Canadian Zooarchaeology
Zooarchéologie canadienne

2009 Number/Numéro 26

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The editors acknowledge the support of the Social Sciences and Humanities Research Council of Canada and the Office of the Dean of Social Sciences, University of Victoria.

Historical Data on the Impact of 16th-Century Basque Whaling on Right and Bowhead Whales in the Western North Atlantic

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ABSTRACT

The Basques pioneered whaling in Newfoundland waters around 1530 and remained the only group to exploit western Atlantic whale populations until 1600, hunting from coastal stations in southern Labrador and eastern Québec. In light of recent research on archaeological whale remains from Red Bay in Labrador, this paper presents historical data relevant to the numbers of whales that were hunted by 16th-century Basques. These data led to an estimate of 13,000 whales killed, a count lower than those provided by other analyses. Whaling peaked in the 1570s, then declined sharply around 1579 to low levels for the remainder of the century. The Basques primarily targeted the bowhead whale (*Balaena mysticetus*). As whaling intensified in the 1560s, the Basques noticed a second bowhead migration in mid-November and extended their hunting season until freeze-up. During this time, the port of Red Bay increased in importance until about half of all Basque whaling ships were based there in the 1570s. Basque whalers preferred stations in the Strait of Belle Isle for economic and security reasons but also because of the late fall bowhead whale hunt.

RÉSUMÉ

Les Basques initient la chasse aux baleines à Terre-Neuve vers 1530 et demeurent le seul groupe à exploiter les cétacés en Atlantique occidental jusqu'à vers 1600, à des stations côtières dans le sud du Labrador et l'est du Québec. En tenant compte des études récentes d'ossements provenant de sites de station baleinière, cet article présente des données sur le nombre de baleines tuées par les Basques au cours du XVIe siècle. Notre estimation de 13 000 baleines tuées est en deçà des estimations précédentes, entre autres en raison des fortes fluctuations que nos données mettent en évidence dans l'activité des Basques au cours du siècle. S'intensifiant jusqu'aux années 1570, la chasse périclite vers 1579 et stagne jusqu'à la fin du siècle. Les Basques ciblent surtout la baleine boréale (*Balaena mysticetus*), d'abord entre août et octobre. Puis, dans les années 1560, ils constatent une seconde migration de cétacés à la mi-novembre et prolongent désormais leurs séjours jusqu'au début de l'hiver. La station à Red Bay attire bientôt la moitié des baleiniers qui délaissent les ports plus à l'ouest. Les Basques se regroupent dans le détroit de Belle-Île pour des raisons d'économie et de sécurité, mais aussi parce que la chasse automnale des baleines boréales y est la plus productive.

The impact of 16th-century Basque whaling on western Atlantic whale populations has come under scrutiny by researchers using historical, osteological and genetic evidence, resulting in divergent points of view. Historical work by Huxley Barkham (Huxley 1987) and osteological analysis by Cumbaa et al. (2002) at the Red Bay whaling site in Labrador suggested that Basques hunted right and bowhead whales in similar numbers, targeting right whales in summer and bowheads in fall. Recent zoological studies of scattered whalebones at 20 sites, using DNA identification, suggest that it was primarily bowhead whales that were hunted by Basques, both in summer and in fall (McLeod et al. 2008; Rastogi et al. 2004). Both of these studies have led to broad interpretations of historic whale population size and distribution and of the impact of 16th-century Basque whaling on right whale and bowhead whale populations.

By introducing historical data that have not been taken into account by zoologists and zooarchaeologists, this paper places whalebone analyses of 16th-century Basque whaling sites, especially Red Bay, in a more accurate historical perspective. It focuses on the total number of whales killed by the Basques before 1600, on the ability of the Basques to differentiate among Atlantic whale populations and on the role played by whaling sites in the Strait of Belle Isle, especially Red Bay, in the fall bowhead hunt (Figure 1).

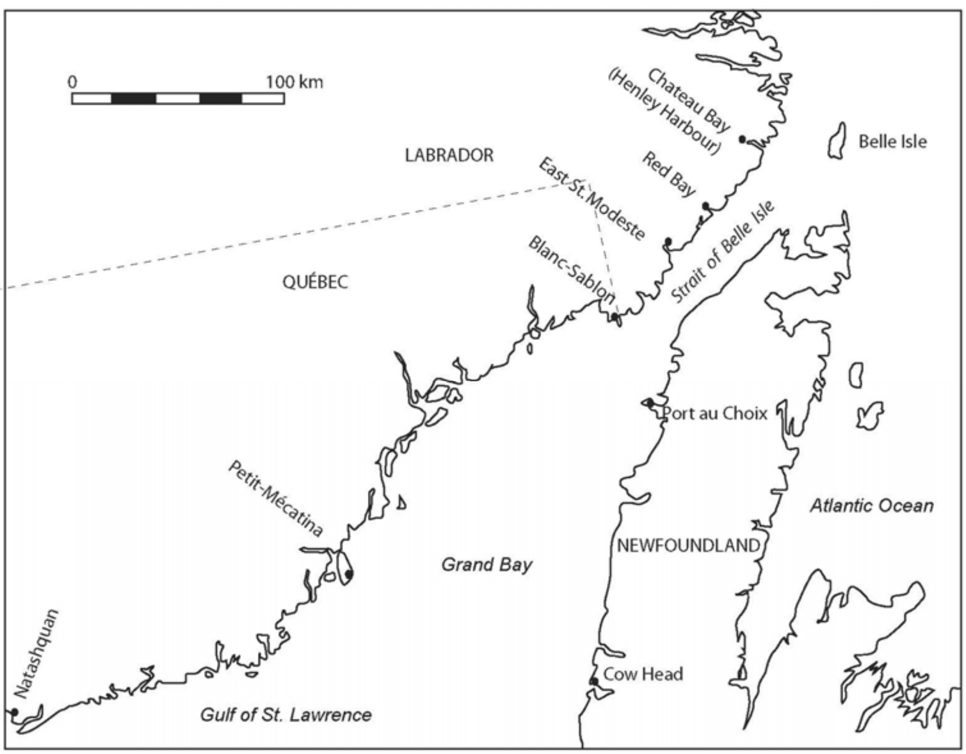

Figure 1: Basque whaling sites in the Strait of Belle Isle and Grand Bay

The Debate over 16th-Century Whalebones

Zooarchaeological interest in whalebones from 16th-century Basque whaling sites grew out of extensive underwater and terrestrial fieldwork in 1978-1985 at the site of Red Bay, Labrador, on the Strait of Belle Isle (Figure 1). Initially, Cumbaa (1986) conducted taxonomic identifications of 17 archaeological whale humeri from Red Bay, using osteological criteria. He concluded that eight of the specimens represented right whales and nine were from bowheads, but he cautioned that the lack of suitable reference collections made the identifications difficult and tenuous. Ongoing work on whale humeri from the Red Bay locality eventually brought the number of identified individuals to 21 — 8 bowhead whales and 13 right whales (Cumbaa et al. 2002). Eighteen other humeri were identified only to genus (Cumbaa 2007). These identifications were taken as evidence that right and bowhead whales were hunted in similar numbers by Basques in the Strait of Belle Isle. A detailed model of whale migration and Basque whaling strategy was developed based on historical data showing that the Basques hunted in two distinct summer and fall seasons. It proposed interlocking migration routes for the two species, allowing a summer right whale hunt and an autumn bowhead hunt at the same location (Aguilar 1987; Huxley 1987:98-101). This model was influential in shaping historical thought on whaling in the 16th century. It also led to ecological arguments that 16th-century Basque whalers had decimated both right and bowhead whale stocks in the western Atlantic (cf. Freedman 1995:418-419). Today, the right whale is endangered globally and the bowhead is limited to Arctic regions and does not inhabit the Gulf of St. Lawrence.

This model of Basque whaling was undermined when species identification based on DNA analysis became possible. Rastogi et al. (2004) studied the same aforementioned 21 humeri from Red Bay and found that 20 of them represented bowhead whales and only one a right whale. In addition, the right whale bone showed signs of depleted genetic diversity, suggesting that stocks of this species were already low in the 16th century. Rastogi et al. (2004) called for a reassessment of the impact of 16th-century Basque hunters on the western Atlantic right whale stocks. In a subsequent comment, Romero and Kannada (2006) drew attention to whale hunting by other nations in the western North Atlantic from the 17th to the 19th centuries in order to argue that the 16th-century Basque impact on right whale populations has been over-estimated. They also suggested that the Red Bay whalebone assemblage was too small and too localized to be representative of the 16th-century hunt.

In response, McLeod et al. (2006) reaffirmed the value of the Red Bay whalebone assemblage and expanded the sample size. Also using DNA analysis, McLeod et al. (2008) made species identifications of 218 bones from 10 Basque whaling sites. (Red Bay provided 141 bones, including 85 for which stratigraphic data were available.) Of this total, 203 bones were found to come from 73 bowhead whales and only one bone from a right whale, leading to the conclusion that the Basques hunted bowheads in both the summer and fall seasons. McLeod et al. emphasize that their findings show a more southerly range for bowheads in the 16th century than today, perhaps due to a cooler climate. They also call for a reassessment of pre-hunt bowhead and right whale populations on the basis of updated estimates of historic whale kills. McLeod et al. conclude that Aguilar's (1987) estimate of 25,000 to 40,000 whales killed by the Basques in the 16th century should not be divided equally between the two species but attributed solely to the bowhead whale.

In presenting historical data on the impact of 16th-century Basque whaling on bowhead and right whale populations, this paper seeks answers to the questions raised by recent DNA research. It reviews the Basques' knowledge on Atlantic right and bowhead whales, especially their ability to distinguish regional stocks and to track migration patterns. Finally, it seeks to clarify the role of Red Bay in 16th-century Basque whaling strategies, especially with regards to the autumn bowhead hunt.

