogan & J. Alway |
| ? " | Borden Ferry | Oct. 23, 1982 | G. Hogan |
| 30 " | " | Apr. 21, 1983 | E. Tull |
| 6 " | Wood Island | Oct. 13, 1984 | J. Burton |
| | | | G. Hogan et al. |
| 5 scoter (unk. spp) | Cape Tormentine Ferry | Oct. 17, 1981 | ? |
| 12 C. Goldeneye | Point Prim | Nov. 14, 1981 | G. Hogan |
| 10 R.-breasted Merganser | Wood Island Ferry | Sep. 16, 1984 | F.R. Curley & L. Townsend |
| 1 Black Guillemot | Borden Ferry | Apr. 21, 1983 | E. Tull |
| 1 " | Seacow Head | June 21, 1986 | F.R. Curley |
| 1 Dovekie | Wood Island Ferry | Feb. 2, 1987 | K. Gamble |

Table 5. Selected seabird observations along the Northumberland Strait and the upper Bay of Fundy that were noted in the New Brunswick Naturalist (Nature Notes), 1960-1990.

| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|------------------------|---|---------------|-----------------------------|
| 1 Red-throated Loon | Buctouche | Aug. 8, 1970 | P. Pearce |
| 200 " | Dalhousie | Apr. 28, 1972 | Jean-Paul Lebel |
| 410 " | Cape Jourimain National Wildlife Area | Oct. 23, 1986 | |
| 24 Horned Grebe | Baie Verte | Wint. 1960/61 | A. Goodwin |
| 1 Northern Gannet | Richibucto Cape | Sep. 23, 1962 | A. Madden |
| 1 " | Buctouche | July 12, 1970 | P. Pearce |
| 2 " | Cape Enrage | Apr. 3, 1970 | E. Tull |
| 30 " | Buctouche Bar | May 22, 1970 | P. Pearce |
| 225 " | Kouchibouguac National Park | July 13, 1973 | E. Tull |
| 1000 " | Miscou Island | May 25, 1975 | Chaisson ? |
| 2 " (imm.) | Cape Tormentine | Dec. 12, 1980 | S. Tingley |
| 4000 Common Eider | Lakeburn (Moncton) | April 5, 1965 | E. Price |
| 200 " | flying NE over Memramcook | March 1, 1970 | R. McManus |
| 200 " (males) | flying W along Memramcook R. | Oct. 2, 1970 | D. Christie and M. Majka |
| 300 " (males) | "moulting" off Waterside | June 29, 1971 | M. Majka |
| 450 " | Shediac Bay | Oct. 21, 1972 | Moncton Naturalist Club |
| 5000 " | Waterside | Apr. 24, 1973 | B. Bradbury |
| 1000 Oldsquaw | Jacquet River | April 9, 1966 | Frere Jean-Paul Lebel |

Table 5. (cont'd)

| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|--------------------------------|--------------------------------------|---------------|------------------------|
| 700 Black Scoter | Waterside | Apr. 25, 1963 | Frere Jean-Paul Lebel |
| 100s " (flocks of 15-40) | flying NE past Point LePreau | Apr. 8, 1973 | Johnston |
| 4500 " | Dalhousie | Apr. 16, 1973 | Frere Jean-Paul Lebel |
| 5000 " | Waterside | Apr. 24, 1973 | B. Bradbury |
| 150,000 " | Dalhousie (Escuninac Bay) | May 1, 1973 | D. Christie |
| 3000 " | Waterside | Apr. 5, 1983 | R. Walker |
| 4450 " | Waterside | Apr. 20, 1983 | R. Walker |
| 8400 Surf Scoter | Point-la-Nim | Apr. 26, 1970 | A. Madden |
| 10,000 " | between Campbellton and Dalhousie | May 3, 1970 | A. Madden |
| 10,000 " | Waterside | Apr. 24, 1973 | B. Bradbury |
| 8000 Surf and Black Scoters | Richibucto Hbr. | May 9, 1973 | E. Tull |

Table 6. Selected seabird observations along the Northumberland Strait that were noted in Nova Scotia Birds (N.S. Bird Society Newsletter) 1964-1990.

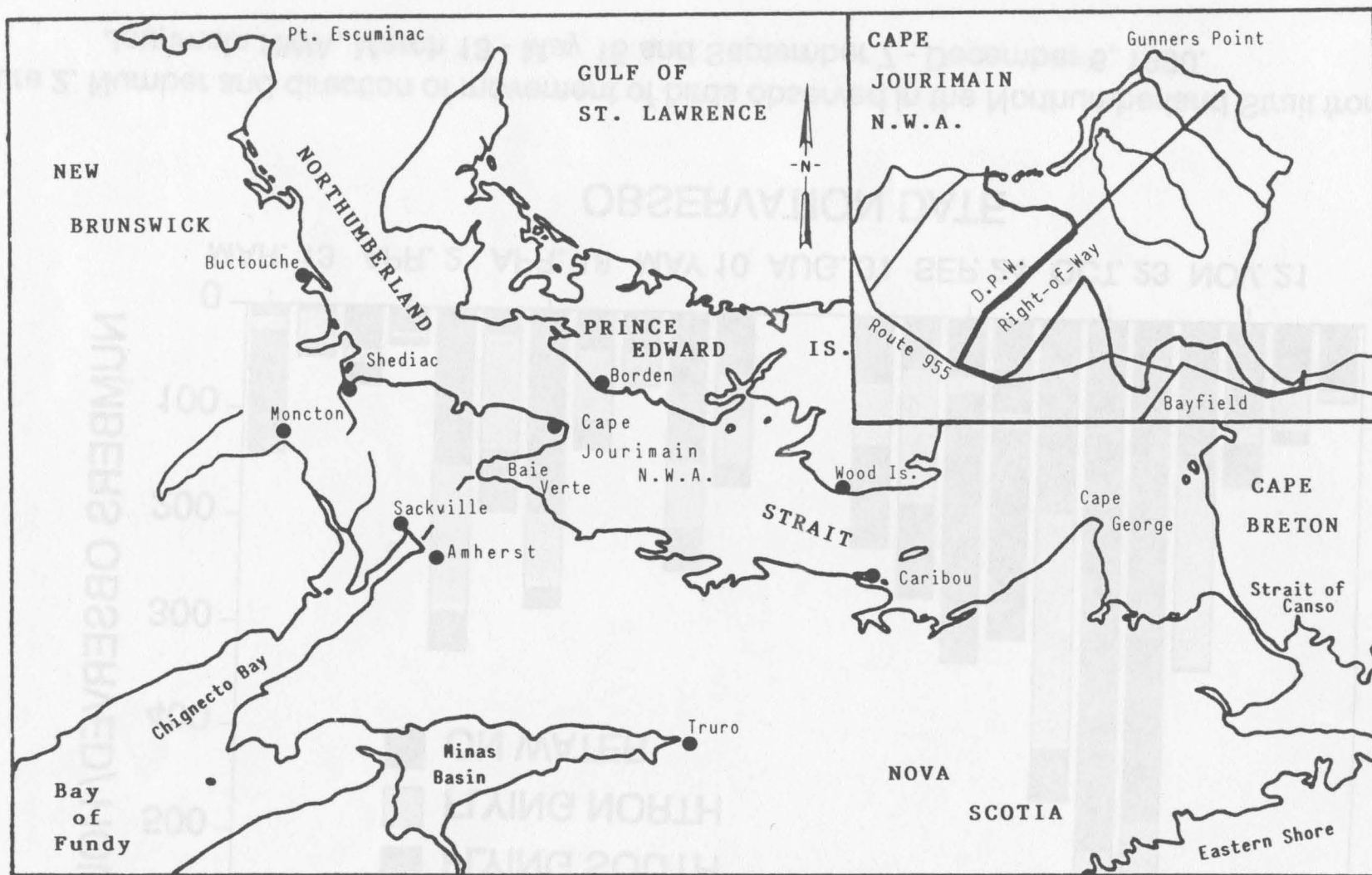
| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|------------------------|--------------------|---------------|------------------------|
| 70 Red-throated Loon | Cape Tormentine | Oct. 26, 1975 | S. Tingley |
| 25 " | Cape Jourimain | Nov. 15, 1976 | " |
| 25 " | Tidnish Dock | Oct. 30, 1978 | " |
| 90 " | Cape Jourimain | Nov. 19, 1979 | ? |
| 8 " | Tidnish | Nov. 17, 1980 | S. Tingley |
| 25 " | Tidnish-P. Phillip | Nov. 25, 1980 | " |
| 55 " | Cape Tormentine | Nov. 26, 1980 | " |
| 1 " | Tidnish | spring, 1985 | ? |
| 22 Common Loon | Pictou | Sep. 2, 1969 | E. Holdway |
| 16 " | " | Sep. 16, 1969 | " |
| 10 " | Tidnish | Oct. 27, 1975 | S. Tingley |
| 33 " | Tidnish-Wallace | Sep. 30, 1979 | " |
| 30 " | Tidnish Dock | Oct. 29, 1983 | " |
| 45 " | " | Sep. 10, 1986 | " |
| 7 Red-necked Grebe | Tidnish | Oct. 11, 1968 | A. Erskine |
| 10 " | " | Oct. 27, 1975 | S. Tingley |
| 30 " | " | Nov. 12, 1975 | " |
| 40 " | Tidnish-Wallace | Sep. 30, 1979 | N.S. Bird Society |
| 45 " | Tidnish Dock | Nov. 15, 1979 | S. Tingley |
| 30 " | Tidnish | Nov. 3, 1980 | " |
| 75 " | " | Nov. 17, 1980 | " |
| 75 " | " | Nov. 24, 1980 | " |
| 25 " | " | Dec. 8, 1980 | " |
| 35 " | Tidnish Dock | Nov. 2, 1981 | S. Tingley et al. |
| 35 " | " | Oct. 29, 1983 | S. Tingley |
| 135 " | Tidnish | Sep. 10, 1986 | " |
| 225 " | " | Oct. 10, 1986 | " |
| 1 Horned Grebe | Pictou | Oct. 15, 1966 | E. Holdway |

Table 6. (cont'd)

| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|-------------------------|-----------------|---------------|------------------------|
| 28 Horned Grebe | Tatamagouche | Nov. 12, 1975 | S. Tingley |
| 18 " | Tidnish Dock | Oct. 30, 1978 | " |
| 10 " | Tidnish-Wallace | Sep. 30, 1979 | " |
| 25 " | Tidnish Dock | Oct. 18, 1979 | ? |
| 20 " | Tidnish | Nov. 3, 1980 | S. Tingley |
| 30 " | " | Nov. 17, 1980 | " |
| 15 " | " | Dec. 8, 1980 | " |
| 13 " | Tidnish Dock | Nov. 2, 1981 | S. Tingley et al. |
| 7 Northern Gannet | Pictou | Aug. 7, 1973 | E. MacLeod |
| 1 " | Cape Jourimain | Nov. 15, 1976 | C. Desplanque |
| 30 " | Northport | Oct. 18, 1979 | S. Tingley |
| 5 " | Tidnish Dock | Oct. 18, 1979 | " |
| 1 " | Cape Jourimain | Nov. 25, 1980 | " |
| 20 " | Caribou Island | Oct. 11, 1989 | D. Purchase |
| 50 D.-crested Cormorant | Tatamagouche | Oct. 27, 1975 | S. Tingley |
| 1 " | Pugwash R. | Dec. 4, 1978 | " |
| 18 Canada Goose | N.S.-P.E.I. | Aug. 23, 1964 | E. Holdway |
| 100 Common Eider | Cape Jourimain | July 1, 1976 | C. Desplanque |
| 27 " | Fort Lawrence | Nov. 6, 1978 | S. Tingley et al. |
| 16 Black Scoter | Pictou | Nov. 27, 1972 | E. Holdway |
| 20 " | Cape Jourimain | June 21, 1976 | C. Desplanque |
| 10 " | " | June 26, 1976 | " |
| 8 " | " | July 1, 1976 | " |
| 20 " | Caribou Harbour | May 18, 1985 | F. Lavender et al. |
| 3 " | " | July 4, 1982 | ? |
| 40 " | Tidnish | May 18, 1985 | F. Lavender et al. |

Table 6. (cont'd)

| <u>Number/ Species</u> | <u>Location</u> | <u>Date</u> | <u>Authority (ies)</u> |
|---------------------------|---------------------|---------------|------------------------|
| 2 Surf Scoter | Northport | ?, 1985 | ? |
| 250 " | " | Sep. 10, 1986 | S. Tingley |
| 100s " | Lorneville | May 9, 1988 | Cohr's Family |
| 5 White-winged Scoters | Cape Jourimain | July 1, 1976 | C. Desplanque |
| 600 R.-breasted Merganser | Pictou | Apr. 9, 1973 | E. Holdway |
| 500 " | " | Apr. 15, 1973 | " |
| 200 " | Tidnish | Oct. 27, 1975 | S. Tingley |
| 170 " | Pictou causeway | Nov. 30, 1976 | E. Holdway |
| 80 " | " | Apr. 5, 1978 | " |
| 1000 " | Tidnish Dock | Nov. 15, 1979 | S. Tingley |
| 1200 " | Tidnish-Port Philip | ? | " |
| 400 " | Northumber. Strait | Mar. 2, 1981 | D. MacDougall |
| 1500 " | Tidnish-Tatamagou. | Apr. 21, 1984 | F. Lavender et al. |
| 1000 " | Northport | ? | I. McLaren et al. |
| 200 " | Linden | Oct. 27, 1986 | S. Tingley |
| 200 " | Caribou | Oct. 29, 1986 | " |
| 700 Common Merganser | Pictou causeway | Jan. 16, 1975 | S. Tingley |
| 23 " | " | Dec. 27, 1978 | S. Tingley et al. |
| 26 " | Pictou Harbour | Mar. 28, 1978 | E. Holdway |
| 52 " | Pugwash | Jan. 25, 1980 | S. Tingley |
| 81 " | Tidnish-Pugwash | Mar. 22, 1980 | " |
| 60 " | Northumber. Strait | Mar. 2, 1981 | D. MacDougall |
| 425 " | Pictou Harbour | Dec. 10, 1982 | B. Dalzell |
| 300 " | " | Feb. 19, 1986 | A. Vienneau |
| 100 " | Pictou causeway | Feb. 6, 1988 | " |



55

Figure 1. Map of study area including key points of interest.

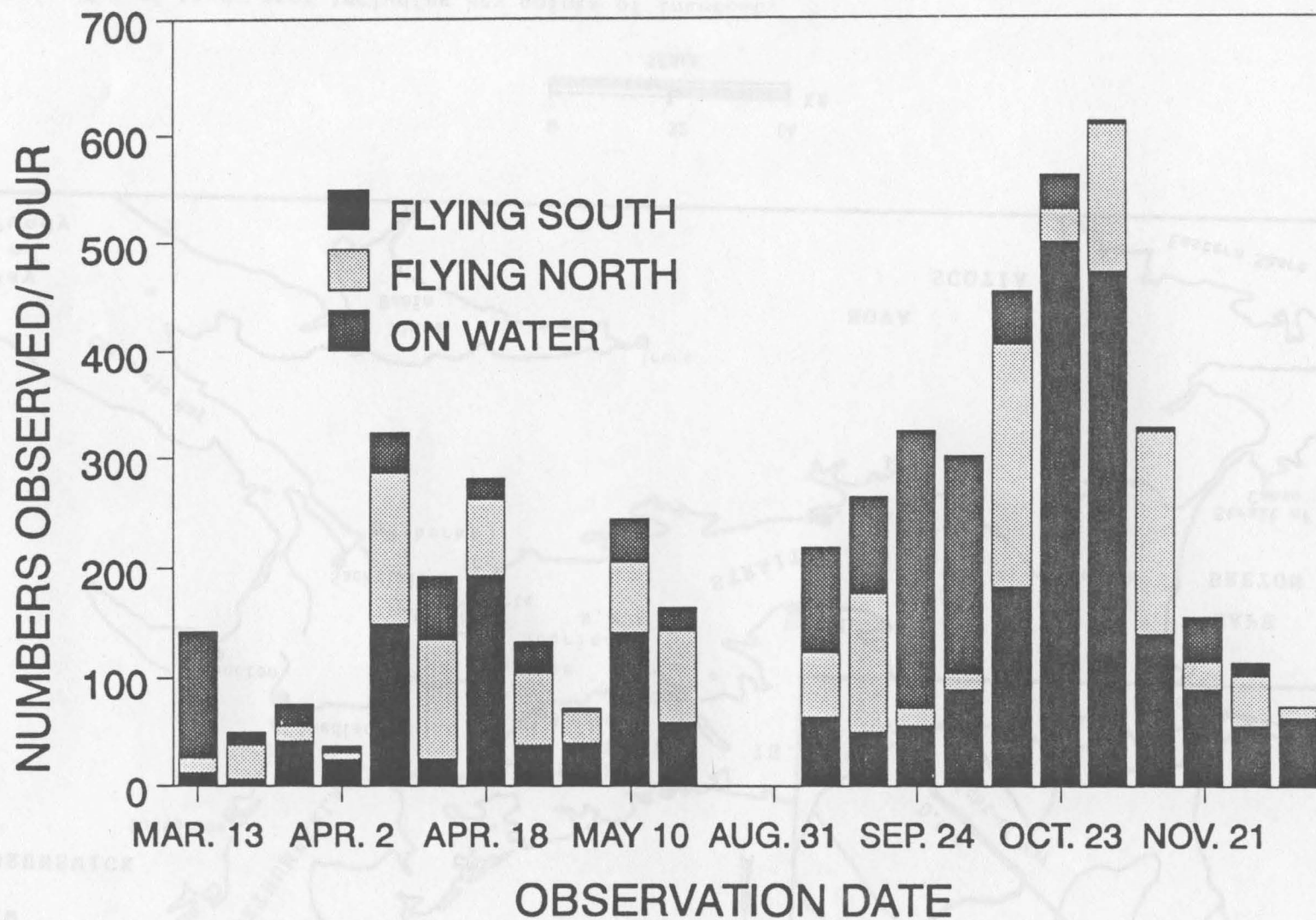


Figure 2. Number and direction of movement of birds observed in the Northumberland Strait from Cape Jourmain NWA, March 13 - May 15 and September 7 - December 6, 1990.

