This PDF file of your paper in *Time and Change* belongs to the publishers Oxbow Books and it is their copyright.

As author you are licenced to make up to 50 offprints from it, but beyond that you may not publish it on the World Wide Web or in any other form.

An offprint from

TIME AND CHANGE

Archaeological and Anthropological Perspectives on the Long-Term in Hunter-Gatherer Societies

Edited by
Dimitra Papagianni, Robert Layton
and Herbert Maschner

© Oxbow Books 2008

ISBN 978-1-84217-320-6

Contents

List of Contributors vi
Preface ix

1 Time and Change: Crisp Snapshots and Fuzzy Trends
Robert Layton 1

PART I: STRATEGIES FOR LONG-TERM STABILITY

2 Stability or Flexibility? Handaxes and Hominins in the Lower Palaeolithic
Robert Hosfield 15

3 Moving Through Unstable Landscapes: Cycles of Change and Palaeolithic Mobility Patterns
Dimitra Papagianni 37

PART II: STUDYING CHANGE OVER THE LONG-TERM

4 Long-Term Human/Animal Interactions and their Implications for Hunter-Gatherer Archaeology in South America
A. Sebastián Muñoz and Mariana Mondini 55

5 Changing Places: Ten Thousand Years of North Australian Rock-Art Transformation
Paul Taçon and Christopher Chippindale 73

6 Catastrophic Events and Punctuated Culture Change: The Southern Bering Sea and North Pacific in a Dynamic Global System
Herbert D. G. Maschner and James W. Jordan 95

7 Interactions Between Hunter-Gatherers and Farmers in the Early and Middle Neolithic in the Polish Part of the North European Plain
Arkadiusz Marciniak 115

PART III: ETHNOGRAPHIC ANALOGY

8 Group-Based Versus Individual-Based Approaches: Selecting an Appropriate Scale for the Archaeological Study of Prehistoric Hunting and Gathering People
Ariane Burke 135

9 Changing Patterns of Sea Mammal Exploitation Among the Makah
Michael Etnier and Jennifer Sepez 143

Chapter 9

Changing Patterns of Sea Mammal Exploitation Among the Makah

Michael Etnier and Jennifer Sepez

Abstract
The Makah Indians from the outer coast of Washington are renowned for their strong maritime orientation, and have maintained high levels of continuity in marine resource use over 500 years. However, marine mammal use has changed considerably. Today, the Makah utilize less than 30% of the same marine mammal taxa as their ancestors at the ancient village site of Ozette. Comparison between the Ozette archaeofaunas and the modern ecological communities on the coast of Washington indicate major changes among marine mammals in this ecosystem within the past 200–300 years. During that time period, the region and its peoples have experienced a tremendous level of political and cultural change. This chapter develops a method for comparing very different sources of data (archaeological, ethnographic and survey data) to analyze change over time in subsistence harvest practices, and uses historical ecology (with particular attention to killer whales and northern fur seals) to examine the evolution of cultural change in terms of the environmental and political history of the Northwest coast.

INTRODUCTION

An increasing body of research is recognizing the value of historical context for understanding the dynamic nature of modern ecological and cultural processes (Etnier 2004; Kay 1994; Holm *et al.* 2001; Jackson *et al.* 2001; Lyman and Cannon 2004). For ecological and cultural processes alike, written descriptions of specific systems often post-date substantial, sometimes catastrophic, changes brought about by foreign cultural influences (Crosby 1986; Ramenofsky 1987) and thus cannot be relied on as accurate portrayals of dynamic long-term histories. This is not to say that ethnographic information should be ignored. On the contrary, ethnographies can provide important data on the nature and pace of change – a quality best manifested if they can be compared with archaeological evidence of the systems in question.

In the study of human ecology, ethnographic data are usually used to clarify or contextualize archaeological data. Ethnographies are not often employed in an explicitly comparative manner with zooarchaeological records, in part, because it can be difficult to extract systematic and comprehensive information about ecosystems and human practices from what are often

elaborate narratives with multiple themes. Modern harvest surveys, however, are much better suited to comparison with the zooarchaeological record.