Methods

The data presented here are derived from archival material published by three historians: Selma Huxley Barkham, Jean-Pierre Proulx and Laurier Turgeon. I have carried out complementary research in the same archives. The nature of these sources is such that the data presented here represent the fruit of many years of research and the examination of thousands of documents, from which data on specific issues have been gleaned. In each of the following sections, the method used to extract relevant information from the available data is described.

The Number of Whales Hunted by Basques in the 16th century

The Basques, a seagoing people living on the border of France and Spain, were the first group to extensively hunt whales in the New World, beginning about 1530. They were also the only group to do so in Canada well into the 17th century. Until about 1630, whaling was shore-based and carried out at stations occupied seasonally to coincide with whale migrations. In order to be successful in the long term, whalers needed precise knowledge of whale populations and their migrations over large areas of ocean. From the 15th to the 18th centuries, whaling was driven by the need for oil in woolen textile manufacturing, especially in Castile, Holland, Normandy and England. Wool needed to be washed prior to dyeing, and it was then “regreased” with whale, linseed or olive oil so that it would flow smoothly through spinning and weaving machines. Many secondary uses documented for whale oil include lighting, caulking and soap-making. In early modern times, whaling was also driven by the geopolitical ambitions of maritime powers. Whaling ships, being among the largest of their time, sometimes fulfilled a geopolitical role by dominating strategic coastlines and routes. In the Strait of Belle Isle, rivalry between France and Spain sometimes pitted Basques against Basques, despite their cultural unity and cross-border maritime practices. Economic and political conditions are as important as whale ecology in explaining the 16th-century Basque whale hunt in southern Labrador.

The present state of research on Basque whaling voyages to Canada allows a detailed estimate of the number of whales killed in 1530-1600. Such an estimate is based on the number of whaling ships outfitted annually and on the quantity of whale oil brought back by each ship. Totals for French and Spanish Basques must be estimated separately. Archival records for the two groups are different in nature and require separate historical research methods, and the number of whaling voyages by each group varied independently over the course of the 16th century.

Based on very complete records in the Bordeaux archives, Turgeon (1995, 2000) collected yearly voyage totals for most of the 16th century. However, the Bordeaux archives document primarily the voyages by French Basques, which formed a minority of all Basque whaling voyages during this time. Archives in the Spanish Basque country are more fragmentary and provide a full picture for only about seven non-consecutive years in the 1560s and 1570s. Nevertheless, they document the greater part of all known Basque whaling expeditions.

Study of these records has allowed historians to identify the beginning of the Basque whale hunt, its uneven rise, its sudden decline and its stagnation at the end of the century. I have broken down these data into decadal estimates of the number of whaling voyages to Canada. These estimates are based on the compilations of Turgeon (1995, 2000), insurance records from Burgos (Barkham 1981), as well as available notarial and judicial documents (Huxley 1987:34, 64; Proulx 1993). While individual decadal estimates are often uncomfortably broad, two lines of independent verification tend to support the estimates presented here. For two years, 1565 and 1566, records are very complete and have been studied exhaustively, allowing the true number of voyages to be closely estimated for the 1560s (Loewen 1999:126-127). In addition, an English investigator in 1578 documented 20 to 30 whaling ships, all of them Spanish Basque, in Newfoundland ports (Parkhurst 1599). This oft-cited reference is generally accepted as representing the apogee of 16th-century Basque whaling in Canada. These crucial figures for the maxima attained in the 1560s and 1570s are reliable data against which the less well documented totals for the remaining decades of the period 1530-1600 may be compared.

Decadal variations in the number of Basque whaling voyages between 1530 and 1600 were quite significant. The 1530s witnessed the tentative beginnings and gradual growth of the Basque whale hunt. The first reference to whale oil, a small shipment of 12 *barricas* (3 tons) brought from Newfoundland by the *Catherine* of Urtubie (France), dates to 1530 (Huxley 1995:62). The first known whaling outfit, a small ship named the *Serenne* of Bourg, can be dated to 1539 (Bernard 1968:812-813). During the decade of the 1530s, whaling was a source of extra revenue for cod-fishing vessels, and voyages specifically devoted to whaling were rare. Based on these sparse data, the equivalent of one to three whaling voyages per year is estimated here for a decadal total of 20.

This low-intensity hunt continued into the early 1540s until a specialised, concentrated hunt was organised in the Strait of Belle Isle region around 1543, by Spanish Basques (Barkham 1982, Huxley 1987:101, 1995; Loewen 1999:122-123, 254; Proulx 2007). The timing of the occupation of this strategic waterway by large ships and crews may have been in reaction to French efforts to colonise the St. Lawrence Valley in 1541-1543 (Loewen 1999:123). Spanish records are rare for this early period and an estimate of 4 to 8 ships per year is based on episodic references and on French Basque counts of less than one ship per year (Turgeon 2000). The decadal total for the 1540s is estimated at 50 ships.

The 1550s were dominated by the Franco-Spanish war (1551-1559). The Strait of Belle Isle, a strategic waterway for access to the Gulf of St. Lawrence, became a war theatre in 1554 when heavily armed French Basque whalers occupied Red Bay at the beginning of the ice-free season and drove out Spanish Basque crews from their station at East St. Modeste (Huxley 1987:64). The Spanish Basque retaliation in 1555 took the form of a two-pronged corsair campaign against the French Basques in their home ports and in Canada (Azpiazu 2006). Boosted by the war effort, French Basque whaling outfits spiked to 12 ships in 1554, compared to between one and six ships annually for the other years of this decade. The years from 1549 to 1560 represent the peak of French Basque whaling in the 16th century (Turgeon 1995). The number of Spanish Basque voyages, while difficult to estimate for the 1550s, appears to have surpassed the number of French Basque voyages by a ratio of as high as 2 to 1. This decade witnessed a general growth in the number of whaling outfits, but this growth was irregular and often unequal between French and Spanish Basque ports. Numbers were about double those of the 1540s, ranging between 5 and 15 ships per year for a decadal total of 100 ships.

Following the peace of Cateau-Cambrésis in 1559, Spanish Basques became dominant in the Labrador whale hunt as the number of French Basque voyages dropped to about one per year. An exhaustive census is possible for two years in the mid-1560s, showing a total of 18 whaling ships in 1565 and 15 ships in 1566 (Loewen 1999:126-127). Of the two Spanish Basque coastal provinces, Gipuzkoa sent the greatest number of ships during the 1560s, as ports in Bizkaia rarely if ever outfitted more than five annually. Based on these figures, I estimate an annual average of 15 ships for a decadal total of 150 voyages.

The peak in 16th-century Basque whaling occurred in the 1570s. Based on fairly complete data that show more than 20 ships for certain years, historians agree with the English captain Anthony Parkhurst who, in 1578, estimated the number of “Spanish” ships whaling in Newfoundland as between 20 and 30 (Parkhurst 1599). Parkhurst's interest in Spanish Basque whalers stemmed from the growing rivalry and tension between Spain and England. In addition, Basques had begun exporting whale oil to England around 1565 and by 1578 the rise of the English market closely paralleled the increase in Basque oil production in Labrador. Closely following Parkhurst's report, on 1 February 1579, England abruptly closed its ports to Spanish whale oil. The embargo was timed to cause maximum disruption, as cargos transhipped in the Basque ports were already en route to England. It caused huge financial losses to Gipuzkoan outfitters and generated a crisis from which the Basque whaling industry never recovered. In 1579, the number of Basque whaling vessels dropped to five or fewer. The following year, the Spanish crown requisitioned all large Basque fishing and whaling ships for the Indies route, to compensate for the loss of Spanish shipping to Dutch and English attacks (Chaunu 1977:244-245; Huxley 1987:143; Loewen 1999:125). Based on nine years with 25 ships on average and one year with 5 ships, the decadal total for the 1570s is estimated at 230 voyages.

During the 1580s and 1590s, some Spanish Basque vessels continued to hunt in Labrador, although their numbers fell to pre-1550 levels. Turgeon (1995) identified no specialised whaling outfits at all from French Basque ports after 1579. He also shows that smaller French Basque ships outfitted for mixed fishing, whaling and fur-trading began sailing for the St. Lawrence estuary after 1581, at an average rate of one per year. Systematic records for the Spanish Basque ports are absent for these decades and Proulx (1993) has found documentation for only 13 Spanish Basque whalers in the Strait of Belle Isle for the entire decade of the 1580s. Huxley

Barkham (Huxley 1987:143) has shown, however, that legal opposition by Basque outfitters to the Spanish royal requisition of ships dragged into 1585 and, during this time, the crown refused passes to ships requesting leave for Labrador. Subsequently, requisitions for the Indies route and preparations for the Grand Armada of 1588 prevented the recovery of Labrador whaling. Based on available yearly totals, the level of activity is estimated at 3 to 5 outfits per year or about 40 per decade for a total of 80 voyages from 1580 to the end of the century.

While historians agree that Basque whaling in Labrador decreased significantly after the 1570s, the rate of decline and its cause have long been debated. Overhunting, climate change, Spanish naval defeats, the redirection of whaling ships to the Indies route and decreased profit margins have all been invoked to explain the decline (Barkham 1977; Hacquebord 1987; Huxley 1987:143). The English embargo on whale oil in 1579 clearly tipped the Spanish Basque whaling industry into a financial crisis but other political factors combined to prevent a recovery in the 1580s (Loewen 1999:125). Spanish Basques in particular stayed away from Canada and, in their absence, French Basques began in 1583 to hunt inside the Gulf of St. Lawrence, especially at the Saguenay River and at Chaleur Bay where they targeted smaller species and combined whaling with trading activities (Turgeon 1995).