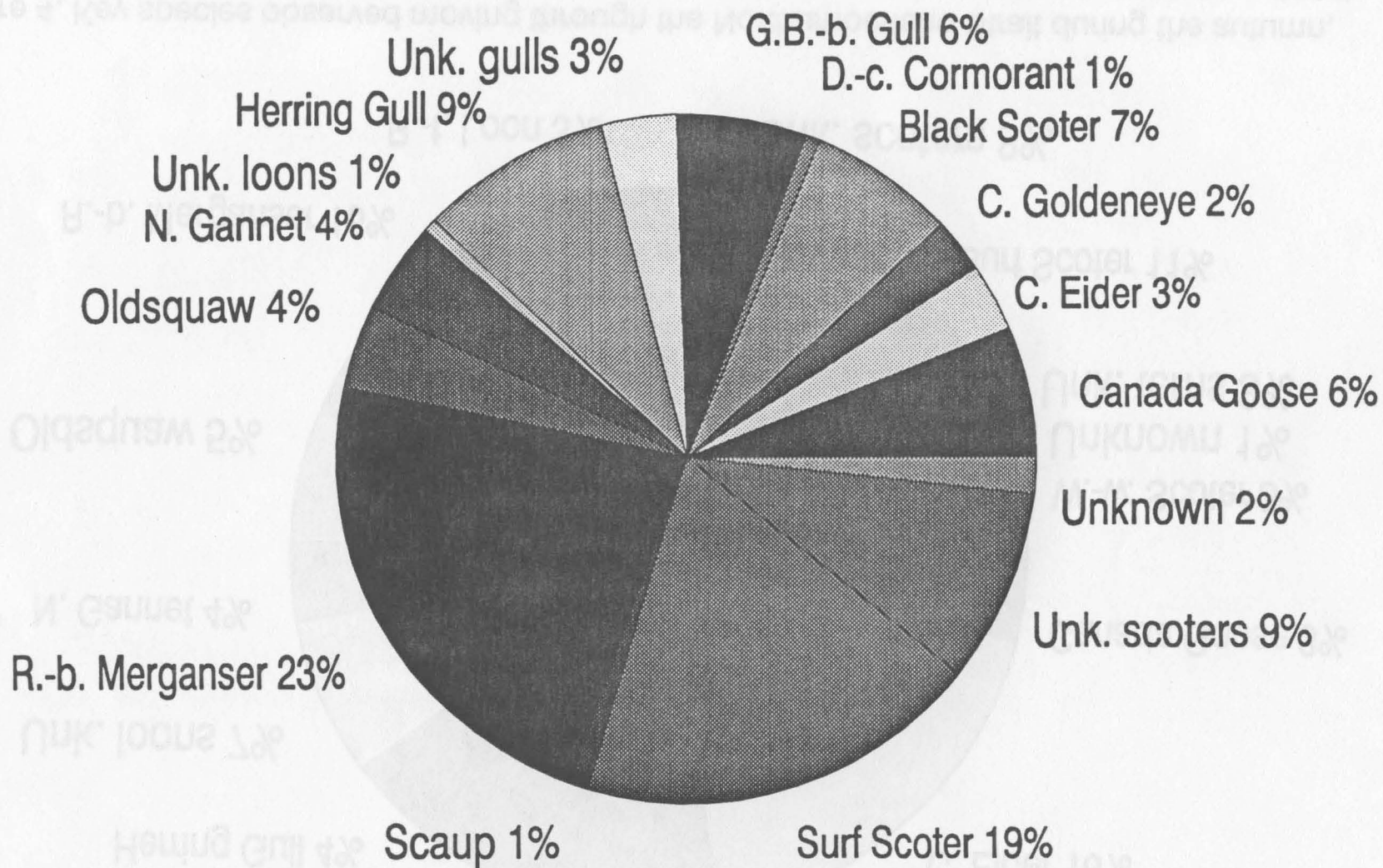


Figure 3. Key species observed moving through the Northumberland Strait during the spring, observations from Cape Jourmain NWA, March 13 - May 15, 1990 (N = 1600).
Incidental observations not included.

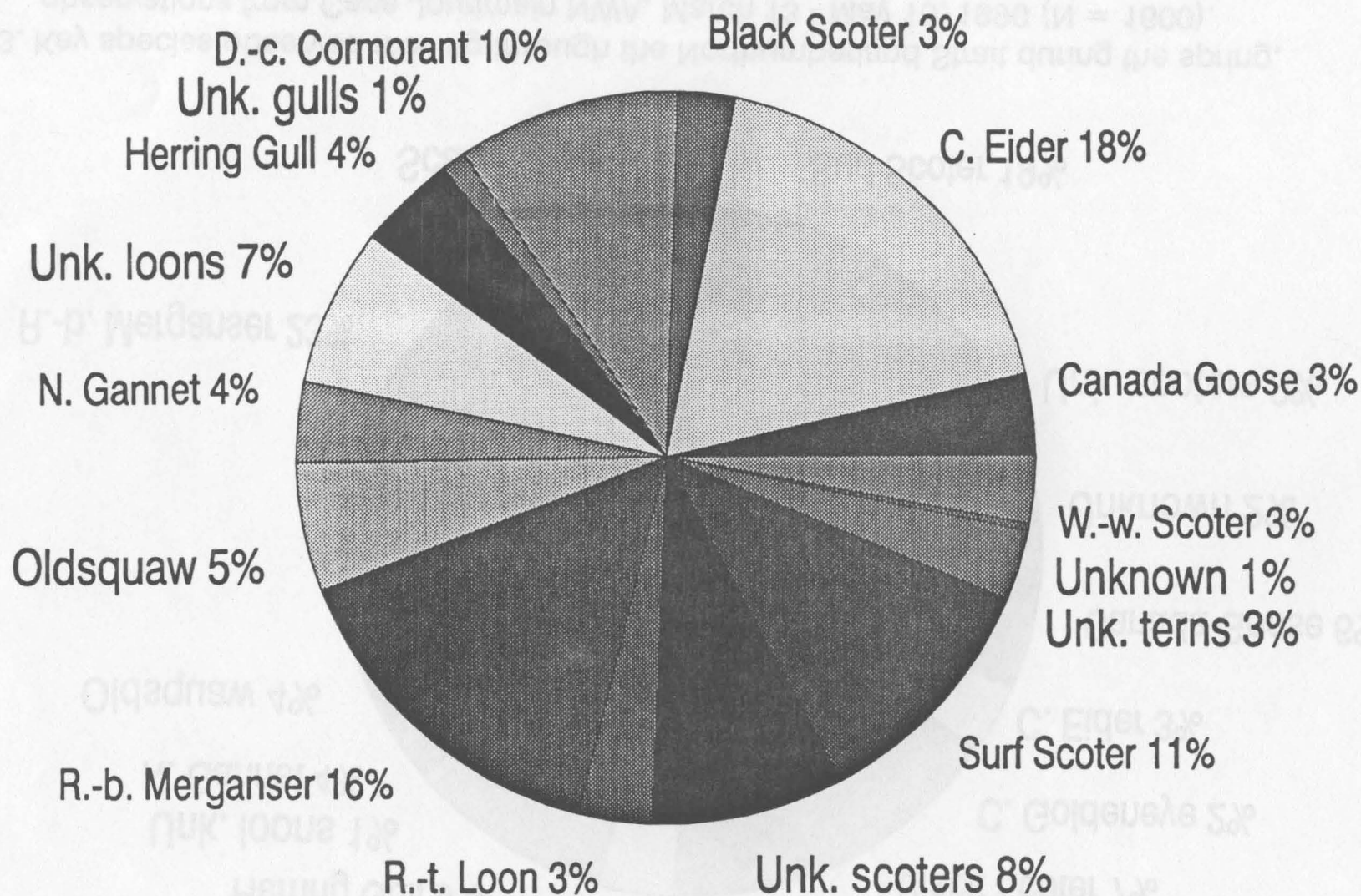


Figure 4. Key species observed moving through the Northumberland Strait during the autumn, observations from Cape Jourimain NWA, September 7 - December 6, 1990 (N = 3220). Incidental observations not included.

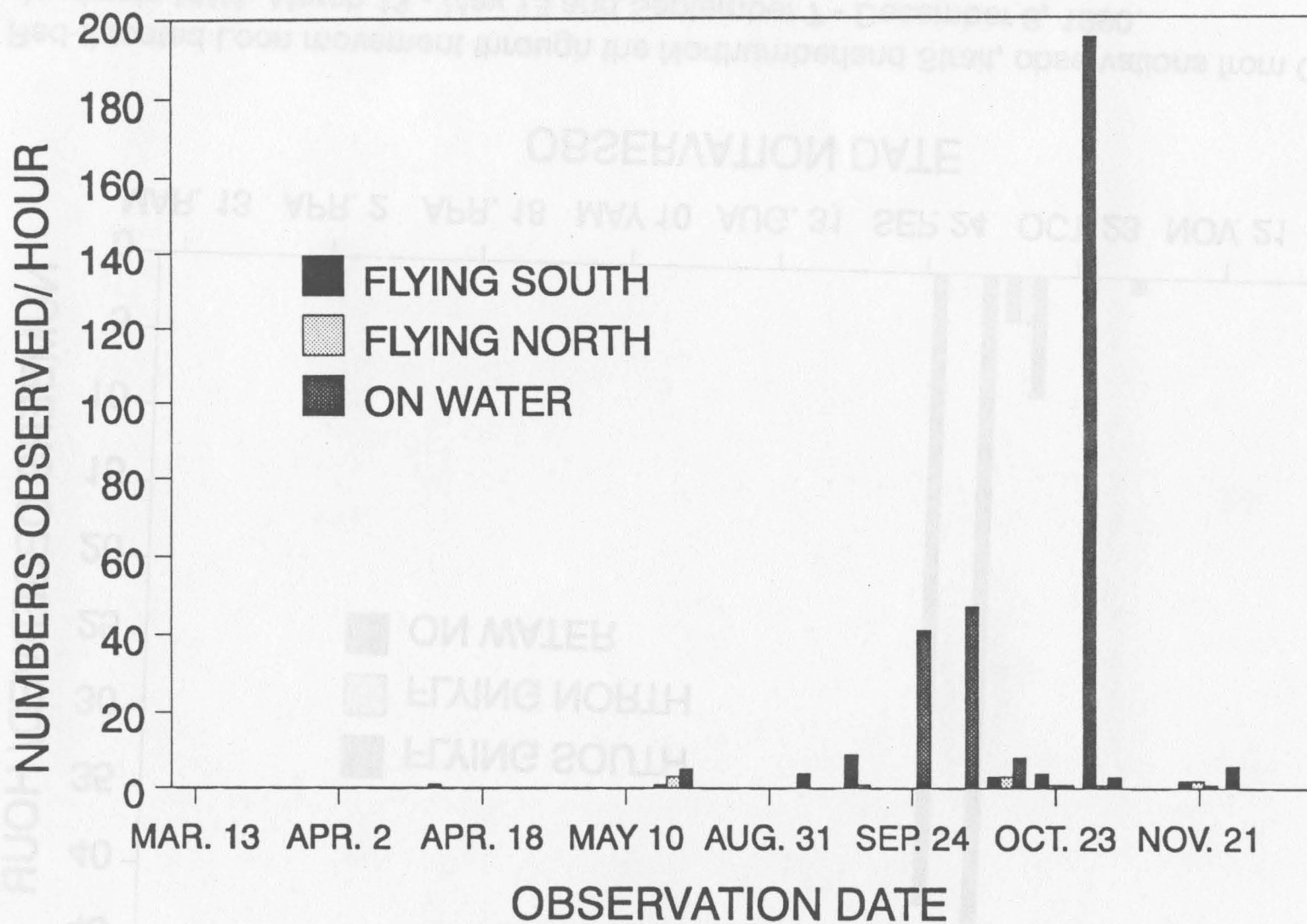


Figure 5. Loon (all spp.) movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

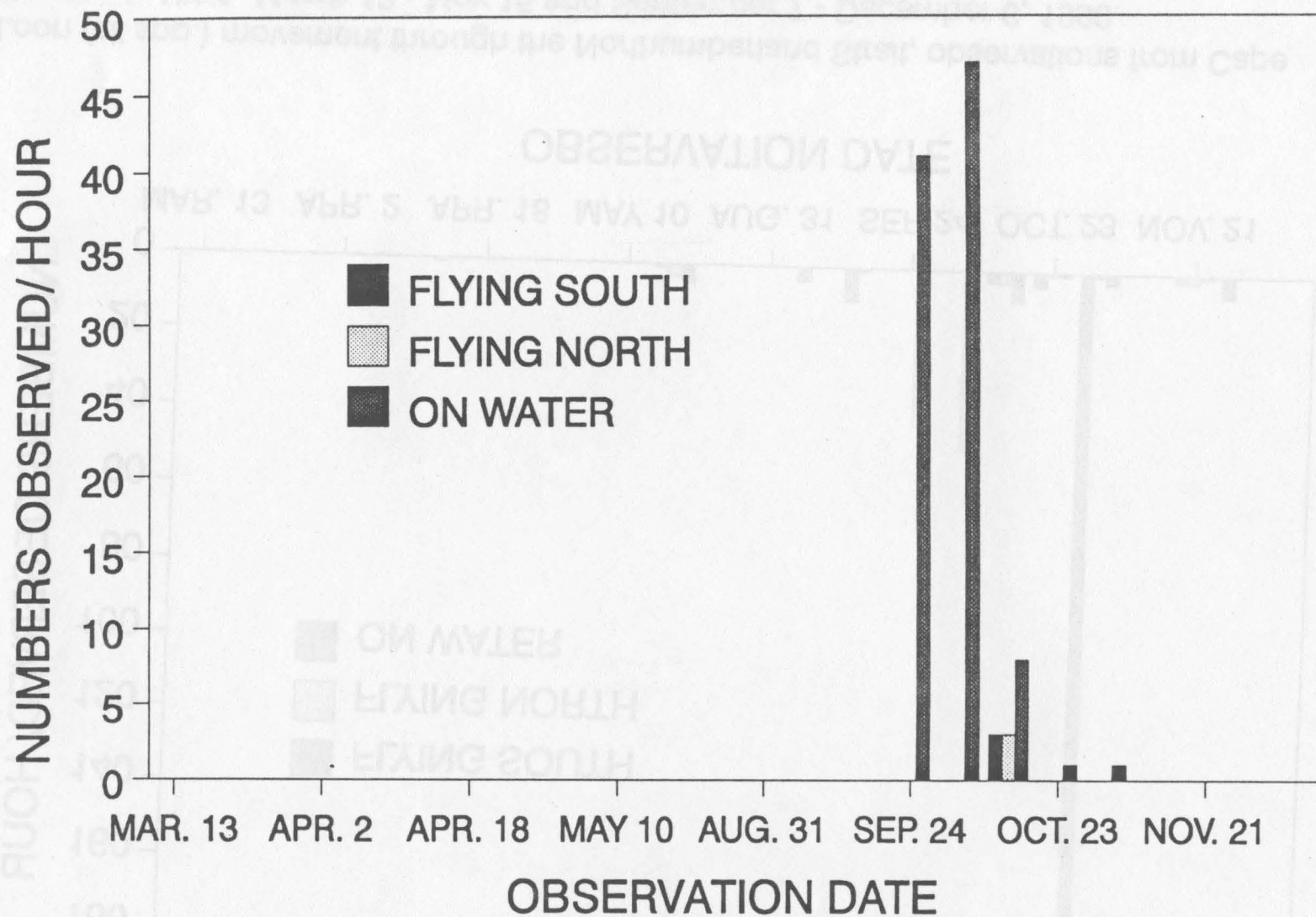


Figure 6. Red-throated Loon movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

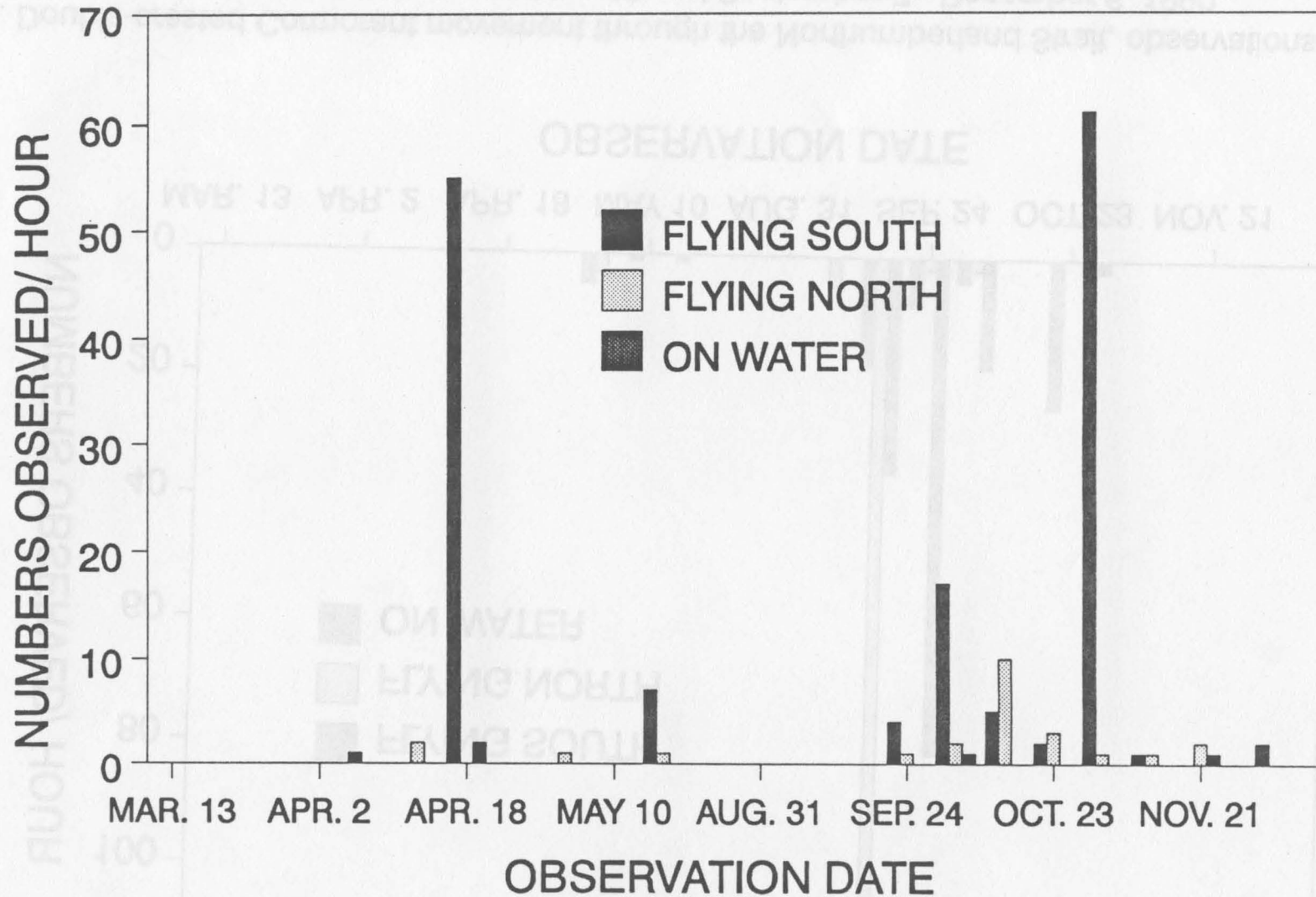


Figure 7. Northern Gannet movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