The Northwest Coast of North America provides one of the few regions where multiple sources of data are well represented: (1) the modern ecological system has been well-studied, (2) there are survey-based ethnographic data available for some modern tribes, (3) ethnographies rich in ecological description were recorded relatively soon after sustained European contact, and (4) unique geological conditions have allowed the discovery of some of the largest and best preserved archaeological sites in North America. A comparison can be made across these data sources, representing three different time periods, using synchronic characterizations of cultural practices (hunting and fishing) and/or species level population estimates at Time 1 (before colonial contact, represented by zooarchaeological analysis), Time 2 (early historic period, represented by ethnographies) and Time 3 (modern era, represented by survey research) to create a diachronic analysis. The challenge is that the types of data generated by these different methods are different enough to impede (but not preclude) meaningful comparison. On the other hand, the reward is the characterization of change over long and/or dynamic time periods. This is particularly valuable if the data cover periods of tremendous political, demographic, environmental, and cultural transitions that separate contemporary Northwest Coast Natives from their pre-colonial past. The method generates empirical data for analyzing and understanding change over the long term, not defined in thousands or millions of years, but rather as between culturally significant time periods that are studied with very different methods.

The case we focus on here involves the Makah Indians from the Cape Flattery region of Washington State, and their consumptive use of three unrelated groups of marine mammals: mustelids (sea otters, *Enhydra lutris*), pinnipeds (seals and sea lions), and cetaceans (whales and dolphins). The Makah are renowned for their maritime subsistence orientation in modern (Colson 1953; Sepez 2001), ethnohistoric (Scammon 1874; Swan 1870, 1883), and archaeological accounts (Gustafson 1968; Huelsbeck 1983, 1988, 1994a, 1994b). Interest in marine mammal exploitation has been driven in part by a desire to apply lessons from ecological history to conservation science and policy in the present. Interest in Makah exploitation of marine mammals has been of particular interest because of the tribe's controversial revival of subsistence whale hunting in 1999 (Sepez-Aradanas and Tweedie 1999).

There is often a 'historicity', or context-dependent trajectory, to environmental change (Crumley 1994, 4). We found the concept of historicity to be indispensable in conceptualizing and understanding changes in cultural practices among the Makah. First, we compare patterns of marine mammal exploitation across the three data types, producing an analysis of change over time. Then, we combine our analysis with population estimates and ethnographic information to produce an historical ecology that traces the evolution of Makah practices within a variety of ecological, cultural, and political influences that are specific to the history of the Northwest coast.

MATERIALS AND METHODS

This analysis utilizes three sources of data – archaeological, ethnographic, and survey-based – to characterize ecological and cultural change over time. Comparison between the three is achieved using Sepez's (2001, in press) method of tracking the presence or absence of a

particular taxon across each data set (see also Grayson 1981). The discussion then focuses on explanations of the patterns that emerge, embedding the evidence for change over time in historically specific ecological conditions, cultural practices and political factors.

Each of the datasets we reference uses different levels of specificity when referring to the animals under study. Thus, we will use the term taxon (and its plural, taxa) to refer to non-overlapping levels of grouping that correspond to relatedness. In most cases, the taxa we use correspond to Linnaean species. In some cases, however, we use a mix of non-overlapping species-level and family-level taxonomic designations. For instance, although killer whales (*Orcinus orca*) are members of the family Delphinidae, their skeletons are sufficiently different from the other members of that family that they can be identified quite easily in archaeological or paleontological contexts. In contrast, the smaller delphinids such as harbor porpoise (*Phocoena phocoena*) and Dall's porpoise (*Phocoenoides dalli*) have typically not been identified beyond the family level in the Ozette archaeological collections (Huelsbeck 1994b), nor in the other data sources. Thus, our analysis uses the family level taxon Delphindae for all porpoises and dolphins exclusive of killer whales. On the other hand, species-specific identifications are available for all the large whales in all three data sources, and so these are analyzed using species-level taxa.