Based on these decadal estimates, the total number of Basque whaling voyages to Newfoundland during the period 1530-1600 is estimated at 630. About 380 of these voyages (60%) occurred during the 1560s and 1570s, making this twenty-year period the apogee of the 16th-century Basque whale hunt in Canada.

These data indicate that the Basque whale hunt expanded less steadily and contracted more abruptly than has been assumed by some authors (Aguilar 1987). When translated into ship's tonnage and the number of whales killed, the number of voyages allow us to revise previous estimates of the impact of 16th-century Basque whaling on western Atlantic whale populations. The average capacity of a whaling ship was about 400 tons, bringing the total capacity of the 16th-century Basque whaling fleet to about 252,000 tons. Whalers measured oil in terms of casks called *barricas* that held about 225 litres each; four barricas took up a full ton of a ship's cargo capacity. On average, whalers returned home with a partial load of 3.06 barricas per ton of ship's capacity (Proulx 2007: 45), which would bring the total whale oil in the 16th century to about 194,000 tons. Period documents indicate that one bowhead whale yielded about 60 barricas or 15 tons of oil (Proulx 2007:73). These numbers suggest that Basques killed about 13,000 whales off eastern Canada between 1530 and 1600.

This estimate falls well short of that advanced by Aguilar (1987) of 25,000 to 40,000 whales killed during the period 1530-1610. Other recent work has also questioned Aguilar's figure. In a revised estimate, Cumbaa (2007) suggested a figure of 18,000 to 19,000 whales killed by the Basques in Labrador from 1530 to 1600. His estimate did not consider variation in hunting efforts over the course of this period.

At 13,000 whales killed, the impact on local stocks would have been noticeable. The impact was heaviest at the end of the twenty-year period from 1560 to 1579 during which 7,800 individuals are estimated to have been killed, following the approximately 3,500 whales killed from 1530 to 1559. Basques in the 1580s realized that their industry had greatly reduced the whale population in the Strait of Belle Isle (Barkham 1977). For this reason, as well as to gain geopolitical advantage, French Basque whalers moved into the Gulf of St. Lawrence in the early 1580s where they may have targeted smaller species, especially in the Saguenay and Chaleur Bay areas. Subsequently, after about 1630, they set up stations along the coasts of southern and western Newfoundland and eastern Québec. Pelagic and shore-based whaling by Basque outfits continued into the 1730s. Canadian, English and New England crews continued the hunt well into the 19th century (Carpin 1995; Fitzhugh and Gallon 2002; Lalande 1989; Niellon and McGain 1987; Staniforth 2005; Turgeon 1995). As recently as the 1930s, a whale-rendering plant operated at Sept-Iles.

Basque Knowledge of Whales

Various historical data show that the Basques accurately distinguished whale species and their regional populations and adapted their hunting strategies according to the status of regional stocks and the migration patterns of whale populations. Bakker (1995) has shown that 16^{th}- and 17^{th}-century Basque whalers recognized at least nine types of whale including the bowhead whale (*Balaena mysticetus*), the right whale of the western Atlantic (*Eubalaena glacialis*), the right or Biscay whale of the eastern Atlantic (called *Eubalaena biscayensis* in some historical literature) and the grey whale (*Eschrichtius robustus*) whose Atlantic population became extinct in the 17^{th} century. Geographic occurrence was a factor in the naming of a whale. The Basques gave the name of *Gran Baya* to the bay enclosed by eastern Québec and western Newfoundland (Egaña Goya 1992a, 1992b); their name for the bowhead whale population that migrated between Gran Baya and Baffin Bay was *granbaiako balea*. This name suggests that the bowhead carried unique significance for the Strait of Belle Isle fishery. Similarly, the Basques also distinguished between the eastern and western Atlantic right whales. *Eusko balea*, or the Basque whale, was the population they knew from the Bay of Biscay, whereas *sarda* designated the population they encountered off of Canada (Bakker 1995). *Sarda* is a generic Basque term for a large group of fish or animals, as in "sardine" (Miren Egaña Goya, pers. comm., 2008). It has no specific regional, economic or biological connotation, which may indicate that the western Atlantic right whale carried no particular meaning for the Basques.

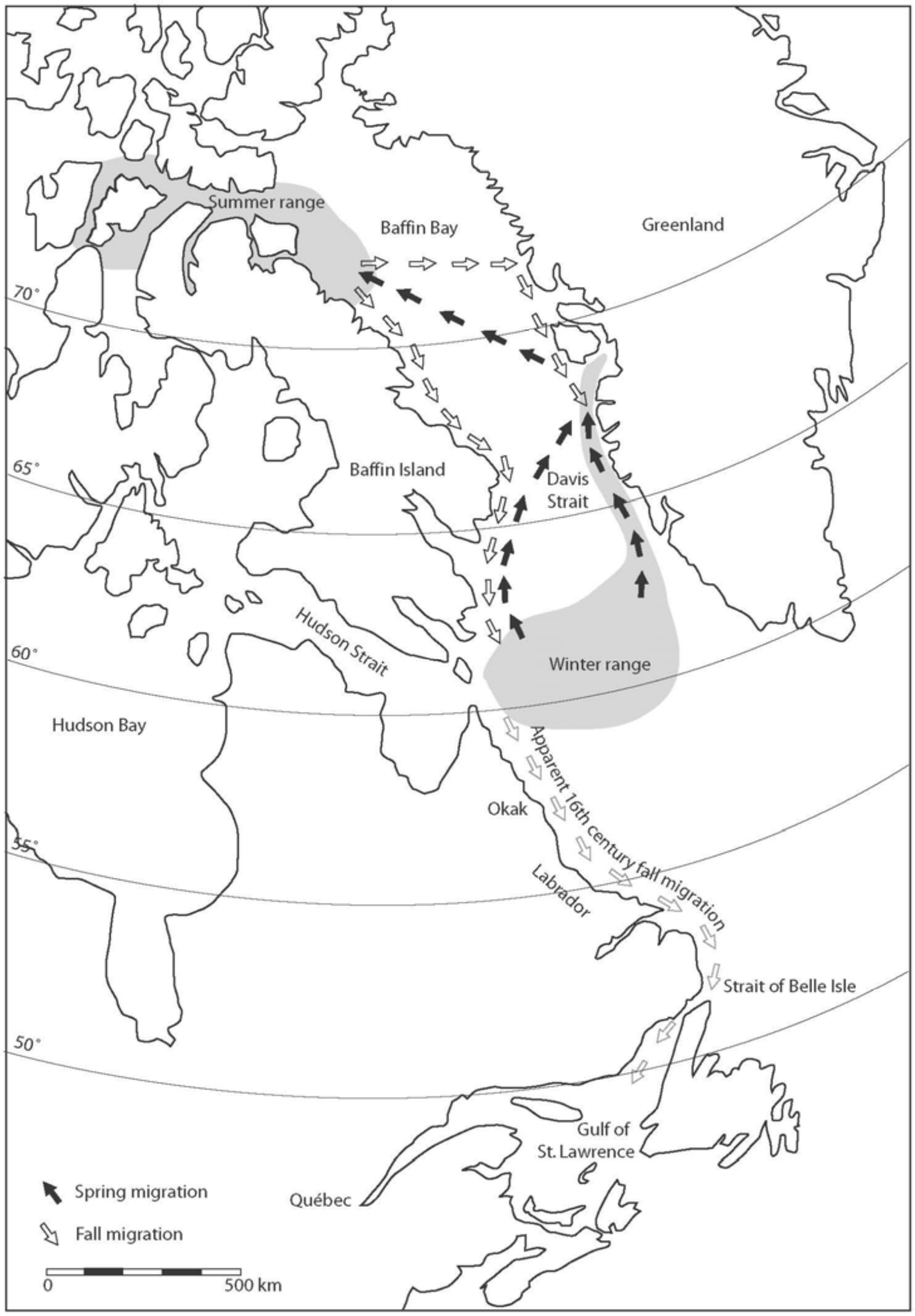

Figure 2: Migration routes of the Baffin Bay-Davis Strait population of bowhead whale

Basque knowledge of regional whale populations included familiarity with their migration routes. According to custom, when whales became scarce in one region, Basques would follow the remaining individuals in order to discover their other seasonal feeding grounds. One traditional account recalls that when the Biscay whale became rare in the 14th century, the Basques set out to find its new feeding grounds, leading them to discover Newfoundland in 1372 (Cleirac 1647:153; Delamare 1705; Ducéré 1911; Loture 1949; Milne-Edwards 1841:259; Valin 1760; van Beneden 1886). This can not be corroborated by any period document and it should be recalled that the Biscay whale's migration route would have led the Basques north rather than west. In fact, the Basques were whaling off of Ireland in 1353 and continued to do so until at least 1561 (Azpiazu 2000). Following the migration route further northwest, in 1412 twenty ships set up whaling stations at Grundarfjördhur in western Iceland (Croizier 1905). In the 17th century, the Basques returned to hunt in western Iceland, setting up shore stations and interacting with the local population (Edvardsson and Rafnsson 2006). They compiled a Basque-Icelandic vocabulary which shows that they called the right whale found near Iceland *eusko balea*, or the Basque (Biscay) whale, and not *sarda* (Bakker 1995). These region-specific names suggest that the Basques knew that eastern and western populations of North Atlantic right whales and bowhead whales were distinct, followed separate migration routes and had different group habits. The names may also underlie a consciousness that eastern and western populations did not intermingle and thus could be depleted independently. Finally, they suggest that the Basques turned their primary attention from the right whale to the bowhead whale in the context of their 16th-century Labrador hunt.