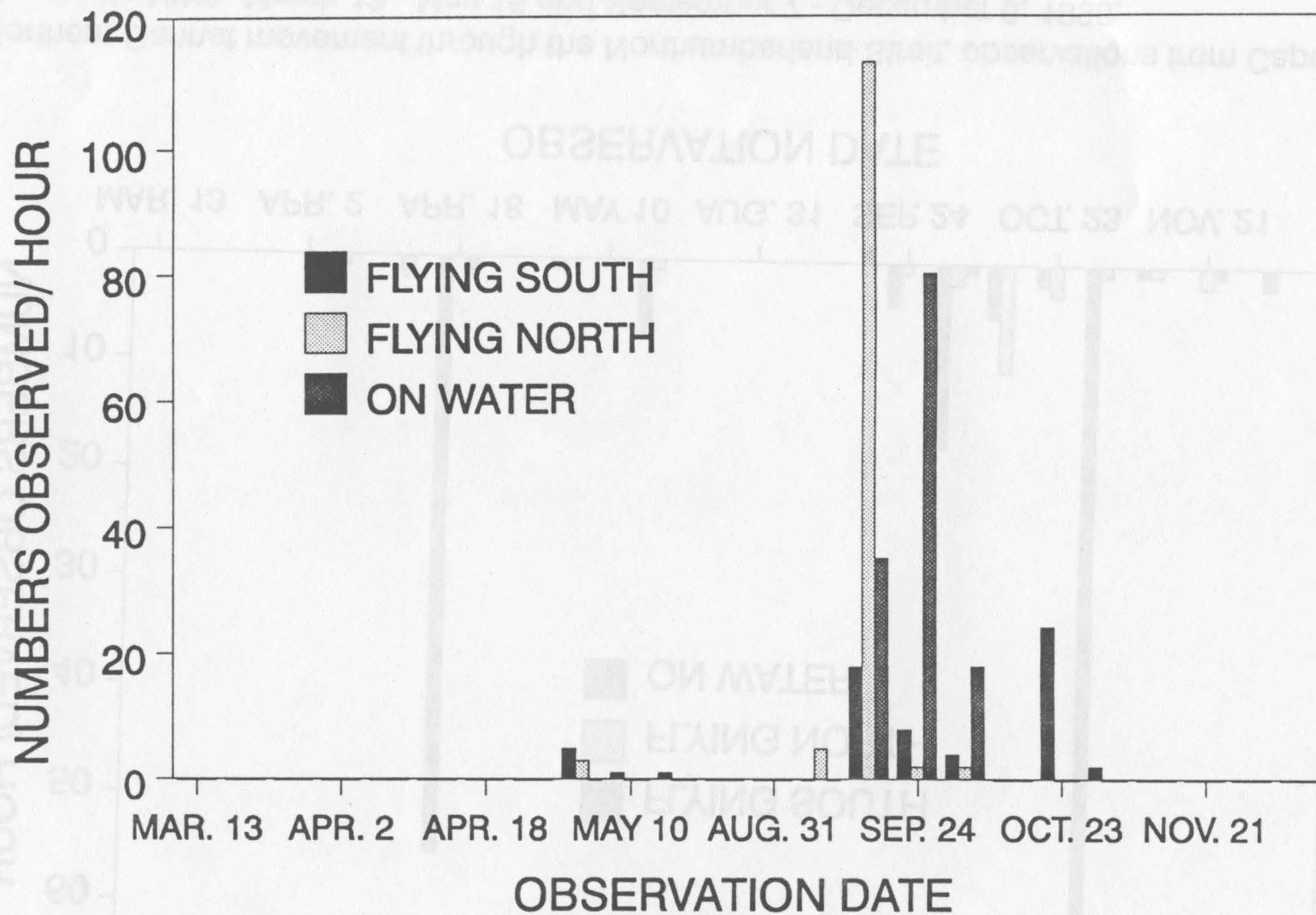


Figure 8. Double-crested Cormorant movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

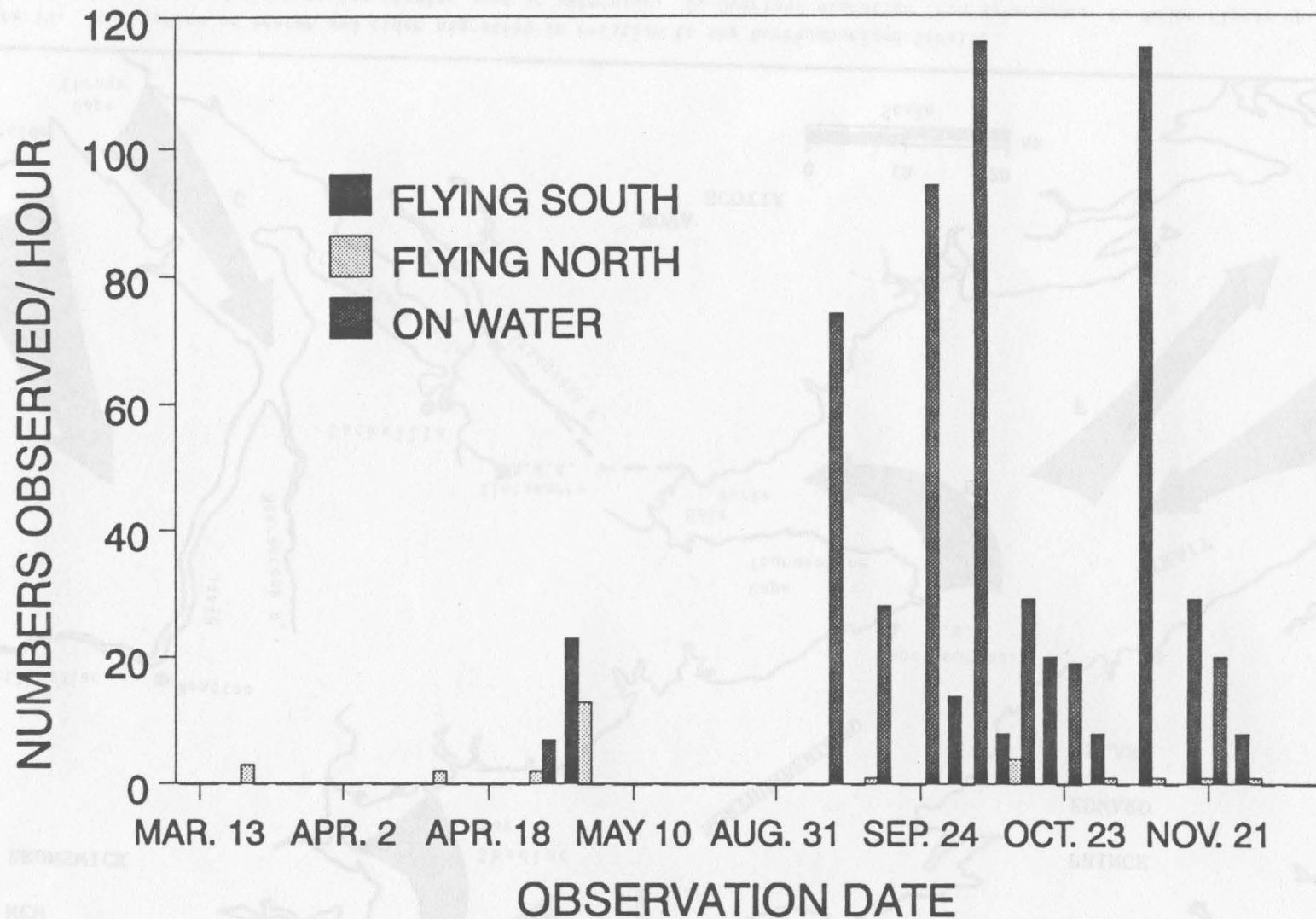


Figure 9. Common Eider movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

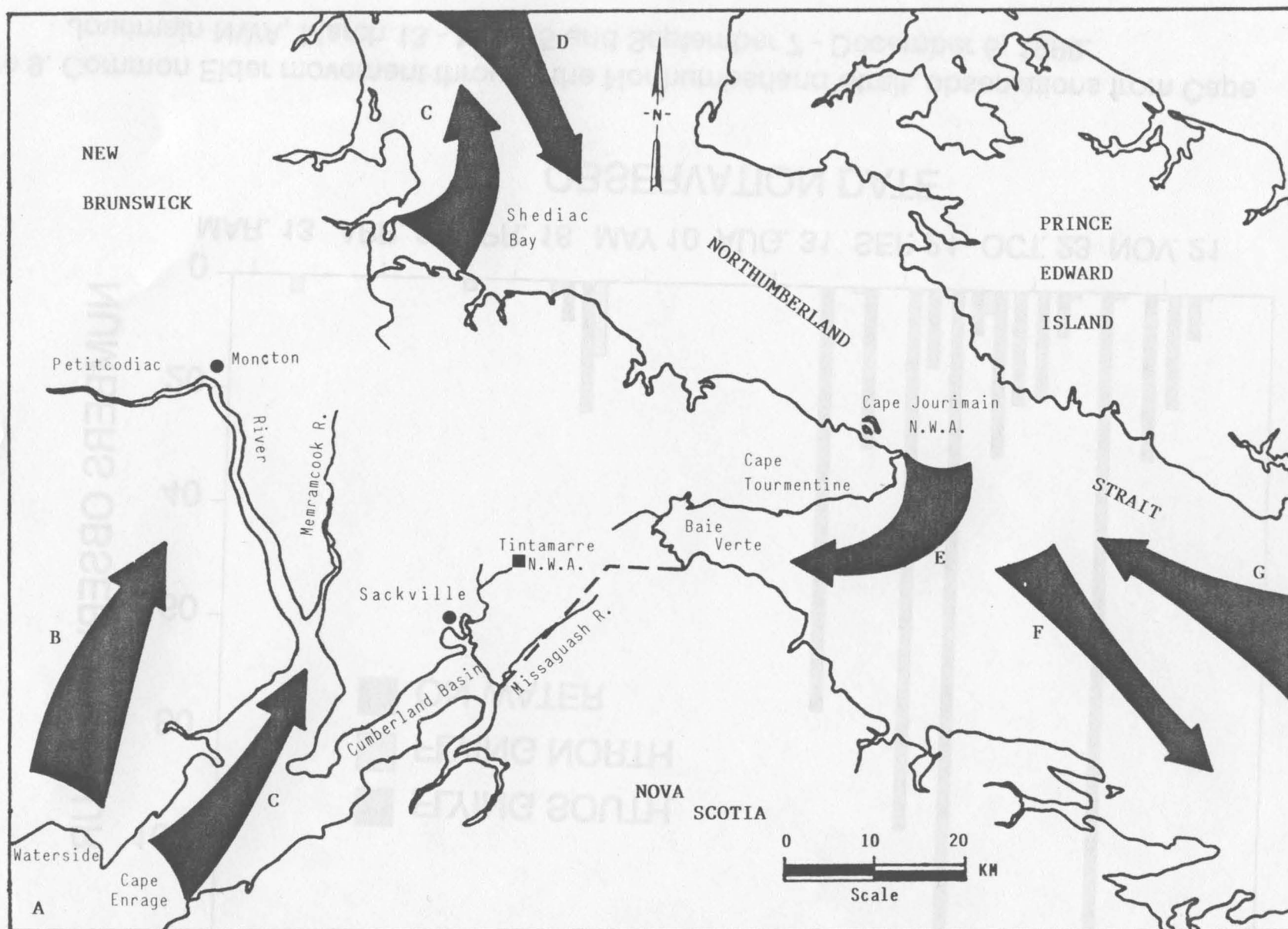


Figure 10. Speculation on scoter and eider migration in relation to the Northumberland Strait.

A. Scoter and eider spring staging area at Waterside. B. Overland migration from Waterside. C. Major flyway up Memramcook River, down Scoudouc River to Shediac Bay (Northumberland Strait). D. Southerly movement of scoters and eiders. E. Large southerly migration of eider across the Chignecto Isthmus. F. Large southerly migration along coast of the Northumberland Strait. G. Northerly migration of scoter and eider. (See text for details)

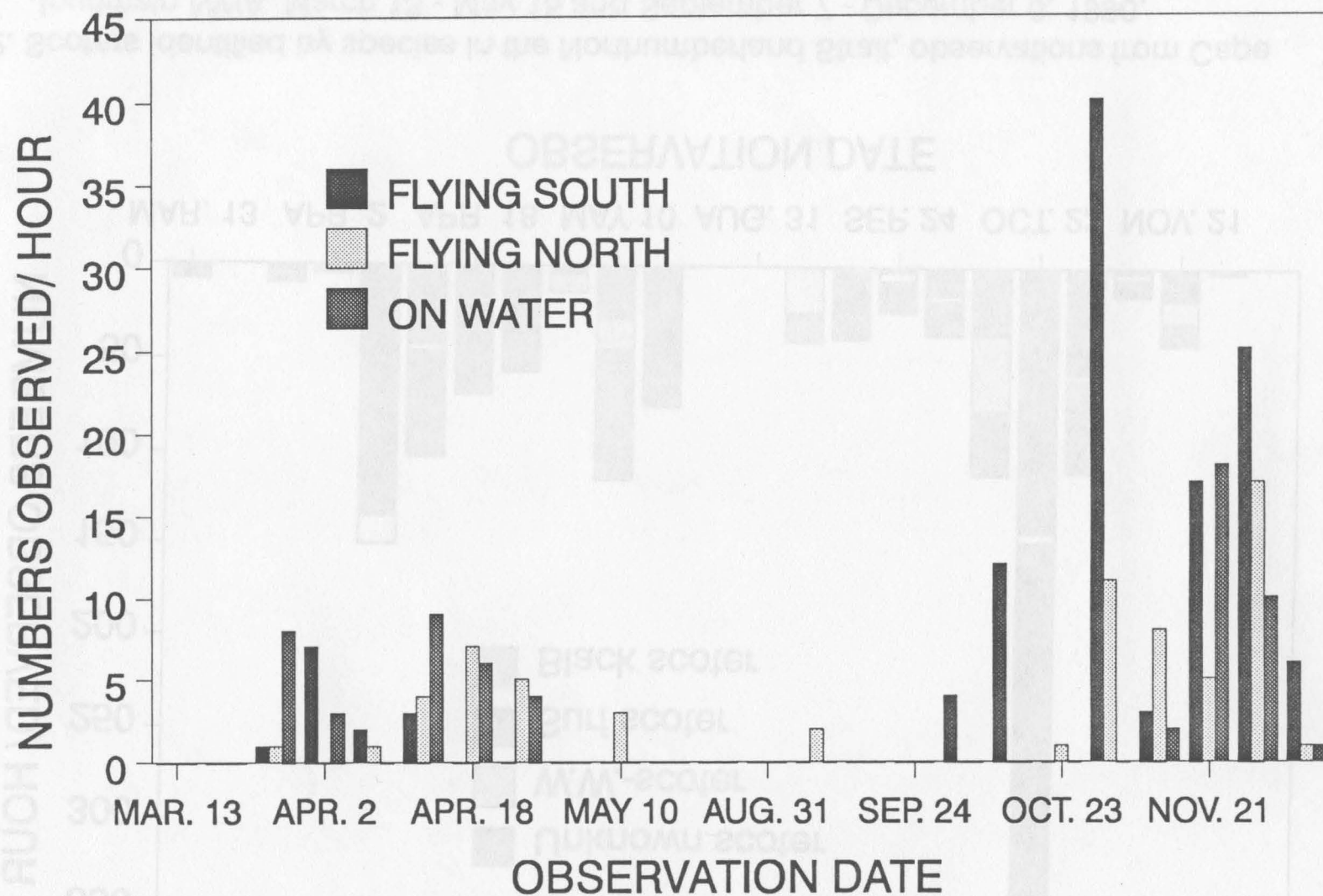


Figure 11. Oldsquaw movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

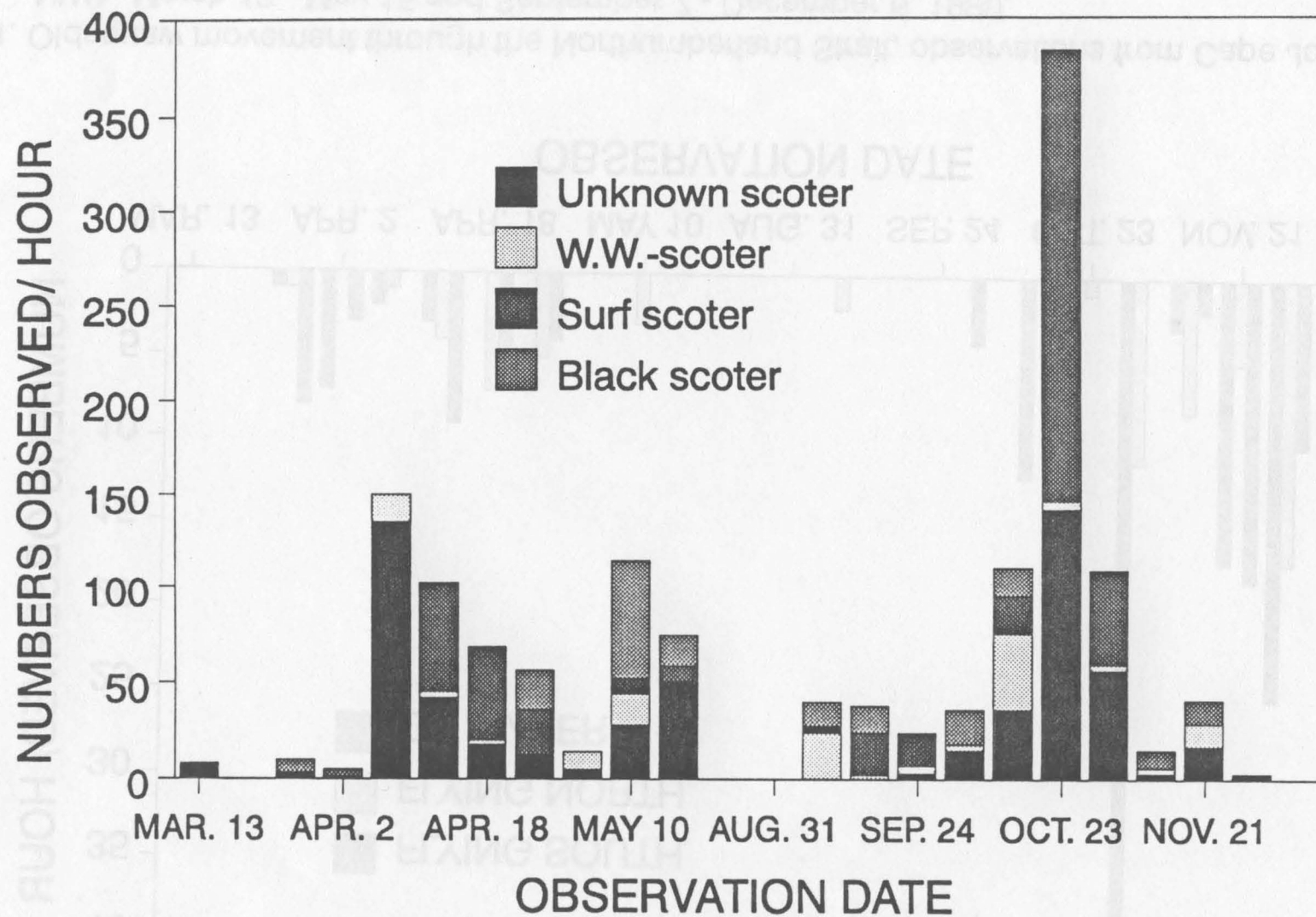


Figure 12. Scoters identified by species in the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