Whale Migrations and Their Pre-Hunt Numbers

Archaeologists and historians who study Basque whaling in the 16th century often refer to Aguilar (1987) for information on the geographic distribution and migration habits of right whales and bowhead whales, both of which had separate eastern and western populations in the Atlantic Ocean. Aguilar describes the present range of the remaining stocks of these species. While whale distribution in the 16th century may have differed due to larger populations and a cooler climate, Aguilar's work remains a starting point for understanding the range of the right and the bowhead whales.

Of these two species, the right whale (*E. glacialis*) presently has a more southerly range and a longer migration route. In the eastern Atlantic, its northerly summer range covers the coasts of Norway, the British Isles, Iceland and eastern Greenland. Its southerly winter range extends from the Bay of Biscay as far as Morocco and Mauritania.

Therefore, when the Basques hunted the right whale in the Bay of Biscay in the Late Middle Age, they did so in winter. The size of the eastern Atlantic population prior to its human exploitation is unknown. In comparison, in the western Atlantic, the right whale migration route is shorter and its summer feeding grounds more southerly. Its summer range extends from the Gulf of Maine and the Bay of Fundy to Newfoundland and as far north as the Strait of Belle Isle. During the winter season, this population migrates south to Bermuda, Florida and the northern coast of the Gulf of Mexico (Aguilar 1987). The population of the western Atlantic right whale circa 1530 is generally estimated at 12,000 to 15,000 individuals (Cumbaa 2007; Romero and Kannada 2006). According to Huxley Barkham (1987), Basque whalers in the 16th century intercepted this population in its northern summer feeding grounds in the Strait of Belle Isle. This idea has been refuted by DNA research, lending added credence to historical whale-name data which suggest that the Basques did not maintain a particular interest in the western right whale. It appears that the right whale was less abundant in the western Atlantic than previously thought.

The bowhead (*B. mysticetus*) is also divided into eastern and western Atlantic populations but has a smaller and more northerly range. The eastern population lives in the coastal waters east of Greenland and north of Iceland as far as Jan Mayen, Spitsbergen and the Barents Sea, staying near the edge of the ice pack. Today reduced to fewer than a hundred, its pre-hunt population is estimated at 25,000 individuals (Aguilar 1987). The Basques encountered this whale in the early 15th century when they hunted off Iceland (Crouzier 1905). In its western range, the bowhead today is restricted to Davis Strait, Baffin Bay and the northern part of Hudson Bay (Figure 2). In winter, it generally remains about 1,000 km north of the Strait of Belle Isle, although Aguilar (1987) believes it moves south as far as Newfoundland in cold winters. Pre-hunt numbers for the western Atlantic bowhead are not given by Aguilar but are estimated elsewhere as 18,000 to 37,000 (Braham 1984:51; Freedman 1995:419). The bowhead's abundance in its former southern range explains why Basque whalers named it the *granbaiako balea*. In the 18th and 19th centuries, Dutch and English whalers targeted this stock and its numbers were down to about 12,000 when Davis Strait whaling intensified in 1825-1850 (Aguilar 1987).

The identification of mostly bowhead bones at Basque whaling sites in southern Labrador and eastern Quebec indicates that this whale's present range is smaller and more northerly than it was in the 16th century (McLeod et al. 2008; Rastogi et al. 2004). This large geographic difference may reflect over-hunting or climate change. For example, a widely documented cool period between 1450 and 1850, with the most extreme winters recorded from 1690 to 1740, may have extended the ice pack southward and, with it, the bowhead range (Lamb 1995; McLeod et al. 2008).

As for the over-hunting hypothesis, historical data shed some light on the impact of Basque and later whalers on regional bowhead numbers. The total number of right and bowhead whales in the western Atlantic circa 1530 is estimated at about 50,000, of which 75% to 80% were bowheads. This number is four times greater than the total number of whales that Basques appear to have killed in the period from 1530 to 1600. However, considering that estimates of whale kills are in turn used to estimate pre-hunt populations, a downward reassessment of 16th-century whale kills also brings down estimates of pre-hunt populations, although to a lesser degree. Moreover, estimates of pre-hunt populations have often been calculated using Aguilar's estimate of 25,000 to 40,000 whales killed by the Basques in the 16th century, divided evenly between bowhead and right whales. New estimates are needed to account not only for lower numbers of whales captured in the 16th century but also for a higher proportion of bowhead whales and a lower proportion of right whales.

Despite these uncertainties, it is safe to say that the Basque hunt had a significant impact on the overall population of the western Atlantic bowhead. The regional impact was even greater on the Gulf of St. Lawrence whale bands. Whales divide into regional bands, called “tribes” by historical whalers (McLeod et al. 2008), and not all groups necessarily migrated through the Strait of Belle Isle. As many as a third of the western Atlantic bowhead's pre-hunt numbers were killed during the course of the 16th century, and bands wintering in the Gulf of St. Lawrence were especially impacted. Socialisation and migration patterns of today's bowhead whales, while limited to a more northerly range, show some degree of sub-grouping according to regions and age-sex cohorts.

The present Baffin Bay-Davis Strait bowhead population does not migrate south of Hudson Strait (Figure 2) — that is, about 60°N (COSEWIC 2005; Heide-Jorgenson et al. 2003, 2006). It leaves its southern range in May or June, returning in October or November. It follows a counter-clockwise route along the Greenland and Baffin coasts, with lengthy stays at regular feeding areas (Finley 1990). The extent of maximum southward migration is variable, with some groups wintering off Greenland at 65-67°N and others in the Davis Strait at 60°N. The age-sex groups of adults, adolescents and mother-calf pairs tend to travel separately and halt for different periods (Braham 1984). Age-sex segregation is caused by a non-annual reproduction cycle that is offset from the migration cycle. Females begin breeding at about 20 years of age. Conception occurs in

March and calving 14 months later in May, at intervals of 3 to 4 years (Braham 1984; COSEWIC 2005). Regional and age-sex groups may be the "tribes" observed by historical whalers.

In the 18th century, the bowhead still migrated south along the Labrador coast. Data compiled by Reeves et al. (1983) show a November bowhead hunt in 1771-1803, peaking in 1793, on the Labrador coast as far south as 55°N. In subsequent years, only stray bowheads were recorded off of Labrador; the last sighting occurred in 1848. However, 19th-century whaling lore also placed the bowhead in a much more southerly context. Nantucket whalers called it the "River St. Lawrence whale" (Reeves et al. 1983:55). Some thought that the bowhead "leaves Davis Strait about the month of November, and produces young in the St. Lawrence River, between Québec and Camaroa [Kamouraska?], returning again in the spring to Davis Strait" (Brown 1868:545, in Reeves et al. 1983:55).

These data suggest the bowhead may have disappeared from the Gulf of St. Lawrence as late as the 19th century. They also suggest that the two Basque whaling seasons may have targeted different age-sex groups, as adults, adolescents and mother-calf pairs moved through the Strait at separate times. If so, the summer and fall hunts impacted the bowhead population in different ways.

Autumn Whaling in the 16th Century

Huxley Barkham (Huxley 1987:98-101) has published historical data showing that the Basques initially hunted in the Strait of Belle Isle from mid-August to mid-October. They eventually learned that another migration wave passed through the Strait in late fall, offering a second hunting season for those who braved the harsh seasonal weather. The hiatus between seasons lasted one month, as the fall hunt began in mid-November and continued until freeze-up. The Basques began staying in the Strait for the later whaling season in the 1560s, as the summer hunt grew less productive and provided ships with only a partial load of oil. As crews stayed later into the winter, they risked being caught in the Strait as pack ice drifted in, and some ships were trapped and crushed. Unforeseen over-winter stays with some loss of life occurred in 1574-1575, 1576-1577 and 1603-1604 (Bernier and Grenier 2007; Huxley 1987:101, 104). Even more revealing of the pressure to hunt in icy conditions was the frequency of voluntary over-winter stays to avoid returning to face creditors with a half-empty hold. Some stays were even planned to gain a strategic advantage over rival outfits (Proulx 2007:74). In 1562-1563, an intentional wintering by French Basques from Saint-Jean-de-Luz was marked by deaths, with the survivors violently ousted in the spring by a Bilbao crew that found its station usurped (Loewen 1999:230).

Examination of the pattern of ice formation in the Strait of Belle Isle helps us understand the timing and location of autumn bowhead whaling. During a 19-year study period from 1979-80 to 1997-98, the Strait was encumbered by drifting sea ice at different dates over the 51-day period from 12 December to 31 January. In ten of these years, drift ice closed the Strait during an 8-day interval between 31 December and 7 January, and in 16 winters within a 21-day interval from 23 December to 15 January. Only twice did the Strait close before Christmas and only once before 23 December (Enfotec 1998). Given such a high degree of predictability in freeze-up dates, we may infer that 16th-century Basques could plan their resource use and departure date with a fair degree of precision. It is not known when freeze-up typically occurred in the 1560s and 1570s, when the climate was cooler. While some crews would occasionally spend Christmas in Labrador (Barkham 1976), records show that most ships would leave before mid-December. In the mid-1560s, ships typically began to unload their oil in the Basque country by 15-23 January, following a return voyage of 35-40 days (Loewen 1999:135; Proulx 2007:74). They likely cleared the Strait of Belle Isle within the two-week period of 5-19 December.

The autumn window for hunting the bowhead whale was relatively short. This species migrates south in the fall, at the edge of advancing sea ice. Today, ice closes Hudson Strait in early December and blocks the Strait of Belle Isle in early January. New ice forms later in the Gulf of St. Lawrence. Freeze-up on the northern Gulf shore, between Cape Whittle and Blanc-Sablon, occurs in mid-January. Waters along western Newfoundland remain ice-free until late January (Environment Canada 2003). Even though freeze-up possibly occurred earlier in the 1570s, it followed a similar pattern. Bowheads entering the Strait as late as December would still find open waters in the Gulf and could move southward along the coast of Newfoundland. Whalers chose their late fall positions in order both to intercept the first whales coming westward and to observe the ice building up at the eastern end of the Strait so as to time their exit into the Atlantic more accurately. In this way, the trend toward autumn whaling in the 1560s and 1570s accentuated the importance of the Strait stations at Chateau Bay, East St. Modeste and, above all, Red Bay.

The Significance of Red Bay in the Basque Whale Hunt

Red Bay came to be the most important Basque whaling station in Canada during the second half of the 16th century. In the 1570s, it was the destination of about half of all whaling voyages (Tuck and Grenier 1989). Its name was labelled on early maps as *Les Butes* by Pierre Desceliers in 1546, as *Butus* by Petrus Planchus in 1592 and as *Boytus* by Denis de Rotis in 1674

(Huxley 1987). These names became *Buttes* on 18th-century French maps, a form that has crept into scholarly usage (Barkham 1984). They all appear to stem from an original Spanish name used by the Basques in the 16th-century. In many Spanish Basque archival records, Red Bay is called *Buitres* or *Buytres*, a common name for the vulture that somehow came to be associated with this whaling station (Loewen 1999:4). The Basques may have hunted marine birds at Red Bay, where a disc-like instrument, still used today as a decoy for hunting birds in the Basque Country, was recovered. (Thrown from a headland above a flock of migrating birds, the disc causes the startled flock to dive downward into netting suspended from high posts.) It is possible that the place name had a more profound cultural meaning. One Pyrenean vulture, the *alimoche*, is migratory and its springtime arrival in the Basque region coincided with the season when cows were herded up to mountain pastures. In Basque mountain folklore, the *alimoche* is called the “white lady of the cattle trail” (Dendalotxe 1997:18-19). Pope (2004) has suggested that this place name, perhaps associated with white marine birds, may symbolise the Basque whalers' migratory lifestyle, closely attuned to the whale's own migration cycle.

Despite its importance in the 16th-century whale fishery, Red Bay does not appear regularly on early maps. Chateau Bay, East St. Modeste (*Samodet*) and several places near Blanc-Sablon are shown more frequently, suggesting that the appeal of Red Bay as a whaling destination was short-lived. Its role as a landmark for navigation, halfway along the Strait of Belle Isle, was relatively minor (Barkham 1977b; Huxley 1987:90-96).

The brief but intense Basque occupation of Red Bay has left a well-preserved archaeological site with extensive remains. Excavations have unveiled the organisation of the whaling station on Saddle Island and the adjacent mainland (Grenier 1988; Grenier et al. 2007; Tuck 1984, 1985). At least 15 ovens for transforming whale blubber into oil have been located. Each oven was associated with its own warehouse and lodging and was probably operated by the crew of a single ship. A few installations in the Saddle Island industrial village were shared by all the crews, including a ramp for hauling whales ashore, a pond for fresh water and a cemetery. Archaeological evidence shows Red Bay to be at its peak development in the 1570s when up to 15 ships and a thousand crewmen used the port annually.

Among Basque whaling stations, Red Bay witnessed the greatest upsurge of activity during the 1560s and 1570s, as well as the most dramatic subsequent decline. Several factors led whalers to concentrate their activities in a few stations during these later decades. Recurrent

Franco-Spanish hostilities and occasional raiding by English corsairs encouraged Basques to stay within sight of each other for mutual security. The less experienced captains that joined the hunt during these decades congregated in larger harbours rather than choose smaller, more isolated inlets where a veteran captain might prefer to work. Basque whaling outfitters, faced with greater competition and decreasing profit margins in the 1560s and 1570s (Uriarte Melo 1995), sent several ships to the same port in a bid to pare down overhead costs and create economies of scale. Compared to other Strait harbours, Red Bay was commodious and safe, with good protection and few reefs. It was close to open water, reducing the distance that whales had to be towed into port and that hunting *chalupas* (shallops) had to be rowed to sea, while minimizing the threat from ice in fall. All of these factors heightened the attractiveness of Red Bay to Basque whalers during the 1560s and 1570s, when autumn bowhead whaling was at its peak. As a result, the most numerous and most accessible whalebones may date from this period.

Conclusion

Previous assessments of the number of whales killed in the western Atlantic by 16th-century Basques appear to have over-estimated the number and regularity of whaling voyages. The peak that occurred in the 1560s and 1570s came after two decades of intermittent growth, and the collapse of Basque shore-based whaling in Labrador *circa* 1579 was not followed by any meaningful recovery during the 1580s and 1590s. Basque impact on regional whale populations, while significant, was less than that of pelagic whaling in later centuries when most species were driven to near extinction. In the 16th century, whaling outfitters expected high profit margins. When regional whale populations declined, outfitters shifted to other sectors of maritime capitalism rather than exploit low-profit residual whale populations as was done in later centuries.

Examination of the Basques' ability to distinguish whale species and their regional populations indicates extensive knowledge of whale ecology. The peak in Labrador whaling during the 1560s and 1570s may have been associated with the strategy of intercepting bowhead whales on both legs of their migration route. However, the heightened risk of closing ice in the Strait of Belle Isle led whalers to concentrate the bowhead hunt in the more easterly ports, especially Red Bay but also Chateau Bay and East St. Modest. As a large, safe port, Red Bay was also preferred by less experienced whalers who came to Labrador during the 1560s and 1570s. These factors created a short-lived boom at Red Bay, and the archaeological deposit of whalebones found here no doubt reflects this brief, specific situation created by diminishing whale populations, increasing numbers of whalers and the risky strategy of staying as late into winter as possible in order to exploit the southward-migrating bowhead.

Following Cumbaa's (1986) identification of right and bowhead whales in roughly equal proportions at Red Bay, historians and archaeologists incorrectly assumed that the whalebone deposit at this site represented right whales killed in summer and bowhead whales killed in autumn. Recent DNA-based studies (Rastogi et al. 2004; McLeod et al. 2008) have changed many aspects of our understanding of 16th-century whaling. By revealing the complete dominance of bowhead whales in archaeological assemblages, the findings call for a reassessment of historical data on Basque whaling practices. The bowhead's disappearance in its former southern wintering area has not been fully explained by available data on climate change and overhunting. These remaining questions call for more detailed and context-specific studies of whaling in the Gulf of St. Lawrence.

Acknowledgments

Research for this paper was made possible by grants from the Ontario Ministry of Education, the Social Sciences and Humanities Research Council of Canada and the Université de Montréal. The author wishes to thank Miren Egaña Goya, Jean-Pierre Proulx, Robert Grenier, James Tuck, Laurier Turgeon, Françoise Niellon, Dominique Lalande, Peter Pope, Mark Staniforth and William Fitzhugh for helping to understand aspects of their published findings. This paper was much improved by comments from one anonymous reader and from Steven Cumbaa, to whom the author expresses his gratitude while taking responsibility for any remaining errors.

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Artiodactyl Skeletal Part Representation at Middle Period and Early Plateau Pithouse Tradition Sites on the Interior Plateau, British Columbia: a View from EdRh-31

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ABSTRACT

The earliest occupation of the site of EdRh-31 on the Interior Plateau of British Columbia dates to the Lochnore Phase of the early Plateau Pithouse Tradition. The faunal remains indicate that the people who occupied the site hunted artiodactyls, hunted or snared small animals such as hares, collected freshwater mussels and occasionally fished. Previous research on three sites roughly contemporaneous with EdRh-31 found that artiodactyl metapodials dominate the associated faunal assemblages, leading to the interpretation of these sites to be animal butchering camps. Analysis of the heavily fragmented EdRh-31 bone assemblage, however, suggests that the dominance of artiodactyl metapodials is not necessarily the result of cultural activity but may also reflect a suite of taphonomic processes. While not discounting the possibility that some of these sites functioned as butchering camps, this article draws attention to possible ambiguities in the interpretations of faunal assemblages.

RÉSUMÉ

L'occupation la plus ancienne du site EdRh-31, situé sur le plateau intérieur de la Colombie-Britannique, remonte à la phase Lochnore de la tradition Plateau Pithouse. Les restes fauniques indiquent que les occupants chassaient les artiodactyles, chassaient ou colletaient le petit gibier dont le lièvre, ramassaient des moules d'eau douce et pêchaient à l'occasion. Les recherches antérieures sur trois sites d'ancienneté similaire au EdRh-31 montrent que les métapodes d'artiodactyles dominent les collections fauniques, menant à l'interprétation de ces sites comme des camps de boucherie. Toutefois, l'analyse des ossements très fragmentés du site EdRh-31 ne conduit pas nécessairement à une explication culturelle pour la dominance des métapodes, qui peut aussi résulter de processus taphonomiques. Sans exclure la possibilité que certains de ces sites aient accueilli des activités de boucherie, cet article attire l'attention au potentiel d'ambiguïtés qui guette l'interprétation des collections fauniques.

Faunal studies of Middle Period and early Plateau Pithouse Tradition (*ca.* 7000 - 3500 BP) sites on the Interior Plateau of British Columbia have noted a predominance of medium (deer-sized) and large (elk-sized) artiodactyl metapodials. Despite differences in the date of occupation and the archaeological context among these sites as well as the paucity of identifiable bones in their faunal assemblages, this pattern was observed independently at Oregon Jack Creek (Rousseau and Richards 1988:54), EeRf-1 (Bussey 1995, Prager 1995) and Rattlesnake Hill (Arcas Associates 1985). The faunal evidence and associated lithic scatters led to the interpretation that these sites represent animal butchering camps (Arcas Associates 1985:iv, Bussey 1995:52, Prager 1995:3, Rousseau and Richards 1988:58). The faunal assemblage from another site in this region, EdRh-31, with calibrated radiocarbon dates of 4830±40 and 4940±40 BP, is examined here with the goal of assessing the function of this site.