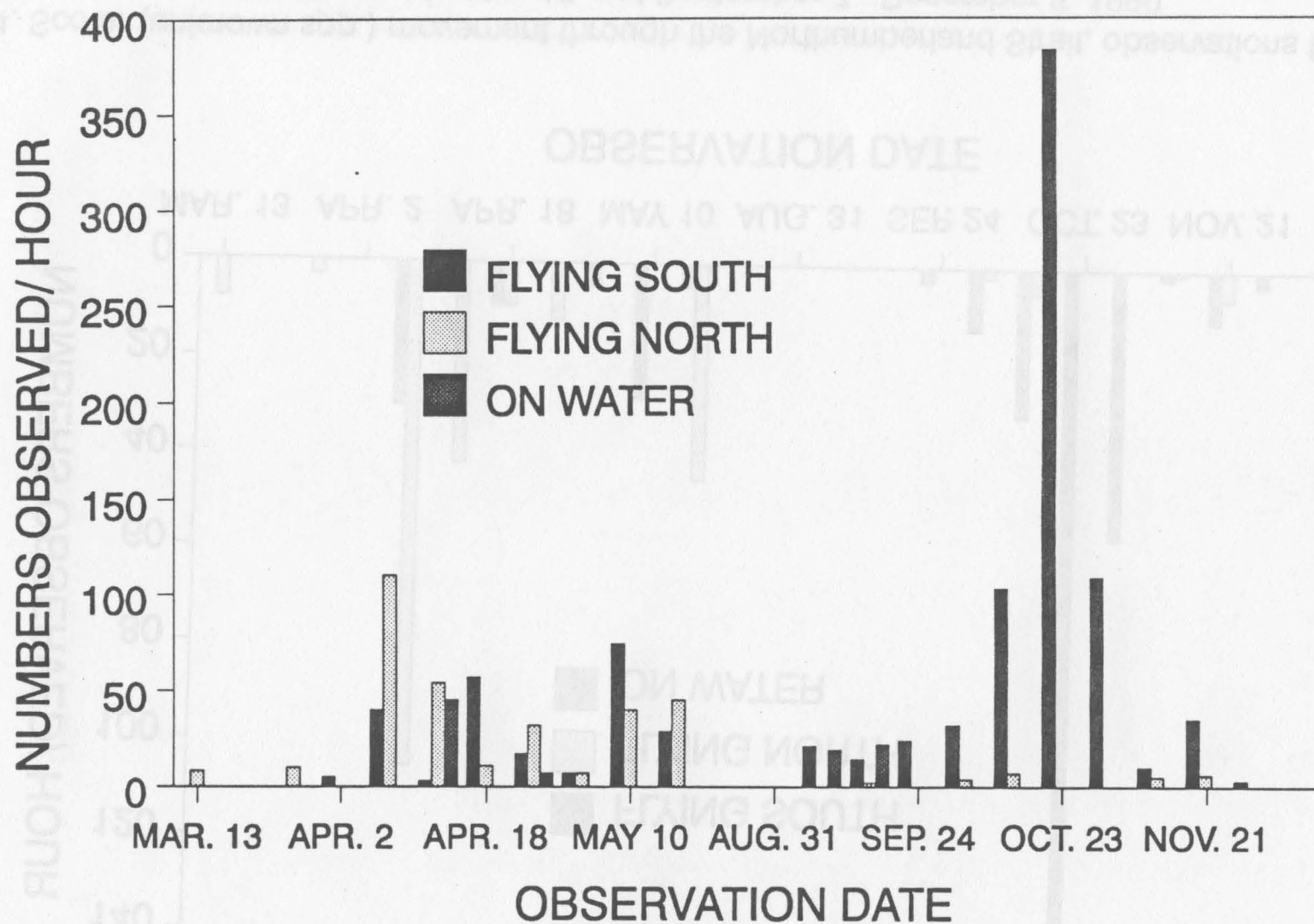


Figure 13. Scoter (all spp.) movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

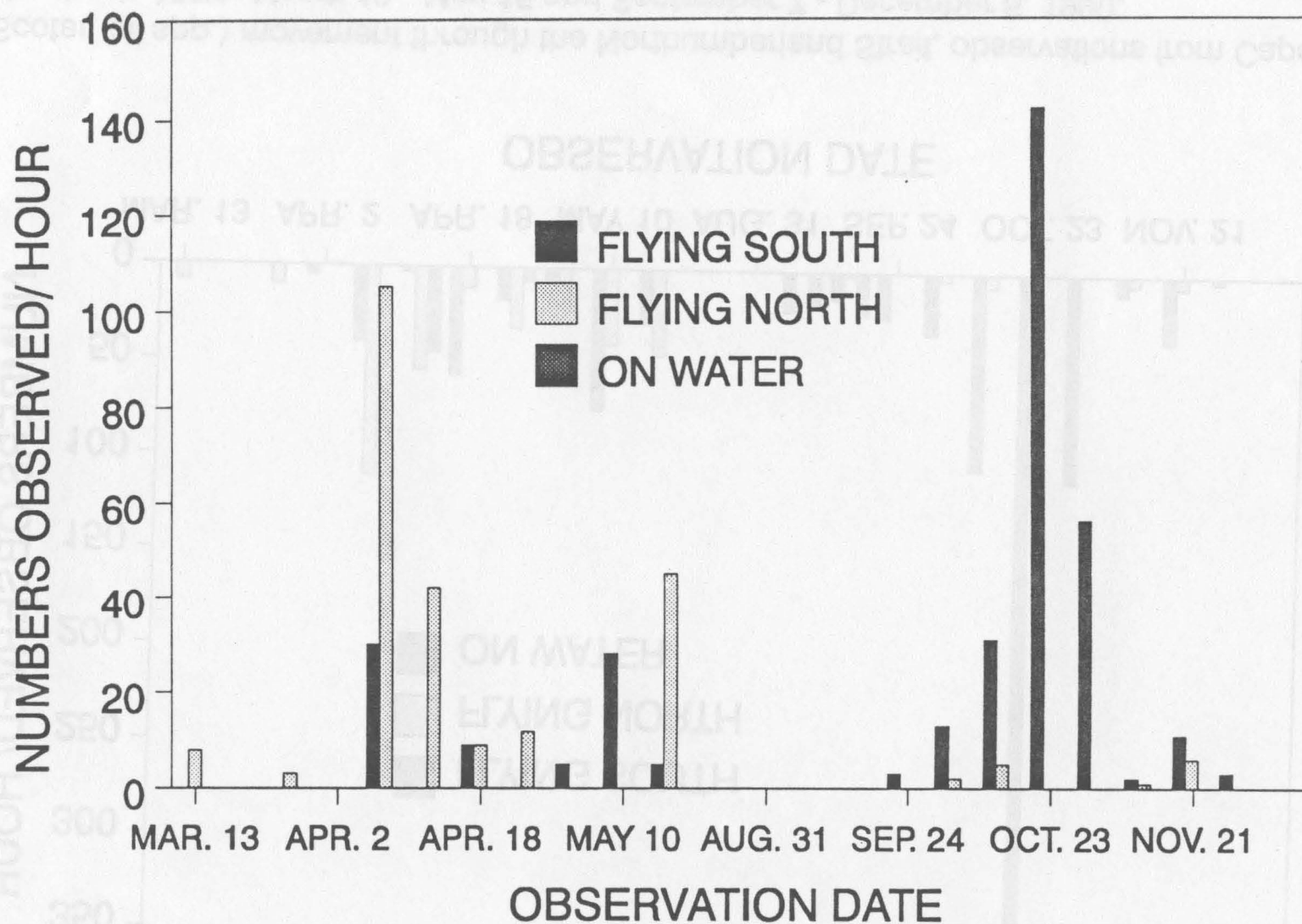


Figure 14. Scoter (unknown spp.) movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

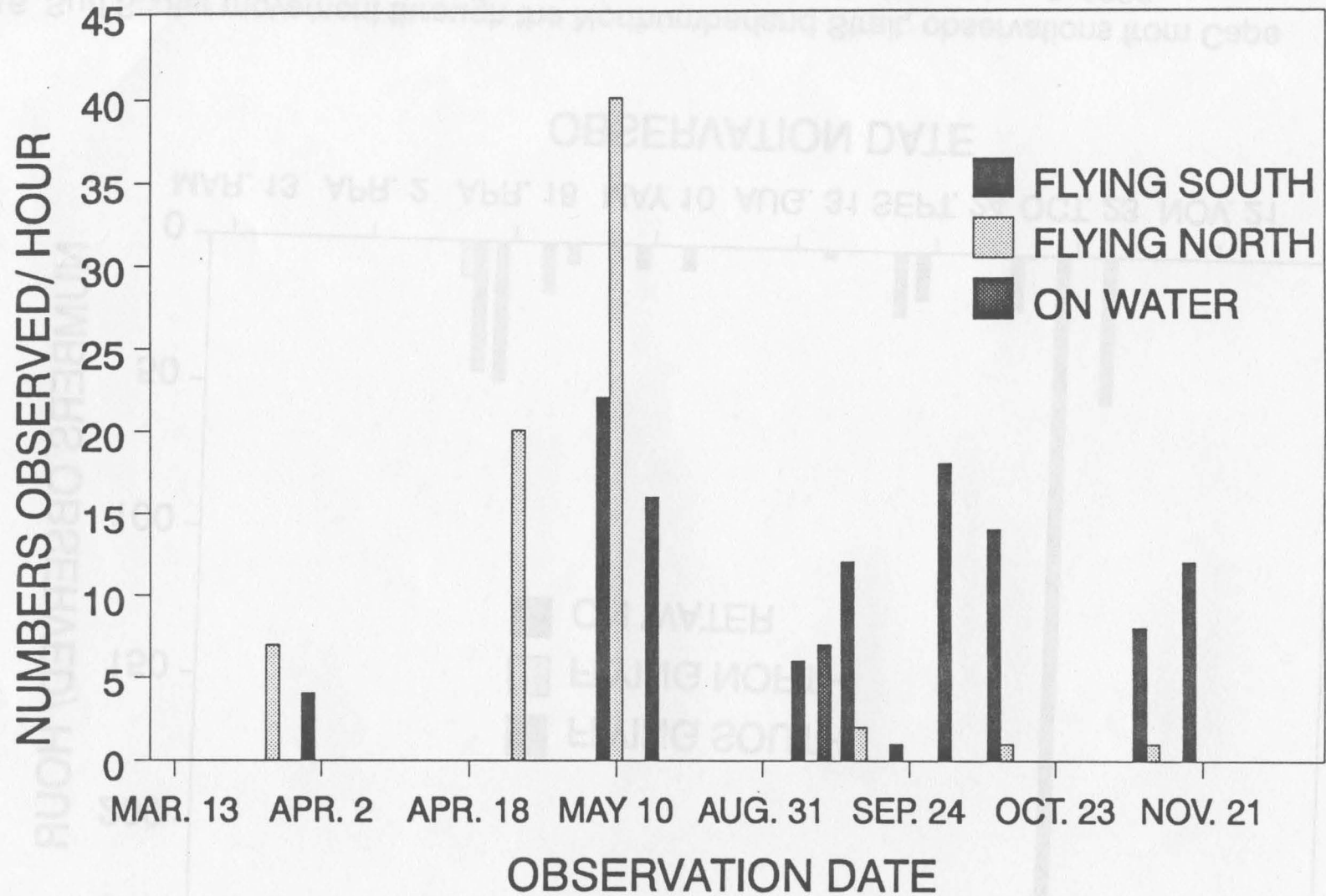


Figure 15. Black Scoter movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

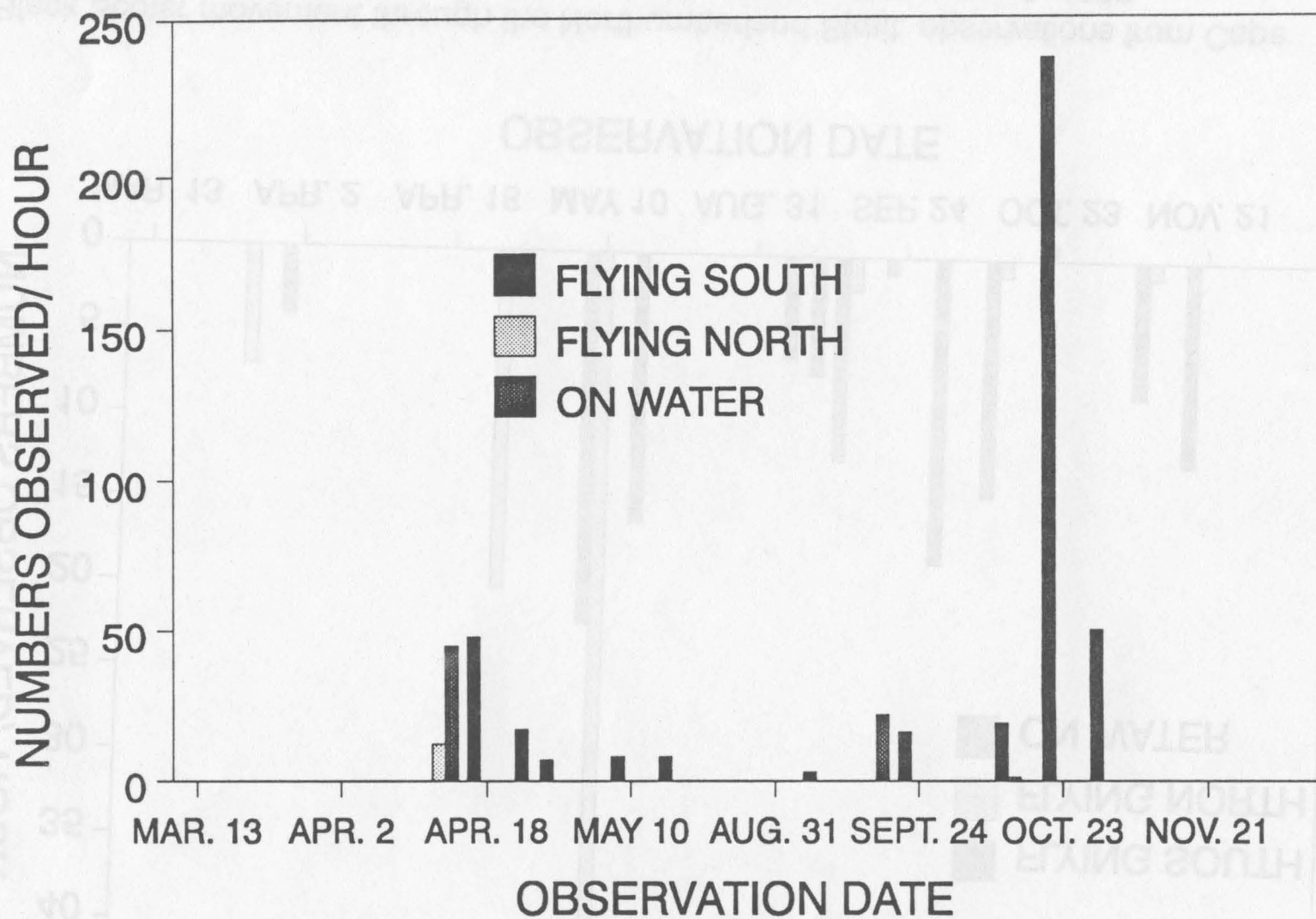


Figure 16. Surf Scoter movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

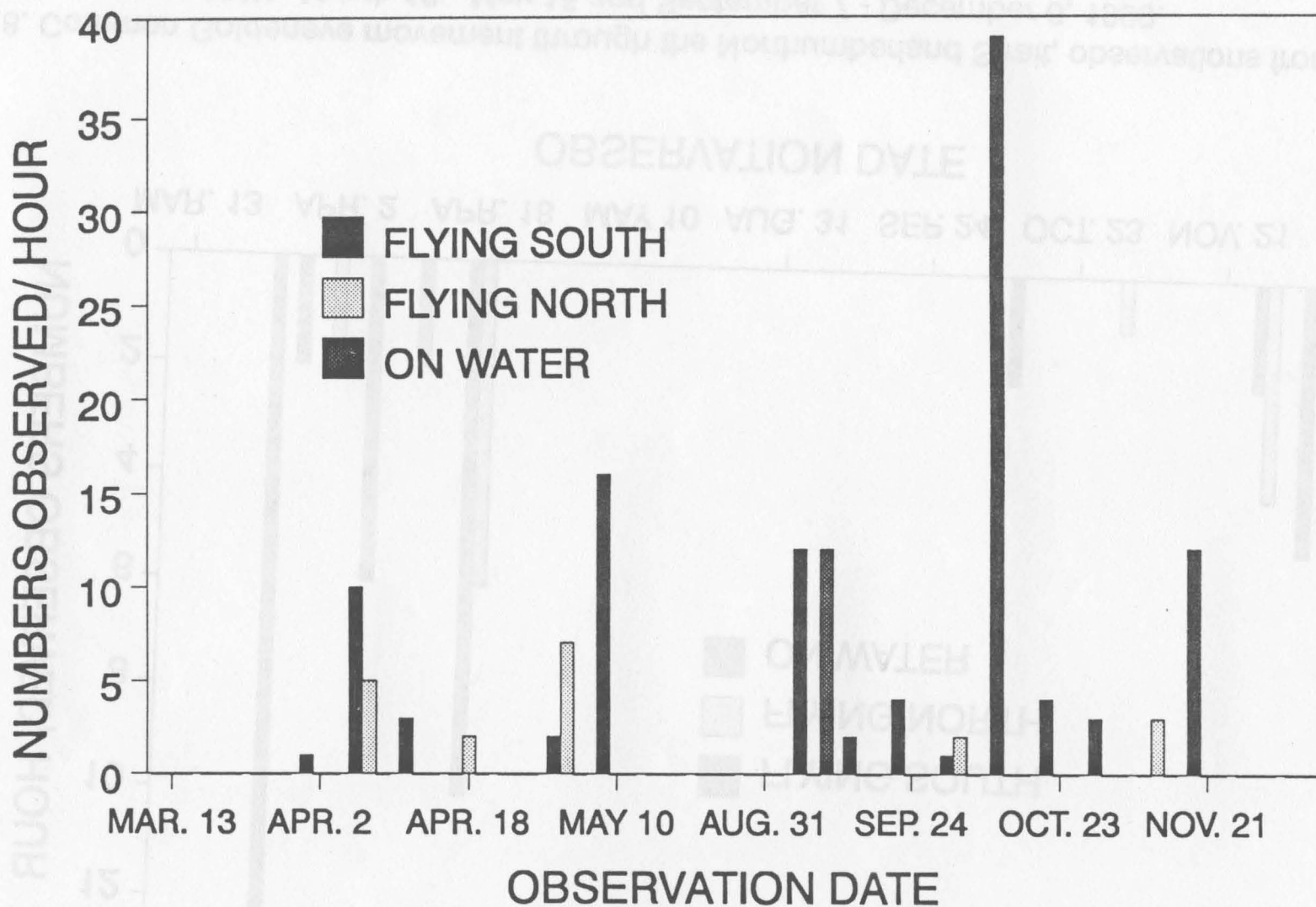


Figure 17. White-winged Scoter movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