The cultural sequences and associated material correlates of the different time periods represented on the Interior Plateau have been summarized by Fladmark (1982), Rousseau (2004) and Stryd and Rousseau (1996). The Middle Period incorporates the Early Nesikep (*ca.* 7000–6000 BP), Lehman (*ca.* 6000–4500 BP) and Lochnore Phases (*ca.* 5500–3500 BP). The Middle Period is followed by the Late Period (*ca.* 3500–200 BP), of which the earliest component is the Shuswap Horizon (*ca.* 3500–2500 BP). The Shuswap, Plateau and Kamloops Horizons of the Late Period, together with the Lochnore Phase of the Middle Period, form the Plateau Pithouse Tradition (Stryd and Rousseau 1996:179).

According to Stryd and Rousseau (1996:197), similarities in artifact types and lithic technology, the construction and usage of pithouses and the focus on salmon (Salmonidae) fishing seem to indicate continuity from the Lochnore Phase to the following Late Period as part of the Plateau Pithouse Tradition. Stryd and Rousseau (1996:198-200) consider the emergence of the Lochnore Phase to be the result of initial Coast Salish migration into the southern interior on a seasonal basis to hunt, collect plants and fish. This would have occurred primarily in the summer months when salmon fishing was relatively poor on the coast and the lower Fraser Canyon. They postulate that, during the fall, these Salish groups returned to their villages in the lower Fraser Canyon to fish salmon. This seasonal usage of the Plateau would have persisted until about 4500 BP when salmon populations were sufficient to allow Salish groups to establish permanent villages on the Plateau (Rousseau 2004, Stryd and Rousseau 1996:199). Wilson (1992), on the other hand, argued for cultural continuity between the Early Nesikep-Lehman Phase and the Lochnore Phase. This proposition is based on the co-occurrence of Lehman and Lochnore artifacts at EdQx-41 and the observation that materials associated with both phases are often found mixed at sites in the region.

Faunal evidence from sites on the Interior Plateau indicates that, during the Middle Period, deer (*Odocoileus* sp.) and elk (*Cervus canadensis*) were hunted and freshwater mussels (Unionidae) collected (Huculak 2004, Rousseau et al. 1991:14-15, Stryd and Rousseau 1996:191). A major shift in subsistence activities occurred about 4000 BP on the Canadian Plateau with the appearance of the intensive salmon utilization (Kuijt 1989:97, Rousseau 2004) that characterizes more recent time periods (Langemann 1987).

Faunal Data from Contemporary Sites

Few faunal assemblages from Middle Period and early Plateau Pithouse Tradition sites have been analyzed (see Driver 1993, Huculak 2004). This paper compares the artiodactyl skeletal element representation from EdRh-31 with those from other contemporary sites in this area for which data are available. Some of these sites have historical components, but only faunal remains dating to the Middle Period and early Plateau Pithouse Tradition are considered here. The relevant sites, described below, are open-air and, like EdRh-31, are located close to rivers.

Oregon Jack Creek (EdRi-6) is a Lehman Phase, open-air lithic scatter with sub-surface deposits dating to 4850±100 cal BP. The site is located about a kilometer west of the Thompson River and about 11 kilometers southwest of the modern town of Ashcroft. Sediments at the site consist of early Holocene glacio-fluvial gravels topped with aeolian silt and sand veneer. Faunal remains recovered include elk bones and freshwater mussels, and the excavators hypothesized that the site was a short-term elk butchering camp used during the Lehman Phase. Only 13 artiodactyl bones were recovered (Rousseau and Richards 1988).

EeRf-1 is an open-air lithic scatter situated on the south bank of the Thompson River at the outlet of Kamloops Lake near Savona. Material from sub-surface deposits yielded dates of 4220±70 and 5670±60 cal BP. An Early Nesikep Tradition, a Lehman or Lochnore Phase and a historical component were present. Deposits at the site consist of glacial diamictons and glacio-fluvial materials. Elk, mule deer *(Odocoileus hemionus*), bighorn sheep (*Ovis canadensis*), coyote (*Canis latrans*), beaver (*Castor canadensis*), porcupine (*Erethizon dorsatum*), marmot (*Marmota* sp.), squirrel (*Sciuridae*), northern pocket gopher (*Thomomys talpoides*), deer mouse (*Peromyscus* sp.), long-tailed vole (*Microtus longicaudus*), red-necked grebe (*Podiceps grisegena*), white-winged scoter (*Melanitta deglandi*), blue grouse (*Dendragapus* sp.), fish and freshwater mussels are all present in the faunal assemblage.

The abundance of artiodactyl metapodials suggests that the site was a butchering camp (Bussey 1995, Prager 1995).

Rattlesnake Hill (EeRh-61) is an open-air lithic scatter. It is a Lehman Phase site with dates ranging between 6290±120 and 4470±110 cal BP. A possible historical component is present at the site but was not investigated. The site is situated 5.2 kilometers by road northeast of Ashcroft in the Thompson River valley. Sub-surface deposits consist primarily of brown chernozems. Deer, a canid (*Canis* sp.), snowshoe hare (*Lepus americanus*), a large artiodactyl, salmon, fish and freshwater mussels are represented in the faunal assemblage. The predominance of artiodactyl metapodials was interpreted to mean that the site functioned as a hunting camp at some stage (Arcas Associates 1985).

Landels (EdRi-11) is a lithic scatter with sub-surface deposits located 13 kilometers southwest of Ashcroft at the eastern end of the Upper Oregon Jack Creek. The Early Nesikep/ Lochnore Phase, the Lochnore Phase and the Plateau Horizon are all represented at Landels. The Lochnore Phase material yielded dates ranging from 6000±80 to 3520±70 cal BP. Deer, snowshoe hare and a canid were identified from the Lochnore faunal sample. Local sediments consist of clayey silt (Rousseau et al. 1991).

EdRh-31: Description of the Site and Excavations

EdRh-31 is situated on a flat terrace approximately 35 meters above the Thompson River on the Interior Plateau near Ashcroft. It was investigated as part of a rescue excavation in advance of development. Two portions of the site were excavated: Areas A and B (Figure 1). A standard 1m x 1m excavation unit was employed. Five and 10 cm arbitrary levels were used except when stratigraphic divisions (distinct layers or cultural features) were clearly evident. All excavated matrix was sieved through 3 mm (1/8 inch) wire mesh screens. Sediments ranged from sandy loams, clayey silt to silty sand (Muir et al. 2006).

Ten 1 m^2 excavation test units were placed within Area A, where intact cultural deposits ranged between 30 and 60 cm in depth. Animal bone recovered from these deposits yielded a radiocarbon date of 4940±40 BP, calibrated to 3790-3650 BC (Muir et al. 2006).

In addition to débitage fragments, five formal and three unformed stone tools were recovered. All eight are made of microcrystalline basalt, three coarse-grained and five fine-grained. The formal lithics consist of three projectile points, one knife/scraper and an indeterminate biface.

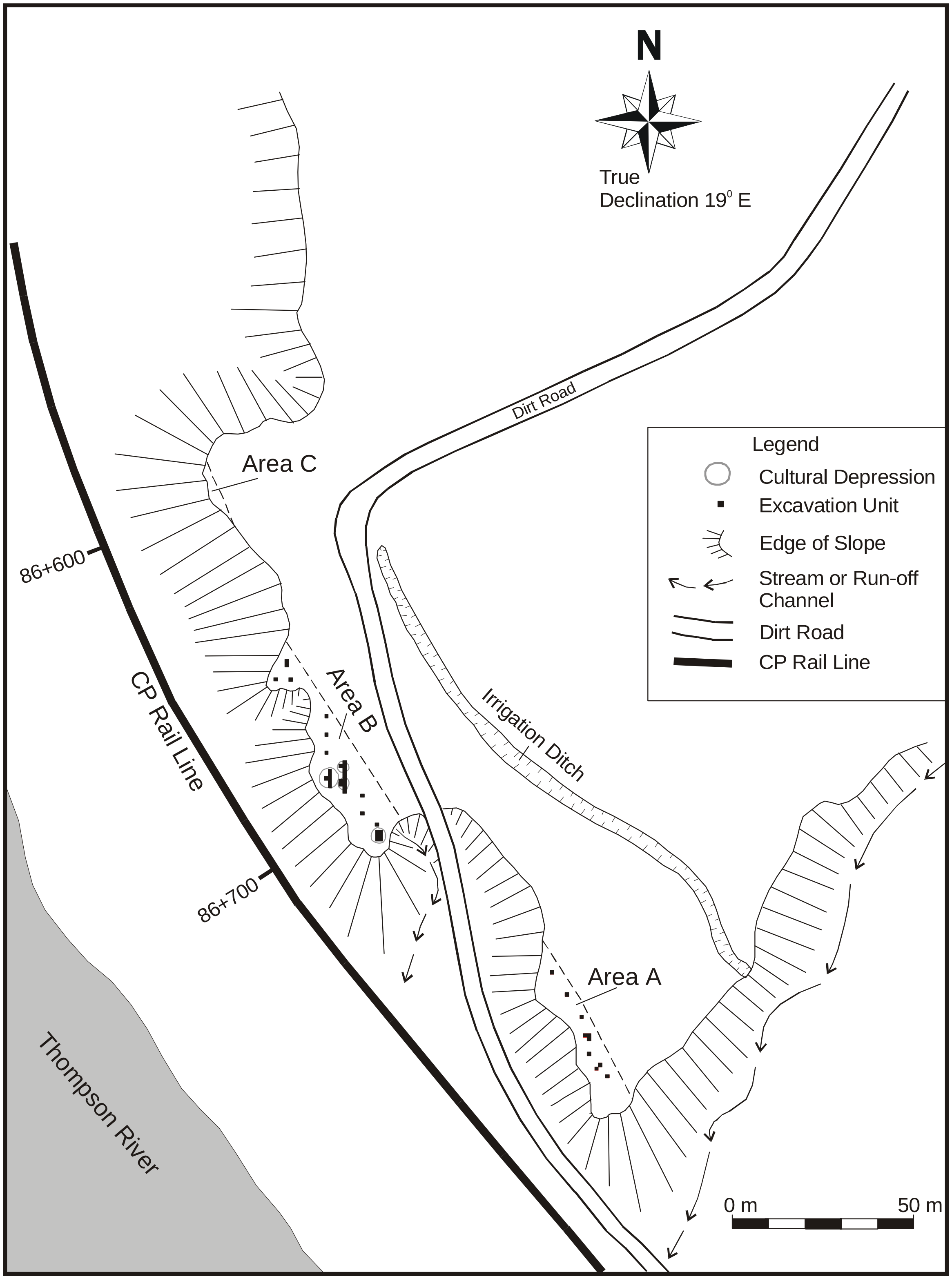

Fig. 1: The location of Area A and B at EdRh-31 (from Muir et al. 2006, used with permission).

Unformed lithics consist of one side scraper, one core and one utilized flake. Only one projectile point has diagnostic features; it is incomplete, leaf-shaped with wide side-notching and a pointed convex base. This lithic is characteristic of the Lochnore Phase (Muir et al. 2006:48, Stryd and Rousseau 1996:193) and corroborates the radiocarbon date for Area A.

A total of thirty-four 1 m^2 units were excavated in Area B. Animal bone recovered from a stratum ranging in depth from 15-85 cm has been radiocarbon-dated to 4830±40 BP (calibrated to 3670-3530 BC) indicating that these deposits are roughly contemporaneous with those from Area A (Muir et al. 2006).

Four cooking and storage pit features dating to within the last 200 years were also excavated in Area B (Figure 1); these contained well-preserved organic remains, stone cobbles, many salmon bones as well as historical artifacts (Muir et al. 2006). The fauna from these much younger pit features will not be considered here; all faunal material associated with the Lochnore Phase came from units adjacent to these features.

In addition to débitage fragments, a total of 18 formal and unformed lithics were recovered from the prehistoric component of Area B. These include four fragmented projectile points, one asymmetrical contracting stemmed knife and four indeterminate biface fragments. Of the four projectile point specimens, three are the bases of small leaf-shaped tools, two of which display side notching. The fourth projectile fragment is a tip of a triangular point with denticulation along both lateral edges. Of three scrapers found, one is a complete thumbnail scraper (Muir et al. 2006), a type of tool common in the Shuswap Horizon (3500–2500 BP) (Rousseau 2004:15). Six unformed tools include one utilized flake, two side scrapers and three cores. Seventeen of the 18 tools are manufactured from microcrystalline basalts; 14 of these are fine-grained (dacite) and three are coarse-grained. The remaining tool is made of Ducks Meadow vitric tuff (Muir et al. 2006:49-50).

Faunal Remains

The analytical procedures used in this study follow those described by Driver (1991, 1992). Each specimen that could be assigned to a skeletal element was deemed “identifiable”. All identifiable bone and tooth specimens were assigned to an appropriate species, genus, family or class. Number of Identified Specimens (NISP) and Minimum Number of Individuals (MNI) were used to quantify the faunal remains. The strengths and weaknesses of these methods are discussed by many authors, including Grayson (1984), Klein and Cruz-Uribe (1984), Plug and Plug (1990) and Reitz and Wing (1999).

Skeletal part representation was calculated for artiodactyls, which in the case of EdRh-31 may include cervids such as deer and elk and bovids such as bighorn sheep (Table 3). Indeterminate medium and large mammal specimens were assumed to belong to artiodactyls. For comparative purposes, artiodactyl skeletal part representation was also calculated for the faunal assemblages from Landels (EdRi-11) (Rousseau et al. 1991:322-334), Oregon Jack Creek (EdRi-6) (Rousseau and Richards 1988:55) and EeRf-1 (Prager 1995).

At EdRh-31, a total of 830 faunal specimens were recovered from Area A. Of these, only 43 (5.1%) were identified. These include a coyote-sized canid, deer, snowshoe hare and vole (Table 1). Five long bone fragments from medium-sized mammals displayed spiral fractures. Chop marks were also observed on three medium-sized artiodactyl specimens, all toe and ankle bones. All bone remains from Area A with visible aging criteria were from adult individuals.

Area B yielded a total of 470 bone remains of which only 34 (7.2%) were identified. These include deer, a rodent, other small mammals and fish. Six recovered egg shell fragments could not be attributed to taxon. With the exception of one sub-adult medium-sized artiodactyl and two juvenile rodent specimens, all of the bones with visible aging criteria came from adult individuals. No spiral fractures were noted on shaft fragments from Area B.

For EdRh-31, freshwater mussel was not counted due to heavy fragmentation. A total of 39 grams of freshwater mussel was recovered for Area A and B combined (Muir et al. 2006:74).

Species	**Area A**	**Area B**	**Total NISP**
medium canid (coyote or dog)	2/1	-	**2**
Odocoileus sp. (deer)	1/1	2/1	**3**
cervid (deer or moose)	2/1	1/1	**3**
medium artiodactyl (deer or bighorn sheep)	21/1	7/2	**28**
Lepus americanus (snowshoe hare)	1/1	-	**1**
Microtus sp. (vole)	1/1	-	**1**
small rodent	1/-	6/2	**7**
small mammal		1/1	**1**
medium mammal	13/-	4/-	**17**
large mammal	1/1	-	**1**
egg shell	-	6/1	**6**
fish	-	7/1	**7**
Unionacea (freshwater mussel)	x	x	**N/A**
Total NISP	**43**	**34**	**77**

Table 1: Species present at EdRh-31 (NISP/MNI). N/A = not applicable; x = present

A bone tool was recovered from Area B. This specimen is a polished, ground and incised barbed bone projectile point. The tool is manufactured from a mammal long bone fragment and is complete save for a small portion of the base (Muir et al. 2006).

The faunal assemblage from EdRh-31 suggests that the people who utilized the site employed a variety of strategies to obtain protein. These could have included hunting, snaring, gathering and fishing. The freshwater mussels are probably *Margaritifera falcate*, *Anodonta* spp. or *Gonidea angulata* (Lindsay 2003, Lyman 1984), which are abundant in the river systems of British Columbia (Clarke 1981). The rodent remains appeared to be in better condition than the other fauna, suggesting that they may have been subsequently introduced through disturbance.

Skeletal part frequencies at EdRh-31, Landels, Oregon Jack Creek and EeRf-1 show that metapodials dominate the artiodactyl samples from the Middle Period and early Plateau Pithouse Tradition (Table 2). While these samples are all rather small, the NISPs for metapodial is greater than those for cranium, vertebra, rib, scapula, pelvis and upper limbs combined.

Discussion

As with EdRh-31, archaeofaunas from other Middle Period and early Plateau Pithouse Tradition sites are poorly preserved and heavily fragmented, producing very few identifiable specimens (Arcas Associates 1985, Bussey 1995:52, Fladmark 1982, Kuijt 1989, Robinson and Eldridge 1998:42, Rousseau et al. 1991:83). For example, 35 (9.5%) of the mammal bones at Rattlesnake Hill (EeRh-61) were identifiable (Arcas Associates 1985:112). (If fish are included, the identifiable portion of the assemblage increases to 17.2%.) At Landels (EdRh-11), only 448 (1.4%) of the recovered 30,446 bones were identified, the majority of which date to the Plateau Horizon (Rousseau et al. 1991). At the site of EdRh-14, which yielded dates of 4940±50 and 5750±60 cal BP, 57 bones (2.8% of the assemblage) were identifiable (Robinson and Eldridge 1998:42).

At Oregon Jack Creek (EdRi-6), EeRf-1, Landels (EdRh-11) and Rattlesnake Hill (EeRh-61), the faunal assemblages indicate a dominance of medium and large artiodactyl metapodials (Table 2). Notwithstanding the small sample, the EdRh-31 faunal assemblage also fits this pattern.

Marshall and Pilgram (1993:261) summarized the various cultural and natural processes that influence skeletal part frequencies in archaeological faunal assemblages. These include carcass transport, food sharing, meat processing, bone density and diagenetic actions (see also Brain 1981, Lyman 1994, Shipman 1981, Reitz and Wing 1999). The determination of the processes responsible for skeletal part frequencies in archaeofaunas is a challenging task, often producing ambiguous results. Lyman (1994:63) pointed out that different cultural and natural processes may produce similar archaeological patterns, a phenomenon known as “equifinality.”

Skeletal Part	EdRh-31	Landels (EdRi-11)	EeRf-1	Oregon Jack Creek (EdRi-6)	Total NISP	Density Categories
Skull (Total = 46)						
antler	1				**1**	Intermediate
skull indet.	12	2	2		**16**	Low to High
mandible		1	1		**2**	High
teeth	4	10	11	1	**26**	High
hyoid			1		**1**	Low
Vertebrae, Ribcage, Pectoral/Pelvic Girdle (Total = 36)						
atlas		1			**1**	High
cervical vt.	1	1			**2**	Intermediate to High
lumbar vt.		3			**3**	Intermediate to High
vertebrae indet.	2	1	5		**8**	High
ribs	6	6	2		**14**	Low
scapula			3	1	**4**	Low to High
pelvis		1	3		**4**	Intermediate to High
Limbs (Total = 151)						
humerus	3	1	1		**5**	Low to High
femur		3*	2	1	**6**	Intermediate
radius		2	3		**5**	Intermediate to High
ulna			1		**1**	Intermediate to High
tibia		1	7	1	**9**	Low to High
carpals	1		2	2	**5**	High
tarsals	2	7	7		**16**	High
metacarpal	1	2	4	3	**10**	High
metatarsal	5	1	12		**18**	High
metapodial	9	14	10		**33**	High
1st phalanx	4	7			**11**	High
2nd phalanx	2	4			**6**	High
3rd phalanx	1	3			**4**	Intermediate
phalanx indet.		4	11	4	**19**	Intermediate to High
sesamoid		3			**3**	High
Total NISP	**54**	**78**	**88**	**13**	**233**	

Table 2: Medium and Large Mammal NISP for EdRh-31, Landels (Rousseau et al. 1991:322-334), Oregon Jack Creek (Rousseau and Richards 1988:55) and EeRf-1 (Prager 1995). Bone density categories from Brain (1981).