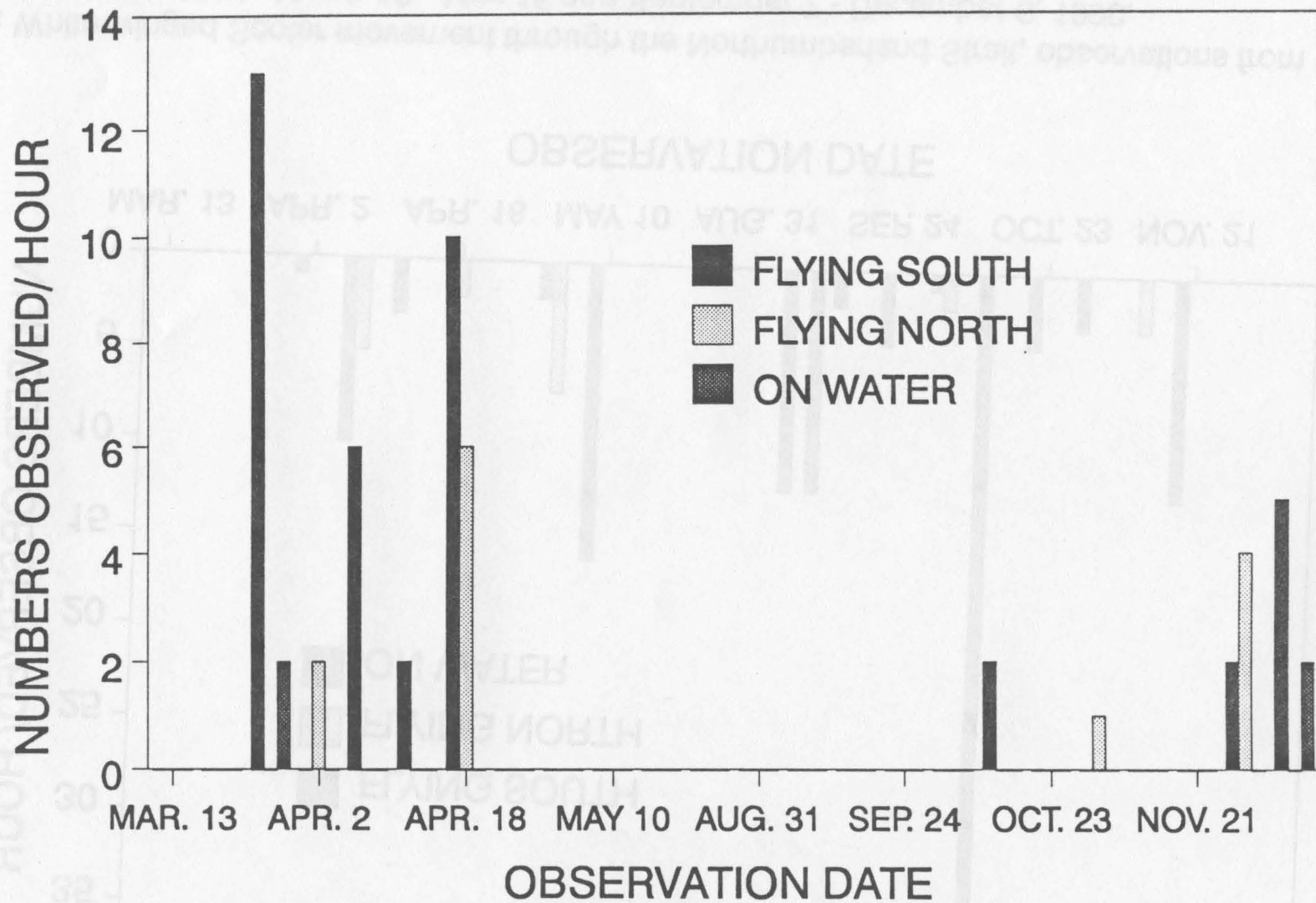


Figure 18. Common Goldeneye movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

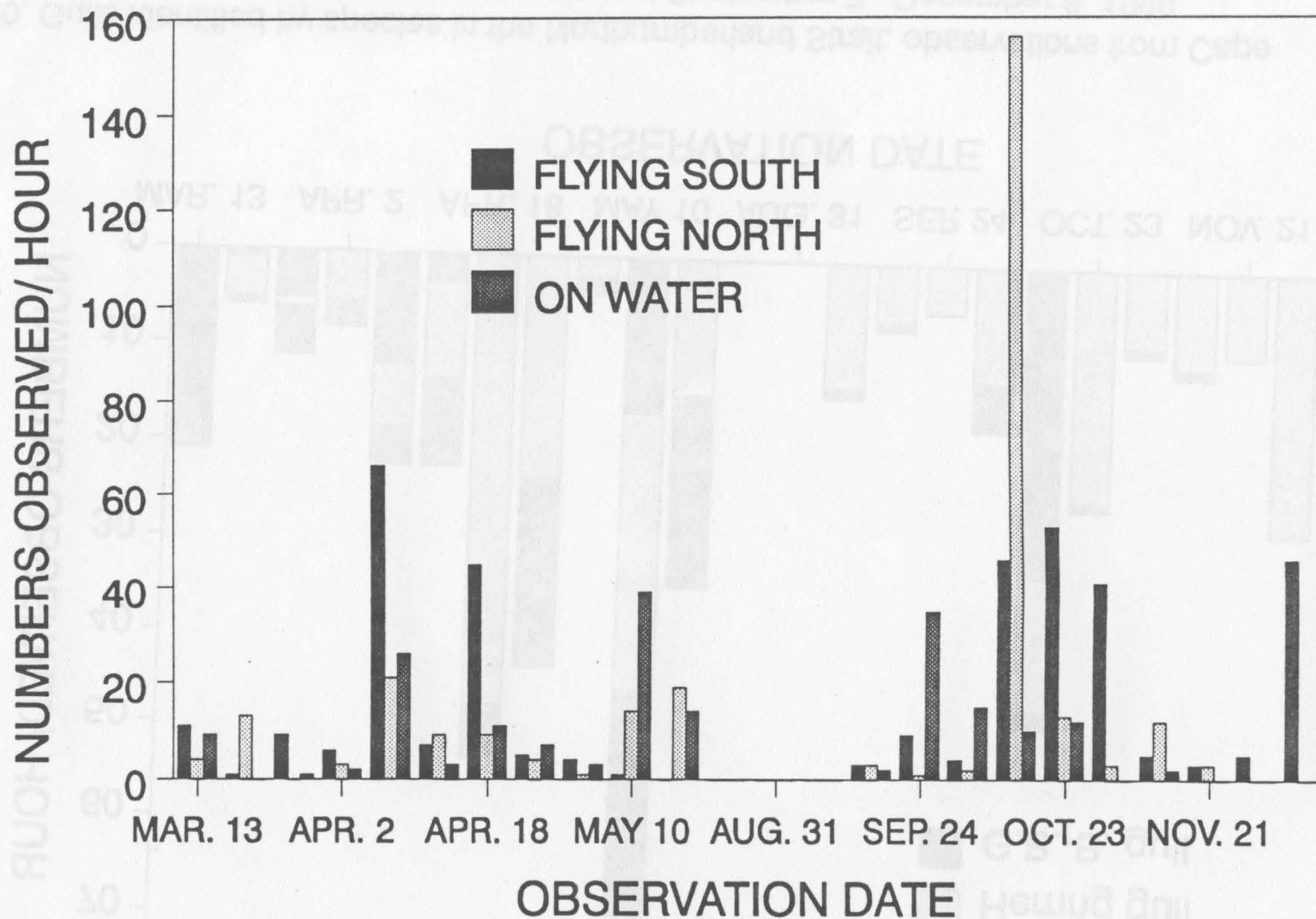


Figure 19. Red-breasted Merganser movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

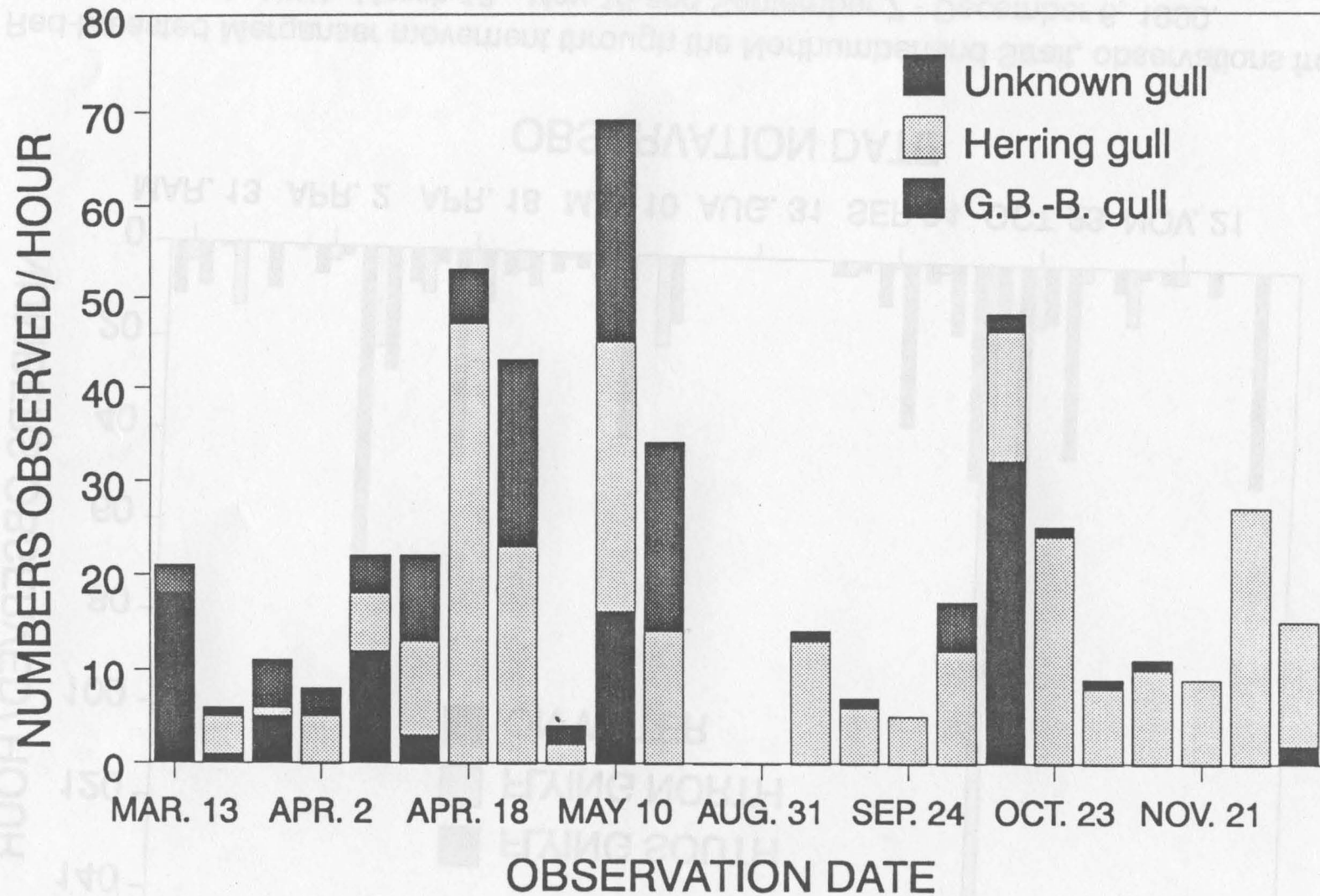


Figure 20. Gulls identified by species in the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

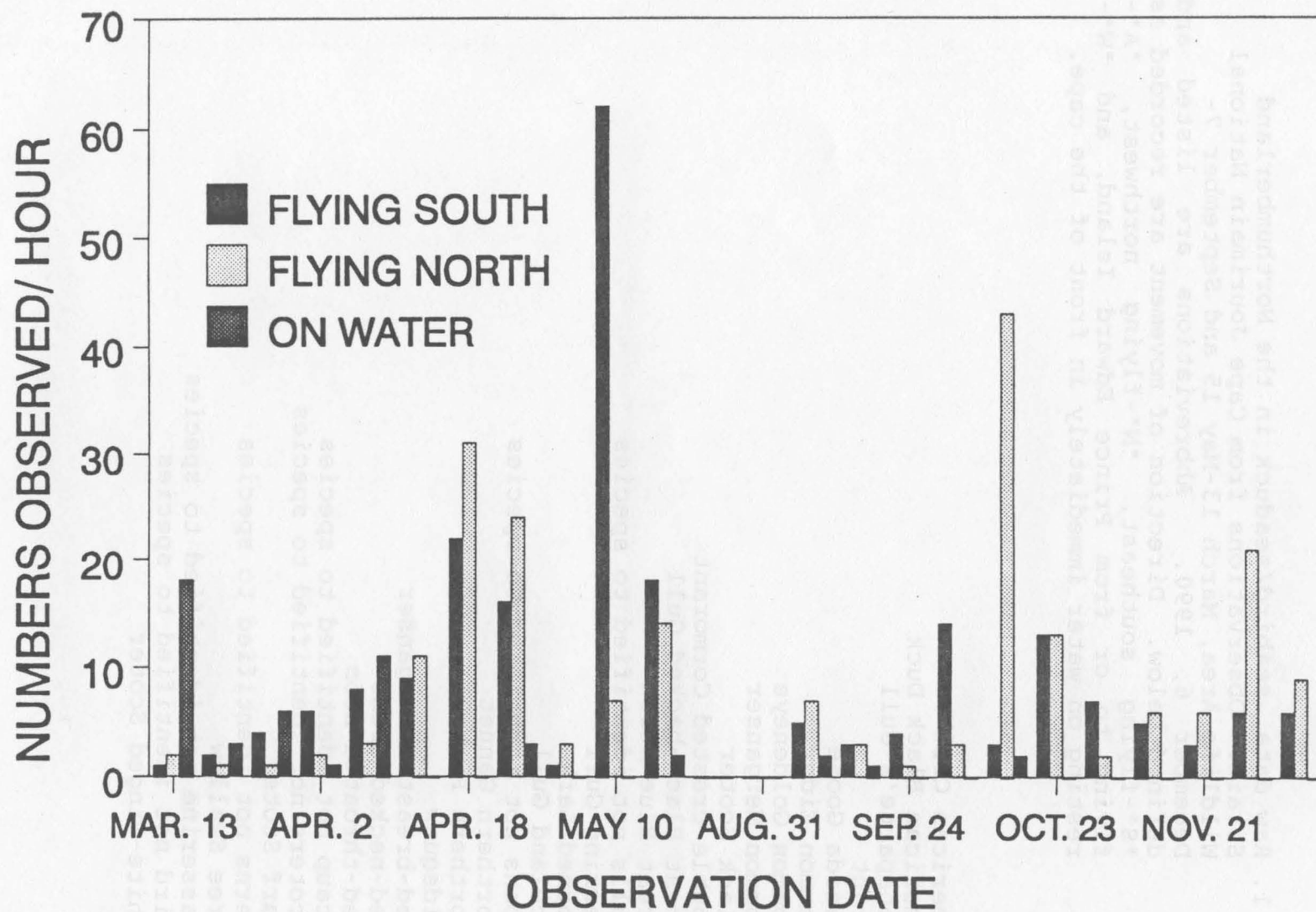


Figure 21. Gull (all spp.) movement through the Northumberland Strait, observations from Cape Jourimain NWA, March 13 - May 15 and September 7 - December 6, 1990.

Appendix 1. Raw data, seabird/seaduck in the Northumberland Strait. Observations from Cape Jourimain National Wildlife Area, March 13-May 15 and September 7-December 6, 1990. Abbreviations are listed and defined below. Direction of movement are recorded as "S"-flying southeast, "N"-flying northwest, "A"-flying to or from Prince Edward Island, and "W"-resting on water immediately in front of the cape.

AMCR - American Crow
 BLDU - American Black Duck
 BOGU - Bonaparte's Gull
 BRAN - Brant
 CAGO - Canada Goose
 COEI - Common Eider
 COGO - Common Goldeneye
 COME - Common Merganser
 COSC - Black Scoter
 DCCO - Double-crested Cormorant
 GBBG - Great Black-backed Gull
 GBHE - Great Blue Heron
 GUSP - gulls not identified to species
 HEGU - Herring Gull
 HOLA - Horned Lark
 ICLG - Iceland Gull
 LOSP - loons not identified to species
 NOGA - Northern Gannet
 NOPI - Northern Pintail
 OLDS - Oldsquaw
 REME - Red-breasted Merganser
 RNGR - Red-necked Grebe
 RTLO - Red-throated Loon
 SCAU - Scaup not identified to species
 SCSP - scoters not identified to species
 SUSC - Surf Scoter
 TESP - terns not identified to species
 TRSW - Tree Swallow
 UNDI - passerine not identified to species
 UNKN - bird not identified to species
 WWSC - White-winged Scoter

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|-----|----|-------|
| | | | S | N | W | A | |
| 03/13/90 | 930 | AMCR | 0 | 0 | 75 | 0 | 75 |
| 03/13/90 | 950 | AMCR | 0 | 0 | 12 | 0 | 12 |
| 03/13/90 | 1010 | AMCR | 0 | 0 | 2 | 0 | 2 |
| 03/19/90 | 930 | AMCR | 1 | 0 | 0 | 0 | 1 |
| 03/19/90 | 900 | AMCR | 0 | 0 | 9 | 0 | 9 |
| 03/26/90 | 910 | AMCR | 2 | 0 | 0 | 0 | 2 |
| 03/26/90 | 900 | AMCR | 0 | 0 | 4 | 0 | 4 |
| 04/06/90 | 950 | AMCR | 10 | 0 | 0 | 0 | 10 |
| 04/06/90 | 920 | AMCR | 1 | 0 | 0 | 0 | 1 |
| 04/06/90 | 910 | AMCR | 2 | 0 | 0 | 0 | 2 |
| 04/06/90 | 930 | AMCR | 0 | 2 | 0 | 0 | 2 |
| 04/09/90 | 930 | AMCR | 0 | 0 | 0 | 2 | 2 |
| 04/09/90 | 1010 | AMCR | 1 | 0 | 0 | 2 | 3 |
| 04/09/90 | 920 | AMCR | 0 | 0 | 0 | 5 | 5 |
| 05/03/90 | 755 | AMCR | 0 | 0 | 0 | 3 | 3 |
| 09/11/90 | 1120 | AMCR | 1 | 0 | 0 | 0 | 1 |
| 11/09/90 | 1025 | AMCR | 0 | 1 | 0 | 0 | 1 |
| 03/19/90 | 900 | BLDU | 2 | 0 | 0 | 0 | 2 |
| 03/26/90 | 910 | BLDU | 2 | 0 | 0 | 0 | 2 |
| 05/15/90 | 1010 | BLDU | 1 | 0 | 0 | 0 | 1 |
| 05/15/90 | 1030 | BLDU | 0 | 2 | 0 | 0 | 2 |
| 10/12/90 | 905 | BLDU | 0 | 2 | 0 | 0 | 2 |
| 10/23/90 | 1000 | BOGU | 0 | 1 | 0 | 0 | 1 |
| 04/06/90 | 1000 | BRAN | 7 | 0 | 0 | 0 | 7 |
| 04/06/90 | 940 | CAGO | 5 | 0 | 0 | 0 | 5 |
| 04/06/90 | 920 | CAGO | 0 | 0 | 0 | 24 | 24 |
| 04/09/90 | 930 | CAGO | 0 | 17 | 0 | 0 | 17 |
| 04/09/90 | 920 | CAGO | 0 | 0 | 0 | 35 | 35 |
| 04/09/90 | 1010 | CAGO | 0 | 0 | 0 | 18 | 18 |
| 10/30/90 | 910 | CAGO | 0 | 39 | 0 | 0 | 39 |
| 10/30/90 | 930 | CAGO | 0 | 76 | 0 | 0 | 76 |
| 03/19/90 | 930 | COEI | 0 | 3 | 0 | 0 | 3 |
| 04/09/90 | 1000 | COEI | 0 | 2 | 0 | 0 | 2 |
| 04/22/90 | 645 | COEI | 0 | 0 | 2 | 0 | 2 |
| 04/22/90 | 725 | COEI | 0 | 0 | 5 | 0 | 5 |
| 04/22/90 | 655 | COEI | 0 | 2 | 0 | 0 | 2 |
| 05/03/90 | 755 | COEI | 0 | 13 | 0 | 0 | 13 |
| 05/03/90 | 745 | COEI | 2 | 0 | 0 | 0 | 2 |
| 05/03/90 | 825 | COEI | 21 | 0 | 0 | 0 | 21 |
| 09/07/90 | 1015 | COEI | 0 | 0 | 65 | 0 | 65 |
| 09/07/90 | 945 | COEI | 0 | 0 | 1 | 0 | 1 |
| 09/07/90 | 925 | COEI | 0 | 0 | 8 | 0 | 8 |
| 09/11/90 | 1040 | COEI | 0 | 1 | 0 | 0 | 1 |
| 09/11/90 | 1030 | COEI | 0 | 0 | 28 | 0 | 28 |
| 09/24/90 | 1345 | COEI | 0 | 0 | 4 | 0 | 4 |
| 09/24/90 | 1435 | COEI | 0 | 0 | 90 | 0 | 90 |
| 10/12/90 | 945 | COEI | 13 | 0 | 110 | 0 | 123 |
| 10/12/90 | 935 | COEI | 1 | 0 | 0 | 0 | 1 |
| 10/12/90 | 905 | COEI | 0 | 0 | 2 | 0 | 2 |
| 10/12/90 | 855 | COEI | 0 | 0 | 4 | 0 | 4 |
| 10/17/90 | 920 | COEI | 8 | 1 | 0 | 0 | 9 |
| 10/17/90 | 1000 | COEI | 0 | 0 | 26 | 0 | 26 |
| 10/17/90 | 930 | COEI | 0 | 2 | 1 | 0 | 3 |
| 10/17/90 | 910 | COEI | 0 | 1 | 2 | 0 | 3 |
| 10/23/90 | 930 | COEI | 0 | 0 | 6 | 0 | 6 |
| 10/23/90 | 940 | COEI | 7 | 0 | 0 | 0 | 7 |
| 10/23/90 | 1000 | COEI | 2 | 0 | 13 | 0 | 15 |
| 10/23/90 | 950 | COEI | 11 | 0 | 0 | 0 | 11 |
| 10/30/90 | 910 | COEI | 0 | 1 | 0 | 0 | 1 |
| 10/30/90 | 930 | COEI | 8 | 0 | 0 | 0 | 8 |
| 11/09/90 | 1005 | COEI | 100 | 0 | 0 | 0 | 100 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|----|---|-------|
| | | | S | N | W | A | |
| 11/09/90 | 945 | COEI | 15 | 0 | 0 | 0 | 15 |
| 11/09/90 | 1025 | COEI | 0 | 1 | 0 | 0 | 1 |
| 11/21/90 | 1010 | COEI | 15 | 1 | 0 | 0 | 16 |
| 11/21/90 | 1000 | COEI | 3 | 0 | 0 | 0 | 3 |
| 11/21/90 | 940 | COEI | 0 | 0 | 20 | 0 | 20 |
| 11/21/90 | 930 | COEI | 11 | 0 | 0 | 0 | 11 |
| 11/27/90 | 920 | COEI | 3 | 1 | 0 | 0 | 4 |
| 11/27/90 | 900 | COEI | 1 | 0 | 0 | 0 | 1 |
| 11/27/90 | 950 | COEI | 4 | 0 | 0 | 0 | 4 |
| 03/26/90 | 900 | COGO | 3 | 0 | 0 | 0 | 3 |
| 03/26/90 | 920 | COGO | 1 | 0 | 0 | 0 | 1 |
| 03/26/90 | 910 | COGO | 0 | 0 | 2 | 0 | 2 |
| 03/26/90 | 930 | COGO | 9 | 0 | 0 | 0 | 9 |
| 04/02/90 | 905 | COGO | 0 | 2 | 0 | 0 | 2 |
| 04/06/90 | 930 | COGO | 3 | 0 | 0 | 0 | 3 |
| 04/06/90 | 920 | COGO | 3 | 0 | 0 | 0 | 3 |
| 04/09/90 | 940 | COGO | 1 | 0 | 0 | 0 | 1 |
| 04/09/90 | 950 | COGO | 1 | 0 | 0 | 0 | 1 |
| 04/18/90 | 840 | COGO | 7 | 0 | 0 | 0 | 7 |
| 04/18/90 | 830 | COGO | 2 | 0 | 0 | 0 | 2 |
| 04/18/90 | 850 | COGO | 0 | 2 | 0 | 0 | 2 |
| 04/18/90 | 910 | COGO | 1 | 4 | 0 | 0 | 5 |
| 10/17/90 | 920 | COGO | 2 | 0 | 0 | 0 | 2 |
| 10/30/90 | 920 | COGO | 0 | 1 | 0 | 0 | 1 |
| 11/27/90 | 930 | COGO | 0 | 2 | 0 | 0 | 2 |
| 11/27/90 | 940 | COGO | 2 | 0 | 0 | 0 | 2 |
| 11/27/90 | 900 | COGO | 0 | 2 | 0 | 0 | 2 |
| 12/06/90 | 940 | COGO | 5 | 0 | 0 | 0 | 5 |
| 04/18/90 | 910 | COME | 4 | 3 | 0 | 0 | 7 |
| 10/30/90 | 900 | COME | 1 | 0 | 0 | 0 | 1 |
| 03/26/90 | 940 | COSC | 0 | 7 | 0 | 0 | 7 |
| 04/02/90 | 935 | COSC | 4 | 0 | 0 | 0 | 4 |
| 04/22/90 | 735 | COSC | 0 | 20 | 0 | 0 | 20 |
| 05/10/90 | 910 | COSC | 2 | 0 | 0 | 0 | 2 |
| 05/10/90 | 900 | COSC | 5 | 0 | 0 | 0 | 5 |
| 05/10/90 | 830 | COSC | 5 | 10 | 0 | 0 | 15 |
| 05/10/90 | 840 | COSC | 10 | 30 | 0 | 0 | 40 |
| 05/15/90 | 1050 | COSC | 16 | 0 | 0 | 0 | 16 |
| 09/07/90 | 1015 | COSC | 6 | 0 | 0 | 4 | 6 |
| 09/07/90 | 1005 | COSC | 0 | 0 | 7 | 0 | 7 |
| 09/11/90 | 1120 | COSC | 0 | 2 | 0 | 0 | 2 |
| 09/11/90 | 1030 | COSC | 12 | 0 | 0 | 0 | 12 |
| 09/24/90 | 1405 | COSC | 1 | 0 | 0 | 0 | 1 |
| 10/12/90 | 925 | COSC | 18 | 0 | 0 | 0 | 18 |
| 10/17/90 | 920 | COSC | 14 | 0 | 0 | 0 | 14 |
| 10/17/90 | 940 | COSC | 0 | 1 | 0 | 0 | 1 |
| 11/09/90 | 1005 | COSC | 0 | 1 | 0 | 0 | 1 |
| 11/09/90 | 1025 | COSC | 8 | 0 | 0 | 0 | 8 |
| 11/21/90 | 1000 | COSC | 10 | 0 | 0 | 0 | 10 |
| 11/21/90 | 950 | COSC | 2 | 0 | 0 | 0 | 2 |
| 05/03/90 | 745 | DCCO | 0 | 1 | 0 | 0 | 1 |
| 05/03/90 | 735 | DCCO | 0 | 2 | 0 | 0 | 2 |
| 05/03/90 | 825 | DCCO | 5 | 0 | 0 | 0 | 5 |
| 05/10/90 | 850 | DCCO | 1 | 0 | 0 | 0 | 1 |
| 05/15/90 | 1000 | DCCO | 1 | 0 | 0 | 0 | 1 |
| 09/07/90 | 1015 | DCCO | 0 | 1 | 0 | 0 | 1 |
| 09/07/90 | 925 | DCCO | 0 | 4 | 0 | 0 | 4 |
| 09/11/90 | 1050 | DCCO | 8 | 12 | 0 | 0 | 20 |
| 09/11/90 | 1100 | DCCO | 0 | 36 | 0 | 0 | 36 |
| 09/11/90 | 1030 | DCCO | 0 | 25 | 35 | 0 | 60 |
| 09/11/90 | 1040 | DCCO | 2 | 6 | 0 | 0 | 8 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|----|---|-------|
| | | | S | N | W | A | |
| 09/11/90 | 1110 | DCCO | 3 | 27 | 0 | 0 | 30 |
| 09/11/90 | 1120 | DCCO | 5 | 7 | 0 | 0 | 12 |
| 09/24/90 | 1425 | DCCO | 0 | 2 | 0 | 0 | 2 |
| 09/24/90 | 1415 | DCCO | 1 | 0 | 0 | 0 | 1 |
| 09/24/90 | 1435 | DCCO | 7 | 0 | 80 | 0 | 87 |
| 10/12/90 | 855 | DCCO | 0 | 0 | 2 | 0 | 2 |
| 10/12/90 | 945 | DCCO | 3 | 2 | 16 | 0 | 21 |
| 10/12/90 | 935 | DCCO | 1 | 0 | 0 | 0 | 1 |
| 10/23/90 | 1000 | DCCO | 20 | 0 | 0 | 0 | 20 |
| 10/23/90 | 920 | DCCO | 4 | 0 | 0 | 0 | 4 |
| 10/30/90 | 950 | DCCO | 1 | 0 | 0 | 0 | 1 |
| 10/30/90 | 930 | DCCO | 1 | 0 | 0 | 0 | 1 |
| 03/13/90 | 1020 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 03/13/90 | 950 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 03/13/90 | 1000 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 03/19/90 | 920 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 03/26/90 | 940 | GBBG | 2 | 0 | 0 | 0 | 2 |
| 03/26/90 | 910 | GBBG | 0 | 0 | 1 | 0 | 1 |
| 03/26/90 | 930 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 03/26/90 | 920 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 04/02/90 | 855 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 04/02/90 | 905 | GBBG | 2 | 0 | 0 | 0 | 2 |
| 04/06/90 | 950 | GBBG | 2 | 1 | 0 | 0 | 3 |
| 04/06/90 | 930 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 04/09/90 | 940 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 04/09/90 | 920 | GBBG | 2 | 1 | 0 | 2 | 5 |
| 04/09/90 | 930 | GBBG | 1 | 2 | 0 | 0 | 3 |
| 04/18/90 | 850 | GBBG | 2 | 0 | 0 | 0 | 2 |
| 04/18/90 | 900 | GBBG | 0 | 2 | 0 | 0 | 2 |
| 04/18/90 | 830 | GBBG | 0 | 2 | 0 | 0 | 2 |
| 04/22/90 | 725 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 04/22/90 | 715 | GBBG | 1 | 6 | 0 | 0 | 7 |
| 04/22/90 | 705 | GBBG | 0 | 3 | 0 | 0 | 3 |
| 04/22/90 | 645 | GBBG | 2 | 0 | 1 | 0 | 3 |
| 04/22/90 | 735 | GBBG | 0 | 6 | 0 | 0 | 6 |
| 05/03/90 | 805 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 05/03/90 | 815 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 05/10/90 | 850 | GBBG | 4 | 0 | 0 | 0 | 4 |
| 05/10/90 | 900 | GBBG | 7 | 0 | 0 | 0 | 7 |
| 05/10/90 | 840 | GBBG | 1 | 1 | 0 | 0 | 2 |
| 05/10/90 | 920 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 05/10/90 | 830 | GBBG | 10 | 0 | 0 | 0 | 10 |
| 05/15/90 | 1020 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 05/15/90 | 1040 | GBBG | 0 | 2 | 0 | 0 | 2 |
| 05/15/90 | 1050 | GBBG | 3 | 1 | 0 | 0 | 4 |
| 05/15/90 | 1010 | GBBG | 6 | 1 | 0 | 0 | 7 |
| 05/15/90 | 1030 | GBBG | 0 | 3 | 2 | 0 | 5 |
| 05/15/90 | 1000 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 09/07/90 | 925 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 09/11/90 | 1100 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 10/12/90 | 905 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 10/12/90 | 925 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 10/12/90 | 935 | GBBG | 0 | 2 | 0 | 0 | 2 |
| 10/12/90 | 945 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 10/17/90 | 910 | GBBG | 1 | 0 | 1 | 0 | 2 |
| 10/23/90 | 930 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 10/30/90 | 950 | GBBG | 1 | 0 | 0 | 0 | 1 |
| 11/09/90 | 1005 | GBBG | 0 | 1 | 0 | 0 | 1 |
| 09/07/90 | 935 | GBHE | 1 | 0 | 0 | 0 | 1 |
| 03/13/90 | 930 | GUSP | 0 | 0 | 18 | 0 | 18 |
| 03/19/90 | 930 | GUSP | 0 | 1 | 0 | 0 | 1 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|---|---|-------|
| | | | S | N | W | A | |
| 03/26/90 | 910 | GUSP | 0 | 1 | 4 | 0 | 5 |
| 04/06/90 | 910 | GUSP | 0 | 0 | 9 | 0 | 9 |
| 04/06/90 | 930 | GUSP | 3 | 0 | 0 | 0 | 3 |
| 04/09/90 | 950 | GUSP | 0 | 3 | 0 | 0 | 3 |
| 05/10/90 | 910 | GUSP | 0 | 2 | 0 | 0 | 2 |
| 05/10/90 | 850 | GUSP | 3 | 0 | 0 | 0 | 3 |
| 05/10/90 | 920 | GUSP | 2 | 0 | 0 | 0 | 2 |
| 05/10/90 | 830 | GUSP | 6 | 0 | 0 | 0 | 6 |
| 05/10/90 | 840 | GUSP | 1 | 0 | 0 | 0 | 1 |
| 05/10/90 | 900 | GUSP | 2 | 0 | 0 | 0 | 2 |
| 10/17/90 | 950 | GUSP | 0 | 6 | 0 | 0 | 6 |
| 10/17/90 | 930 | GUSP | 0 | 26 | 0 | 0 | 26 |
| 12/06/90 | 940 | GUSP | 0 | 2 | 0 | 0 | 2 |
| 03/19/90 | 920 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 03/19/90 | 900 | HEGU | 0 | 0 | 3 | 0 | 3 |
| 03/26/90 | 900 | HEGU | 0 | 0 | 1 | 0 | 1 |
| 04/02/90 | 945 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 04/02/90 | 915 | HEGU | 2 | 0 | 0 | 0 | 2 |
| 04/02/90 | 935 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 04/02/90 | 905 | HEGU | 0 | 0 | 1 | 0 | 1 |
| 04/06/90 | 950 | HEGU | 0 | 2 | 0 | 0 | 2 |
| 04/06/90 | 920 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 04/06/90 | 910 | HEGU | 1 | 0 | 2 | 0 | 3 |
| 04/09/90 | 1010 | HEGU | 3 | 0 | 0 | 0 | 3 |
| 04/09/90 | 1000 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 04/09/90 | 950 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 04/09/90 | 940 | HEGU | 3 | 1 | 0 | 0 | 4 |
| 04/09/90 | 930 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 04/18/90 | 850 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 04/18/90 | 920 | HEGU | 0 | 2 | 0 | 0 | 2 |
| 04/18/90 | 900 | HEGU | 1 | 21 | 0 | 0 | 22 |
| 04/18/90 | 830 | HEGU | 16 | 2 | 0 | 0 | 18 |
| 04/18/90 | 840 | HEGU | 2 | 0 | 0 | 0 | 2 |
| 04/18/90 | 910 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 04/22/90 | 715 | HEGU | 1 | 2 | 0 | 0 | 3 |
| 04/22/90 | 705 | HEGU | 3 | 4 | 0 | 0 | 7 |
| 04/22/90 | 735 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 04/22/90 | 655 | HEGU | 4 | 1 | 0 | 0 | 5 |
| 04/22/90 | 725 | HEGU | 2 | 0 | 0 | 0 | 2 |
| 04/22/90 | 645 | HEGU | 2 | 0 | 2 | 0 | 4 |
| 05/03/90 | 745 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 05/03/90 | 755 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 05/10/90 | 840 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 05/10/90 | 850 | HEGU | 2 | 1 | 0 | 0 | 3 |
| 05/10/90 | 910 | HEGU | 12 | 0 | 0 | 0 | 12 |
| 05/10/90 | 920 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 05/10/90 | 900 | HEGU | 7 | 1 | 0 | 0 | 8 |
| 05/10/90 | 830 | HEGU | 3 | 1 | 0 | 0 | 4 |
| 05/15/90 | 1050 | HEGU | 2 | 1 | 0 | 0 | 3 |
| 05/15/90 | 1000 | HEGU | 3 | 1 | 0 | 0 | 4 |
| 05/15/90 | 1030 | HEGU | 3 | 3 | 0 | 0 | 6 |
| 05/15/90 | 1040 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 09/07/90 | 945 | HEGU | 0 | 4 | 0 | 0 | 4 |
| 09/07/90 | 955 | HEGU | 5 | 1 | 0 | 0 | 6 |
| 09/07/90 | 1015 | HEGU | 0 | 1 | 2 | 0 | 3 |
| 09/11/90 | 1050 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 09/11/90 | 1110 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 09/11/90 | 1040 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 09/11/90 | 1100 | HEGU | 0 | 0 | 1 | 0 | 1 |
| 09/24/90 | 1355 | HEGU | 4 | 0 | 0 | 0 | 4 |
| 09/24/90 | 1415 | HEGU | 0 | 1 | 0 | 0 | 1 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|-----|---|---|-------|
| | | | S | N | W | A | |
| 10/12/90 | 915 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 10/12/90 | 905 | HEGU | 2 | 0 | 0 | 0 | 2 |
| 10/12/90 | 945 | HEGU | 7 | 0 | 0 | 0 | 7 |
| 10/12/90 | 935 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 10/17/90 | 910 | HEGU | 2 | 0 | 1 | 0 | 3 |
| 10/17/90 | 930 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 10/17/90 | 1000 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 10/17/90 | 940 | HEGU | 0 | 5 | 0 | 0 | 5 |
| 10/17/90 | 950 | HEGU | 0 | 4 | 0 | 0 | 4 |
| 10/23/90 | 940 | HEGU | 0 | 2 | 0 | 0 | 2 |
| 10/23/90 | 920 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 10/23/90 | 950 | HEGU | 4 | 0 | 0 | 0 | 4 |
| 10/23/90 | 1000 | HEGU | 1 | 2 | 0 | 0 | 3 |
| 10/23/90 | 910 | HEGU | 5 | 1 | 0 | 0 | 6 |
| 10/23/90 | 930 | HEGU | 1 | 6 | 0 | 0 | 7 |
| 10/30/90 | 910 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 10/30/90 | 930 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 10/30/90 | 920 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 10/30/90 | 940 | HEGU | 3 | 0 | 0 | 0 | 3 |
| 10/30/90 | 950 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 11/09/90 | 1035 | HEGU | 3 | 1 | 0 | 0 | 4 |
| 11/09/90 | 1025 | HEGU | 1 | 2 | 0 | 0 | 3 |
| 11/09/90 | 1005 | HEGU | 1 | 0 | 0 | 0 | 2 |
| 11/09/90 | 955 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 11/21/90 | 1000 | HEGU | 0 | 3 | 0 | 0 | 3 |
| 11/21/90 | 940 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 11/21/90 | 1010 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 11/21/90 | 930 | HEGU | 1 | 2 | 0 | 0 | 3 |
| 11/27/90 | 910 | HEGU | 0 | 5 | 0 | 0 | 5 |
| 11/27/90 | 940 | HEGU | 1 | 4 | 0 | 0 | 5 |
| 11/27/90 | 900 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 11/27/90 | 920 | HEGU | 2 | 3 | 0 | 0 | 5 |
| 11/27/90 | 950 | HEGU | 1 | 7 | 0 | 0 | 8 |
| 11/27/90 | 930 | HEGU | 1 | 2 | 0 | 0 | 3 |
| 12/06/90 | 940 | HEGU | 1 | 0 | 0 | 0 | 1 |
| 12/06/90 | 910 | HEGU | 2 | 2 | 0 | 0 | 4 |
| 12/06/90 | 950 | HEGU | 1 | 2 | 0 | 0 | 3 |
| 12/06/90 | 930 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 12/06/90 | 920 | HEGU | 0 | 1 | 0 | 0 | 1 |
| 12/06/90 | 1000 | HEGU | 1 | 1 | 0 | 0 | 2 |
| 11/09/90 | 1035 | HOLA | 0 | 150 | 0 | 0 | 150 |
| 04/02/90 | 915 | ICLG | 1 | 0 | 0 | 0 | 1 |
| 04/09/90 | 940 | LOSP | 0 | 1 | 0 | 0 | 1 |