The predominance of artiodactyl metapodials at sites such as EdRh-31 may have resulted from a number of different processes. The relative abundance of artiodactyl metapodials may reflect the function of the sites. Previous research on fauna from Middle Period and early Plateau Pithouse Tradition sites in fact suggested that some may have been butchering stations (Arcas Associates 1985:iv, Bussey 1995:52, Prager 1995:3, Rousseau and Richards 1988:58). Many animals are likely killed some distance from residential sites and decisions must be made as to which parts will be taken back. Lower leg bones such as phalanges and metapodials of medium to large animals are often left behind at short-term kill-sites or butchering camps as they have marginal utility with regards to meat, fat and grease compared to the shoulders and haunches (Binford 1978, Bartram 1993, Driver 1990, Enloe 1993, Jones 1993, Perkins and Daly 1968, Speth 1983).

The artiodactyl skeletal element frequencies from Middle Period and early Plateau Pithouse Tradition sites are similar to what other researchers have found at kill sites or butchering stations. However, no sites in this region have produced an abundance of bones from the meatier parts of artiodactyl skeletons such as upper haunches, ribs and vertebrae, which would indicate that they were locations to which meat was transported. Taphonomic processes may produce skeletal part profiles similar to those that result from cultural behavior (Brain 1967, 1969, 1981). A common feature of sites on the Interior Plateau such as EdRh-31 is the high degree of bone fragmentation. Marshall and Pilgram (1993:261) have noted that, initially, bone breakage tends to increase NISP. However, in the case of heavily fragmented samples, a greater proportion of bones becomes too small to identify so then NISP decreases. Lyman and O'Brien (1987:496) commented that when bones are "…reduced beyond the minimal identifiable size, then the proportion of identifiable fragments will be decreased." It may be possible in cases of very intense bone fragmentation that most of the originally deposited skeleton had been recovered during excavation. However, the high levels of fragmentation would hamper element and species identification (see Todd and Rapson 1988, Watson 1972). Lyman and O'Brien (1987:496) refer to this effect as an "analytic absence" of elements and perhaps even of taxa. The high intensity of mammal bone fragmentation at EdRh-31 and contemporary sites on the Interior Plateau suggests that numerous skeletal elements and possibly even some taxa represented in the faunal assemblages were not identified.

Although the artiodactyl skeletal profiles at EdRh-31 and other Middle Period and early Plateau Pithouse Tradition sites may reflect site function, taphonomic factors such as intense meat processing, meat preparation, cooking, differential bone preservation and diagenetic processes may have contributed to the observed artiodactyl skeletal pattern and high proportion of unidentifiable bones. It is possible that butchering contributed to the high degree of fragmentation of archaeofaunas such as that at EdRh-31. However, it remains difficult to assess the impact of butchering. Actualistic (Jones 1993, Parsons and Badenhorst 2004) and archaeological (Trolle-Lassen 1990) studies have shown that butchered animals yield few cut or chop marks. However, bone breakage patterns may be an important avenue for future research in the region (cf. Villa and Mahieu 1991).

Spiral fractures may occur on fresh breaks (e.g., Haynes 1983) and may offer insights into the taphonomic history of the faunal samples. Five out of 18 (28%) medium mammal long bones from EdRh-31 display spiral fractures; however, these were the only such fractures observed among the 1300 specimens in the entire sample. This suggests that post-depositional bone fracturing had a considerable impact on this assemblage. Comparative data on spiral fractures from other Middle Period and early Plateau Pithouse Tradition sites indicate that at Landels, only one spiral fracture was recorded, on a medium mammal tibia shaft (Rousseau et al. 1991:331). Neither Prager (1995) nor Arcas Associates (1985) mention the presence or absence of spiral fractures on artiodactyl long bones from EeRf-1 or from Rattlesnake Hill, respectively.

The low number of spiral fractures at EdRh-31 and Landels suggests that post-depositional processes likely contributed to bone fragmentation, which in turn would have affected skeletal element representation at these sites. As these are both open-air sites, the faunal remains were not shielded from natural elements such as heat and moisture fluctuations that fracture and destroy animal bones (e.g., Meadow 1978).

In addition, the soil pH at these open air sites probably contributed to the fragmentation of the faunal remains. The ideal pH for bone preservation is neutral (7.8-7.9). Both alkaline and acidic soils are not conducive to bone preservation (Reitz and Wing 1999:117). Middle Period and early Plateau Pithouse Tradition sites on the Interior Plateau are often situated on glacio-fluvial gravels topped with aeolian sand of varying depths (e.g., Rousseau and Richards 1988:43). Leaching of sediments in many parts of the Thompson River basin created a calcium carbonate layer (Sanger 1970) which is dry and alkaline (Arcas Associates 1985:26). A calcareous deposition is often found on bones such as those from Lillooet (Langemann 1987:22-23). These alkaline soil conditions are not conducive to bone preservation (cf. Reitz and Wing 1999) and may have been one of the most important taphonomic factors affecting Middle Period and early Plateau Pithouse Tradition archaeofaunas. It does not seem as if the presence of mussel shells, which are very fragile at EdRh-31, neutralized the deposits.

Bone density studies will be useful to apply to sites on the Interior Plateau. However, such studies will have to take note of methodological issues (e.g., Ioannidou 2003, Lam et al. 2003, Lam and Pearson 2005, Lyman 1994, Pavao and Stahl 1999, Symmons 2002). Brain's (1981:139) ordinal density categories show that many of the well-represented bones in the studied assemblages have high densities. Low density elements such as rib, sternum and thoracic vertebra are either present in low numbers or completely absent (Table 2). It can therefore be surmised that bone density had some impact on the skeletal part representation of artiodactyls at Middle Period and early Plateau Pithouse Tradition sites. This does not imply that human behaviors did not contribute to the observed patterns at sites such as EdRh-31.

An important factor that must be considered in comparing artiodactyl skeletal element counts is that different analysts use different methods of identification. For example, the system proposed by Driver (1991, 1992) considers each bone specimen that can be assigned to an element as "identifiable," even if only to class level such as "medium mammal." Table 2 includes all bones identified as "medium mammal," which refers to an animal the size of deer. Other analysts have used other methods. For example, Prager (1995:1) considers "identifiable" bone as those specimens that can be identified to at least the family level. This latter approach no doubt underestimates the abundance of certain skeletal elements in archaeofaunas such as rib and long bone shaft fragments which may not be readily identified to family level.

From Table 2 it is clear that metapodials are well represented in Middle Period and early Plateau Pithouse Tradition sites. These elements are of marginal utility (Binford 1978). Some elements, such as metapodials, even if highly fragmented, can be assigned to an element with greater ease and confidence than others. Fragmented shafts of humeri, radii, femora and tibiae are often difficult to separate from one another (but see Marean and Spencer 1991). On the other hand, metapodial diaphyses, with their deep groove and square shape, are easily recognizable (more so in cervids than in bovids), even when highly fragmented. Remnants of the inner bone wall in metapodial shafts are also extremely diagnostic. Moreover, their epiphyses are highly distinguishable from those of other long bones. The distal epiphysis is compact and often preserves well, and the flat proximal articulation is also easily recognized (Marean and Frey 1997). Therefore, the relative abundance of metapodials in the samples listed in Table 2 may reflect biases not only in preservation but also in identification (cf. Ryder 1969). This issue has received attention from faunal analysts. For example, Marean and Spencer (1991) found that in experimental assemblages ravaged by carnivores, long bone shafts, rather than bone ends, actually provided the best measure of element abundance. The chosen method of measuring element abundance and, more specifically, of identifying long bone shafts may seriously affect overall counts in faunal assemblages.

Conclusions

The meat diet of Middle Period and early Plateau Pithouse Tradition peoples is relatively well documented (see summary by Stryd and Rousseau [1996]). The faunal analysis of EdRh-31, however, suggests that, until more assemblages are studied, inferences about site usage based on faunal remains may be premature. This article cautions against interpretations of bone element representation without a consideration of post-depositional processes and methods of analyses. High levels of bone fragmentation, the result of both cultural and natural processes, can obscure skeletal part frequencies and even the number of taxa identified from archaeological deposits.

The predominance of artiodactyl metapodials at Middle Period and early Plateau Pithouse Tradition sites on the Canadian Plateau is probably the result of a combination of factors including site usage, human decisions about carcass transport, butchering activities, the low proportion of identified specimens and post-depositional fracturing. Moreover, elements such as metapodials are not only dense but are more easily recognized in heavily fragmented assemblages. Future faunal studies in this region should note the degree of fragmentation of an assemblage and establish a standardized method of analysis to permit more reliable comparisons between different assemblages (see Driver 1982, 1991, 1992).

Acknowledgments

I would like to thank Drs. J. C. Driver and G. Nicholas of Simon Fraser University for comments on earlier drafts. Dr. R. J. Muir of Simon Fraser University gave permission to use Figure 1. Dr. Y. Lam provided additional comments and suggestions. All oversights are my own responsibility.

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