| 05/15/90 | 1040 | LOSP | 0 | 0 | 4 | 0 | 4 |
| 05/15/90 | 1000 | LOSP | 0 | 2 | 0 | 0 | 2 |
| 05/15/90 | 1030 | LOSP | 0 | 1 | 1 | 0 | 2 |
| 05/15/90 | 1050 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 09/07/90 | 1015 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 09/07/90 | 1005 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 09/07/90 | 945 | LOSP | 2 | 0 | 0 | 0 | 2 |
| 09/11/90 | 1120 | LOSP | 4 | 0 | 0 | 0 | 4 |
| 09/11/90 | 1100 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 09/11/90 | 1040 | LOSP | 3 | 1 | 0 | 0 | 4 |
| 09/11/90 | 1050 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 10/23/90 | 1000 | LOSP | 3 | 0 | 0 | 0 | 3 |
| 10/23/90 | 930 | LOSP | 1 | 1 | 0 | 0 | 2 |
| 10/30/90 | 900 | LOSP | 5 | 0 | 0 | 0 | 5 |
| 10/30/90 | 940 | LOSP | 59 | 0 | 0 | 0 | 59 |
| 10/30/90 | 920 | LOSP | 29 | 1 | 0 | 0 | 30 |
| 10/30/90 | 950 | LOSP | 54 | 0 | 2 | 0 | 56 |
| 10/30/90 | 930 | LOSP | 9 | 0 | 0 | 0 | 9 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|---|---|---|-------|
| | | | S | N | W | A | |
| 10/30/90 | 910 | LOSP | 39 | 0 | 0 | 0 | 39 |
| 11/21/90 | 1020 | LOSP | 0 | 1 | 0 | 0 | 1 |
| 11/21/90 | 1000 | LOSP | 0 | 1 | 0 | 0 | 1 |
| 11/21/90 | 950 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 11/21/90 | 940 | LOSP | 1 | 0 | 1 | 0 | 2 |
| 11/27/90 | 920 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 11/27/90 | 930 | LOSP | 4 | 0 | 0 | 0 | 4 |
| 11/27/90 | 910 | LOSP | 1 | 0 | 0 | 0 | 1 |
| 04/06/90 | 940 | NOGA | 1 | 0 | 0 | 0 | 1 |
| 04/09/90 | 920 | NOGA | 0 | 2 | 0 | 0 | 2 |
| 04/18/90 | 840 | NOGA | 4 | 0 | 0 | 0 | 4 |
| 04/18/90 | 910 | NOGA | 36 | 0 | 0 | 0 | 36 |
| 04/18/90 | 830 | NOGA | 4 | 0 | 0 | 0 | 4 |
| 04/18/90 | 850 | NOGA | 5 | 0 | 2 | 0 | 7 |
| 04/18/90 | 900 | NOGA | 6 | 0 | 0 | 0 | 6 |
| 05/03/90 | 745 | NOGA | 0 | 1 | 0 | 0 | 1 |
| 05/15/90 | 1010 | NOGA | 4 | 0 | 0 | 0 | 4 |
| 05/15/90 | 1050 | NOGA | 0 | 1 | 0 | 0 | 1 |
| 05/15/90 | 1040 | NOGA | 3 | 0 | 0 | 0 | 3 |
| 09/24/90 | 1425 | NOGA | 1 | 0 | 0 | 0 | 1 |
| 09/24/90 | 1345 | NOGA | 2 | 0 | 0 | 0 | 2 |
| 09/24/90 | 1415 | NOGA | 1 | 1 | 0 | 0 | 2 |
| 10/12/90 | 855 | NOGA | 0 | 0 | 1 | 0 | 1 |
| 10/12/90 | 935 | NOGA | 1 | 0 | 0 | 0 | 1 |
| 10/12/90 | 925 | NOGA | 6 | 1 | 0 | 0 | 7 |
| 10/12/90 | 915 | NOGA | 3 | 1 | 0 | 0 | 4 |
| 10/12/90 | 905 | NOGA | 4 | 0 | 0 | 0 | 4 |
| 10/12/90 | 945 | NOGA | 3 | 0 | 0 | 0 | 3 |
| 10/17/90 | 910 | NOGA | 1 | 3 | 0 | 0 | 4 |
| 10/17/90 | 950 | NOGA | 0 | 3 | 0 | 0 | 3 |
| 10/17/90 | 940 | NOGA | 0 | 1 | 0 | 0 | 1 |
| 10/17/90 | 1000 | NOGA | 2 | 0 | 0 | 0 | 2 |
| 10/17/90 | 930 | NOGA | 1 | 1 | 0 | 0 | 2 |
| 10/17/90 | 920 | NOGA | 1 | 2 | 0 | 0 | 3 |
| 10/23/90 | 940 | NOGA | 1 | 1 | 0 | 0 | 2 |
| 10/23/90 | 950 | NOGA | 1 | 0 | 0 | 0 | 1 |
| 10/23/90 | 910 | NOGA | 0 | 2 | 0 | 0 | 2 |
| 10/30/90 | 920 | NOGA | 1 | 0 | 0 | 0 | 1 |
| 10/30/90 | 950 | NOGA | 9 | 0 | 0 | 0 | 9 |
| 10/30/90 | 940 | NOGA | 14 | 0 | 0 | 0 | 14 |
| 10/30/90 | 930 | NOGA | 6 | 0 | 0 | 0 | 6 |
| 10/30/90 | 910 | NOGA | 11 | 0 | 0 | 0 | 11 |
| 10/30/90 | 900 | NOGA | 20 | 1 | 0 | 0 | 21 |
| 11/09/98 | 945 | NOGA | 1 | 1 | 0 | 0 | 2 |
| 11/21/90 | 1000 | NOGA | 0 | 2 | 0 | 0 | 2 |
| 11/21/90 | 1020 | NOGA | 0 | 0 | 1 | 0 | 1 |
| 11/27/90 | 910 | NOGA | 0 | 0 | 2 | 0 | 2 |
| 09/24/90 | 1415 | NOPI | 0 | 1 | 0 | 0 | 1 |
| 03/26/90 | 850 | OLDS | 0 | 0 | 8 | 0 | 8 |
| 03/26/90 | 900 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 03/26/90 | 930 | OLDS | 1 | 0 | 0 | 0 | 1 |
| 04/02/90 | 925 | OLDS | 1 | 0 | 0 | 0 | 1 |
| 04/02/90 | 935 | OLDS | 0 | 0 | 1 | 0 | 1 |
| 04/02/90 | 905 | OLDS | 6 | 0 | 2 | 0 | 8 |
| 04/06/90 | 920 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 04/06/90 | 950 | OLDS | 2 | 0 | 0 | 0 | 2 |
| 04/09/90 | 1010 | OLDS | 1 | 1 | 0 | 0 | 2 |
| 04/09/90 | 1000 | OLDS | 1 | 2 | 1 | 0 | 4 |
| 04/09/90 | 950 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 04/09/90 | 930 | OLDS | 1 | 0 | 1 | 0 | 2 |
| 04/09/90 | 920 | OLDS | 0 | 0 | 3 | 0 | 3 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|----|---|-------|
| | | | S | N | W | A | |
| 04/09/90 | 940 | OLDS | 0 | 0 | 4 | 0 | 4 |
| 04/18/90 | 900 | OLDS | 0 | 2 | 0 | 0 | 2 |
| 04/18/90 | 830 | OLDS | 0 | 0 | 6 | 0 | 6 |
| 04/18/90 | 850 | OLDS | 0 | 5 | 0 | 0 | 5 |
| 04/22/90 | 735 | OLDS | 0 | 2 | 0 | 0 | 2 |
| 04/22/90 | 655 | OLDS | 0 | 2 | 0 | 0 | 2 |
| 04/22/90 | 645 | OLDS | 0 | 0 | 4 | 0 | 4 |
| 04/22/90 | 705 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 05/10/90 | 850 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 05/10/90 | 830 | OLDS | 0 | 2 | 0 | 0 | 2 |
| 09/07/90 | 945 | OLDS | 0 | 2 | 0 | 0 | 2 |
| 10/12/90 | 925 | OLDS | 2 | 0 | 0 | 0 | 2 |
| 10/12/90 | 905 | OLDS | 2 | 0 | 0 | 0 | 2 |
| 10/17/90 | 920 | OLDS | 12 | 0 | 0 | 0 | 12 |
| 10/23/90 | 1000 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 10/30/90 | 940 | OLDS | 16 | 0 | 0 | 0 | 16 |
| 10/30/90 | 950 | OLDS | 8 | 2 | 0 | 0 | 10 |
| 10/30/90 | 930 | OLDS | 1 | 1 | 0 | 0 | 2 |
| 10/30/90 | 900 | OLDS | 11 | 0 | 0 | 0 | 11 |
| 10/30/90 | 920 | OLDS | 4 | 8 | 0 | 0 | 12 |
| 11/09/90 | 945 | OLDS | 0 | 3 | 2 | 0 | 5 |
| 11/09/90 | 1025 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 11/09/90 | 1035 | OLDS | 2 | 1 | 0 | 0 | 3 |
| 11/09/90 | 1005 | OLDS | 1 | 3 | 0 | 0 | 4 |
| 11/21/90 | 1010 | OLDS | 8 | 1 | 1 | 0 | 10 |
| 11/21/90 | 930 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 11/21/90 | 1020 | OLDS | 1 | 0 | 0 | 0 | 1 |
| 11/21/90 | 940 | OLDS | 2 | 1 | 1 | 0 | 4 |
| 11/21/90 | 950 | OLDS | 4 | 2 | 13 | 0 | 19 |
| 11/21/90 | 1000 | OLDS | 2 | 0 | 3 | 0 | 5 |
| 11/27/90 | 950 | OLDS | 6 | 9 | 0 | 0 | 15 |
| 11/27/90 | 940 | OLDS | 0 | 0 | 1 | 0 | 1 |
| 11/27/90 | 920 | OLDS | 5 | 4 | 0 | 0 | 9 |
| 11/27/90 | 930 | OLDS | 3 | 4 | 5 | 0 | 12 |
| 11/27/90 | 910 | OLDS | 0 | 0 | 2 | 0 | 2 |
| 11/27/90 | 900 | OLDS | 11 | 0 | 2 | 0 | 13 |
| 12/06/90 | 910 | OLDS | 2 | 0 | 1 | 0 | 3 |
| 12/06/90 | 940 | OLDS | 0 | 1 | 0 | 0 | 1 |
| 12/06/90 | 930 | OLDS | 4 | 0 | 0 | 0 | 4 |
| 03/13/90 | 1000 | REME | 1 | 0 | 0 | 0 | 1 |
| 03/13/90 | 930 | REME | 4 | 0 | 9 | 0 | 13 |
| 03/13/90 | 1010 | REME | 5 | 0 | 0 | 0 | 5 |
| 03/13/90 | 940 | REME | 1 | 4 | 0 | 0 | 5 |
| 03/19/90 | 940 | REME | 0 | 1 | 0 | 0 | 1 |
| 03/19/90 | 950 | REME | 1 | 0 | 0 | 0 | 1 |
| 03/19/90 | 920 | REME | 0 | 9 | 0 | 0 | 9 |
| 03/19/90 | 910 | REME | 0 | 1 | 0 | 0 | 1 |
| 03/19/90 | 900 | REME | 0 | 2 | 0 | 0 | 2 |
| 03/26/90 | 930 | REME | 5 | 0 | 0 | 0 | 5 |
| 03/26/90 | 910 | REME | 1 | 0 | 1 | 0 | 2 |
| 03/26/90 | 940 | REME | 3 | 0 | 0 | 0 | 3 |
| 04/02/90 | 925 | REME | 3 | 0 | 0 | 0 | 3 |
| 04/02/90 | 855 | REME | 0 | 2 | 0 | 0 | 2 |
| 04/02/90 | 935 | REME | 2 | 1 | 0 | 0 | 3 |
| 04/02/90 | 915 | REME | 1 | 0 | 0 | 0 | 1 |
| 04/02/90 | 905 | REME | 0 | 0 | 2 | 0 | 2 |
| 04/06/90 | 940 | REME | 6 | 7 | 14 | 0 | 27 |
| 04/06/90 | 910 | REME | 14 | 11 | 0 | 0 | 25 |
| 04/06/90 | 1000 | REME | 17 | 3 | 8 | 0 | 28 |
| 04/06/90 | 950 | REME | 0 | 0 | 3 | 0 | 3 |
| 04/06/90 | 920 | REME | 27 | 0 | 0 | 0 | 27 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|----|---|-------|
| | | | S | N | W | A | |
| 04/06/90 | 930 | REME | 2 | 0 | 1 | 0 | 3 |
| 04/09/90 | 1000 | REME | 1 | 2 | 3 | 0 | 6 |
| 04/09/90 | 1010 | REME | 1 | 0 | 0 | 0 | 1 |
| 04/09/90 | 920 | REME | 0 | 1 | 0 | 0 | 1 |
| 04/09/90 | 940 | REME | 2 | 5 | 0 | 0 | 7 |
| 04/09/90 | 950 | REME | 0 | 0 | 0 | 1 | 1 |
| 04/09/90 | 930 | REME | 3 | 1 | 0 | 0 | 4 |
| 04/18/90 | 900 | REME | 1 | 0 | 0 | 0 | 1 |
| 04/18/90 | 910 | REME | 4 | 3 | 2 | 0 | 9 |
| 04/18/90 | 920 | REME | 5 | 0 | 0 | 0 | 5 |
| 04/18/90 | 830 | REME | 8 | 3 | 9 | 0 | 20 |
| 04/18/90 | 840 | REME | 18 | 1 | 0 | 0 | 19 |
| 04/18/90 | 850 | REME | 9 | 2 | 0 | 0 | 11 |
| 04/22/90 | 645 | REME | 0 | 0 | 7 | 0 | 7 |
| 04/22/90 | 715 | REME | 1 | 1 | 0 | 0 | 2 |
| 04/22/90 | 655 | REME | 2 | 2 | 0 | 0 | 4 |
| 04/22/90 | 705 | REME | 2 | 1 | 0 | 0 | 3 |
| 05/03/90 | 735 | REME | 4 | 0 | 3 | 0 | 7 |
| 05/03/90 | 805 | REME | 0 | 1 | 0 | 0 | 1 |
| 05/10/90 | 900 | REME | 1 | 0 | 9 | 0 | 10 |
| 05/10/90 | 920 | REME | 0 | 0 | 28 | 0 | 28 |
| 05/10/90 | 830 | REME | 0 | 2 | 0 | 0 | 2 |
| 05/10/90 | 850 | REME | 0 | 1 | 2 | 0 | 3 |
| 05/10/90 | 840 | REME | 0 | 11 | 0 | 0 | 11 |
| 05/15/90 | 1010 | REME | 0 | 4 | 0 | 0 | 4 |
| 05/15/90 | 1040 | REME | 0 | 4 | 0 | 0 | 4 |
| 05/15/90 | 1000 | REME | 0 | 1 | 14 | 0 | 15 |
| 05/15/90 | 1030 | REME | 0 | 2 | 0 | 0 | 2 |
| 05/15/90 | 1020 | REME | 0 | 8 | 0 | 0 | 8 |
| 09/11/90 | 1100 | REME | 3 | 0 | 2 | 0 | 5 |
| 09/11/90 | 1110 | REME | 0 | 3 | 0 | 0 | 3 |
| 09/24/90 | 1435 | REME | 0 | 0 | 35 | 0 | 35 |
| 09/24/90 | 1405 | REME | 0 | 1 | 0 | 0 | 1 |
| 09/24/90 | 1425 | REME | 9 | 0 | 0 | 0 | 9 |
| 10/12/90 | 945 | REME | 0 | 2 | 15 | 0 | 17 |
| 10/12/90 | 855 | REME | 4 | 0 | 0 | 0 | 4 |
| 10/17/90 | 920 | REME | 4 | 3 | 0 | 0 | 7 |
| 10/17/90 | 950 | REME | 17 | 50 | 0 | 0 | 67 |
| 10/17/90 | 930 | REME | 6 | 31 | 0 | 0 | 37 |
| 10/17/90 | 1000 | REME | 2 | 39 | 10 | 0 | 51 |
| 10/17/90 | 940 | REME | 11 | 19 | 0 | 0 | 30 |
| 10/17/90 | 910 | REME | 6 | 14 | 0 | 6 | 26 |
| 10/23/90 | 930 | REME | 0 | 2 | 0 | 0 | 2 |
| 10/23/90 | 910 | REME | 11 | 3 | 12 | 0 | 26 |
| 10/23/90 | 920 | REME | 15 | 1 | 0 | 0 | 16 |
| 10/23/90 | 940 | REME | 1 | 7 | 0 | 0 | 8 |
| 10/23/90 | 950 | REME | 15 | 0 | 0 | 0 | 15 |
| 10/23/90 | 1000 | REME | 11 | 0 | 0 | 0 | 11 |
| 10/30/90 | 920 | REME | 0 | 2 | 0 | 0 | 2 |
| 10/30/90 | 900 | REME | 5 | 0 | 0 | 0 | 5 |
| 10/30/90 | 910 | REME | 11 | 0 | 0 | 0 | 11 |
| 10/30/90 | 930 | REME | 21 | 0 | 0 | 0 | 21 |
| 10/30/90 | 950 | REME | 4 | 1 | 0 | 0 | 5 |
| 11/09/90 | 1005 | REME | 0 | 1 | 0 | 0 | 1 |
| 11/09/90 | 1025 | REME | 2 | 5 | 0 | 0 | 7 |
| 11/09/90 | 1035 | REME | 3 | 3 | 0 | 0 | 6 |
| 11/09/90 | 955 | REME | 0 | 3 | 0 | 0 | 3 |
| 11/09/90 | 945 | REME | 0 | 0 | 2 | 0 | 2 |
| 11/21/90 | 940 | REME | 1 | 0 | 0 | 0 | 1 |
| 11/21/90 | 1020 | REME | 0 | 1 | 0 | 0 | 1 |
| 11/21/90 | 950 | REME | 1 | 0 | 0 | 0 | 1 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|----|---|-------|
| | | | S | N | W | A | |
| 11/21/90 | 1000 | REME | 1 | 1 | 0 | 0 | 2 |
| 11/21/90 | 930 | REME | 0 | 1 | 0 | 0 | 1 |
| 11/27/90 | 940 | REME | 4 | 0 | 0 | 0 | 4 |
| 11/27/90 | 950 | REME | 1 | 0 | 0 | 0 | 1 |
| 12/06/90 | 940 | REME | 3 | 0 | 0 | 0 | 3 |
| 12/06/90 | 920 | REME | 13 | 0 | 0 | 0 | 13 |
| 12/06/90 | 950 | REME | 8 | 0 | 0 | 0 | 8 |
| 12/06/90 | 930 | REME | 22 | 0 | 0 | 0 | 22 |
| 09/24/90 | 1435 | RNGR | 0 | 0 | 2 | 0 | 2 |
| 11/21/90 | 950 | RNGR | 0 | 0 | 1 | 0 | 1 |
| 09/24/90 | 1345 | RTLO | 0 | 0 | 4 | 0 | 4 |
| 09/24/90 | 1355 | RTLO | 0 | 0 | 12 | 0 | 12 |
| 09/24/90 | 1435 | RTLO | 0 | 0 | 25 | 0 | 25 |
| 10/12/90 | 905 | RTLO | 0 | 0 | 10 | 0 | 10 |
| 10/12/99 | 925 | RTLO | 0 | 0 | 12 | 0 | 12 |
| 10/12/90 | 945 | RTLO | 0 | 0 | 12 | 0 | 12 |
| 10/12/90 | 855 | RTLO | 0 | 0 | 13 | 0 | 13 |
| 10/17/90 | 930 | RTLO | 1 | 0 | 0 | 0 | 1 |
| 10/17/90 | 1000 | RTLO | 2 | 0 | 2 | 0 | 4 |
| 10/17/90 | 940 | RTLO | 0 | 2 | 1 | 0 | 3 |
| 10/17/90 | 910 | RTLO | 0 | 0 | 2 | 0 | 2 |
| 10/17/90 | 950 | RTLO | 0 | 1 | 3 | 0 | 4 |
| 10/23/90 | 930 | RTLO | 0 | 0 | 1 | 0 | 1 |
| 10/30/90 | 900 | RTLO | 0 | 0 | 1 | 0 | 1 |
| 03/26/90 | 940 | SCAU | 7 | 0 | 0 | 0 | 7 |
| 03/26/90 | 900 | SCAU | 4 | 0 | 0 | 0 | 4 |
| 04/18/90 | 840 | SCAU | 0 | 2 | 0 | 0 | 2 |
| 03/13/90 | 950 | SCSP | 0 | 4 | 0 | 0 | 4 |
| 03/13/90 | 1020 | SCSP | 0 | 4 | 0 | 0 | 4 |
| 03/26/90 | 920 | SCSP | 0 | 3 | 0 | 0 | 3 |
| 04/06/90 | 940 | SCSP | 0 | 12 | 0 | 0 | 12 |
| 04/06/90 | 950 | SCSP | 20 | 0 | 0 | 0 | 20 |
| 04/06/90 | 920 | SCSP | 10 | 24 | 0 | 0 | 34 |
| 04/06/90 | 1000 | SCSP | 0 | 69 | 0 | 0 | 69 |
| 04/09/90 | 1010 | SCSP | 0 | 17 | 0 | 0 | 17 |
| 04/09/90 | 920 | SCSP | 0 | 8 | 0 | 0 | 8 |
| 04/09/90 | 940 | SCSP | 0 | 1 | 0 | 0 | 1 |
| 04/09/90 | 1000 | SCSP | 0 | 16 | 0 | 0 | 16 |
| 04/18/90 | 850 | SCSP | 5 | 1 | 0 | 0 | 6 |
| 04/18/90 | 840 | SCSP | 0 | 2 | 0 | 0 | 2 |
| 04/18/90 | 900 | SCSP | 2 | 2 | 0 | 0 | 4 |
| 04/18/90 | 920 | SCSP | 2 | 4 | 0 | 0 | 6 |
| 04/22/90 | 725 | SCSP | 0 | 12 | 0 | 0 | 12 |
| 05/03/90 | 745 | SCSP | 3 | 0 | 0 | 0 | 3 |
| 05/03/90 | 755 | SCSP | 2 | 0 | 0 | 0 | 2 |
| 05/10/90 | 840 | SCSP | 5 | 0 | 0 | 0 | 5 |
| 05/10/90 | 830 | SCSP | 5 | 0 | 0 | 0 | 5 |
| 05/10/90 | 920 | SCSP | 16 | 0 | 0 | 0 | 16 |
| 05/10/90 | 850 | SCSP | 2 | 0 | 0 | 0 | 2 |
| 05/15/90 | 1020 | SCSP | 0 | 31 | 0 | 0 | 31 |
| 05/15/90 | 1030 | SCSP | 0 | 12 | 0 | 0 | 12 |
| 05/15/90 | 1040 | SCSP | 5 | 0 | 0 | 0 | 5 |
| 05/15/90 | 1010 | SCSP | 0 | 2 | 0 | 0 | 2 |
| 09/24/90 | 1425 | SCSP | 3 | 0 | 0 | 0 | 3 |
| 10/12/90 | 915 | SCSP | 2 | 0 | 0 | 0 | 2 |
| 10/12/90 | 935 | SCSP | 8 | 0 | 0 | 0 | 8 |
| 10/12/90 | 905 | SCSP | 3 | 2 | 0 | 0 | 5 |
| 10/17/90 | 910 | SCSP | 8 | 5 | 0 | 0 | 13 |
| 10/17/90 | 920 | SCSP | 11 | 0 | 0 | 0 | 11 |
| 10/17/90 | 1000 | SCSP | 12 | 0 | 0 | 0 | 12 |
| 10/23/90 | 920 | SCSP | 10 | 0 | 0 | 0 | 10 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|----|----|---|-------|
| | | | S | N | W | A | |
| 10/23/90 | 910 | SCSP | 5 | 0 | 0 | 0 | 5 |
| 10/23/90 | 1000 | SCSP | 2 | 0 | 0 | 0 | 2 |
| 10/23/90 | 950 | SCSP | 120 | 0 | 0 | 0 | 120 |
| 10/23/90 | 940 | SCSP | 5 | 0 | 0 | 0 | 5 |
| 10/30/90 | 900 | SCSP | 39 | 0 | 0 | 0 | 39 |
| 10/30/90 | 930 | SCSP | 17 | 0 | 0 | 0 | 17 |
| 11/09/90 | 1025 | SCSP | 2 | 0 | 0 | 0 | 2 |
| 11/09/90 | 1035 | SCSP | 0 | 1 | 0 | 0 | 1 |
| 11/21/90 | 940 | SCSP | 4 | 0 | 0 | 0 | 4 |
| 11/21/90 | 1010 | SCSP | 7 | 0 | 0 | 0 | 7 |
| 11/21/90 | 1020 | SCSP | 0 | 6 | 0 | 0 | 6 |
| 11/27/90 | 920 | SCSP | 3 | 0 | 0 | 0 | 3 |
| 04/09/90 | 1010 | SUSC | 0 | 12 | 0 | 0 | 12 |
| 04/09/90 | 920 | SUSC | 0 | 0 | 45 | 0 | 45 |
| 04/18/90 | 920 | SUSC | 40 | 0 | 0 | 0 | 40 |
| 04/18/90 | 850 | SUSC | 8 | 0 | 0 | 0 | 8 |
| 04/22/90 | 645 | SUSC | 17 | 0 | 7 | 0 | 24 |
| 05/10/90 | 910 | SUSC | 4 | 0 | 0 | 0 | 4 |
| 05/10/90 | 850 | SUSC | 4 | 0 | 0 | 0 | 4 |
| 05/15/90 | 1040 | SUSC | 8 | 0 | 0 | 0 | 8 |
| 09/07/90 | 1005 | SUSC | 3 | 0 | 0 | 0 | 3 |
| 09/11/90 | 1100 | SUSC | 0 | 0 | 22 | 0 | 22 |
| 09/24/90 | 1435 | SUSC | 16 | 0 | 0 | 0 | 16 |
| 10/17/90 | 930 | SUSC | 4 | 1 | 0 | 0 | 5 |
| 10/17/90 | 920 | SUSC | 15 | 0 | 0 | 0 | 15 |
| 10/23/90 | 920 | SUSC | 12 | 0 | 0 | 0 | 12 |
| 10/23/90 | 950 | SUSC | 225 | 0 | 0 | 0 | 225 |
| 10/30/90 | 930 | SUSC | 50 | 0 | 0 | 0 | 50 |
| 09/07/90 | 935 | TESP | 29 | 1 | 0 | 0 | 30 |
| 09/07/90 | 945 | TESP | 4 | 3 | 0 | 0 | 7 |
| 09/07/90 | 1005 | TESP | 0 | 35 | 0 | 0 | 35 |
| 09/07/90 | 955 | TESP | 0 | 3 | 0 | 0 | 3 |
| 09/07/90 | 1015 | TESP | 0 | 3 | 0 | 0 | 3 |
| 09/11/90 | 1100 | TESP | 0 | 3 | 0 | 0 | 3 |
| 09/11/90 | 1120 | TESP | 2 | 0 | 0 | 0 | 2 |
| 09/24/90 | 1415 | TESP | 1 | 0 | 0 | 0 | 1 |
| 09/24/90 | 1355 | TESP | 1 | 0 | 0 | 0 | 1 |
| 09/24/90 | 1405 | TESP | 0 | 4 | 0 | 0 | 4 |
| 09/24/90 | 1425 | TESP | 1 | 0 | 0 | 0 | 1 |
| 09/24/90 | 1345 | TESP | 4 | 4 | 0 | 0 | 8 |
| 09/24/90 | 1435 | TESP | 0 | 2 | 0 | 0 | 2 |
| 05/10/90 | 920 | TRSW | 3 | 0 | 0 | 0 | 3 |
| 05/15/90 | 1010 | TRSW | 2 | 0 | 0 | 0 | 2 |
| 05/10/90 | 920 | UNDI | 0 | 0 | 0 | 1 | 1 |
| 03/19/90 | 910 | UNKN | 0 | 15 | 0 | 0 | 15 |
| 03/26/90 | 920 | UNKN | 0 | 1 | 0 | 0 | 1 |
| 04/06/90 | 940 | UNKN | 1 | 0 | 0 | 0 | 1 |
| 04/09/90 | 940 | UNKN | 0 | 10 | 0 | 0 | 10 |
| 05/03/90 | 745 | UNKN | 0 | 1 | 0 | 0 | 1 |
| 10/30/90 | 930 | UNKN | 6 | 0 | 0 | 0 | 6 |
| 10/30/90 | 910 | UNKN | 1 | 0 | 0 | 0 | 1 |
| 11/27/90 | 910 | UNKN | 0 | 3 | 0 | 0 | 3 |
| 04/02/90 | 945 | WWSC | 1 | 0 | 0 | 0 | 1 |
| 04/06/90 | 930 | WWSC | 3 | 0 | 0 | 0 | 3 |
| 04/06/90 | 950 | WWSC | 7 | 0 | 0 | 0 | 7 |
| 04/06/90 | 920 | WWSC | 0 | 3 | 0 | 0 | 3 |
| 04/06/90 | 910 | WWSC | 0 | 2 | 0 | 0 | 2 |
| 04/09/90 | 1000 | WWSC | 3 | 0 | 0 | 0 | 3 |
| 04/18/90 | 830 | WWSC | 0 | 2 | 0 | 0 | 2 |
| 05/03/90 | 815 | WWSC | 0 | 4 | 0 | 0 | 4 |
| 05/03/90 | 805 | WWSC | 2 | 2 | 0 | 0 | 4 |

| DATE | TIME | SPECIES | DIRECTION | | | | TOTAL |
|----------|------|---------|-----------|---|----|---|-------|
| | | | S | N | W | A | |
| 05/03/90 | 825 | WWSC | 0 | 1 | 0 | 0 | 1 |
| 05/10/90 | 910 | WWSC | 6 | 0 | 0 | 0 | 6 |
| 05/10/90 | 840 | WWSC | 10 | 0 | 0 | 0 | 10 |
| 09/07/90 | 1005 | WWSC | 2 | 0 | 12 | 0 | 14 |
| 09/07/90 | 935 | WWSC | 10 | 0 | 0 | 0 | 10 |
| 09/11/90 | 1100 | WWSC | 2 | 0 | 0 | 0 | 2 |
| 09/24/90 | 1435 | WWSC | 4 | 0 | 0 | 0 | 4 |
| 10/12/90 | 935 | WWSC | 1 | 0 | 0 | 0 | 1 |
| 10/12/90 | 855 | WWSC | 0 | 2 | 0 | 0 | 2 |
| 10/17/90 | 940 | WWSC | 8 | 0 | 0 | 0 | 8 |
| 10/17/90 | 910 | WWSC | 22 | 0 | 0 | 0 | 22 |
| 10/17/90 | 920 | WWSC | 7 | 0 | 0 | 0 | 7 |
| 10/17/90 | 930 | WWSC | 1 | 0 | 0 | 0 | 1 |
| 10/17/90 | 1000 | WWSC | 1 | 0 | 0 | 0 | 1 |
| 10/23/90 | 920 | WWSC | 1 | 0 | 0 | 0 | 1 |
| 10/23/90 | 940 | WWSC | 3 | 0 | 0 | 0 | 3 |
| 10/30/90 | 900 | WWSC | 1 | 0 | 0 | 0 | 1 |
| 10/30/90 | 950 | WWSC | 2 | 0 | 0 | 0 | 2 |
| 11/09/90 | 1035 | WWSC | 0 | 3 | 0 | 0 | 3 |
| 11/21/90 | 1020 | WWSC | 4 | 0 | 0 | 0 | 4 |
| 11/21/90 | 930 | WWSC | 4 | 0 | 0 | 0 | 8 |

CANADIAN WILDLIFE SERVICE
P. O. BOX 1590
SACKVILLE, N. B.
EOA 300