Archaeological data

The archaeological data are found in a variety of analyses of the excavation of the abandoned village of Ozette, one of five ancestral Makah villages that was the focus of extensive archaeological excavations in the 1960s and 1970s (Samuels 1991, 1994). The archaeological materials at Ozette were extremely well-preserved and abundant, enabling a detailed reconstruction of the subsistence activities at the site spanning several hundred years (Fiskin 1979, 1980; Gustafson 1968; Huelsbeck 1983, 1988, 1994a, 1994b).

The archaeological data derive from identifications of marine mammal bones and teeth from the Ozette Village site, which lies on Cape Alava on the outer coast of Washington, just south of the current boundary of the Makah Reservation. The Ozette identifications combine data from three different researchers. Huelsbeck (1983, 1994a) analyzed most of the mammals. The large whales were analyzed by Fiskin (1979, 1980) and later reported in Huelsbeck (1994b). More recently, Etnier (2002a, 2002b) systematically re-examined the pinniped remains from Ozette and opportunistically re-examined a small portion of the cetacean material (Etnier 2003).

Based on the evidence from the excavations and from the bones and/or teeth themselves, it is inferred that all of the materials represent consumptive use of one sort or another. This primarily represents direct consumption for food, evidenced by the distribution of cut- and burn-marks on the bones. However, it is also clear from the Ozette collections that bones and teeth were used as raw materials in the construction of house features (Huelsbeck 1994b; Mauger 1991), hunting weaponry and decorative ornaments (Etnier 2003; Huelsbeck 1994a). It was not always possible to determine the full range of consumptive uses for some taxa.

Ethnographic data

For the ethnographic dataset, we have the benefit of direct observations to indicate how various taxa were utilized. Specifically, we distinguish between subsistence use, meaning a taxon was consumed locally as food, and cultural use, meaning a taxon was used as a non-food product (such as for fuel, art, clothing, building materials, etc.).

The early ethnographic data were recorded by James Swan, who was a schoolteacher on the reservation in the mid-1800s with a strong interest in Makah culture and the environment. This dataset contains harvest information and population estimates for the various species of marine mammals that were utilized at Ozette and/or were documented by Swan (1870) as a part of the Makah diet during the years he lived in Neah Bay.

Survey data

The analysis relies on two kinds of modern survey data based on systematic sampling procedures. Subsistence harvest data are based on household surveys on the reservation (Sepez 2001) and marine mammal population data are based on stock assessment surveys conducted by the National Marine Fisheries Service and published as annual population estimates for marine mammal species (exclusive of sea otters) that breed in or migrate through U.S. waters (Angliss and Lodge 2003; Caretta *et al.* 2002). Ideally, information regarding what is known about the migration paths of the marine mammals, on the one hand, and the effective hunting range of the Makah, on the other, would be used to estimate the relative encounter rates for the species analyzed here. However, although many of the species have population estimates at a local, state, and regional scale, consistent estimates were only available for the aggregated region covering Washington, Oregon, and California. Thus, the population estimates only provide a coarse measure of what marine mammals are locally available to the Makah today.

The household surveys in Sepez's research into modern Makah subsistence (Sepez 2001) consisted of a harvest and consumption survey conducted in person with Makah tribal members in the autumn of 1998, supplemented by ethnographic research on additional subsistence activities between 1997 and 1999. Sepez's survey covered a 15% random sample of Makah reservation households, with a response rate of ~90%. Respondents were asked to use mental recall to quantify their harvests of local fish, shellfish, marine mammals, terrestrial mammals and birds over a one-year period. Information about subsistence and cultural uses of resources, methods of harvest such as incidental take or direct harvest, and frequency of usage are taken from ethnographic work by Sepez (2001).

RESULTS

Examination of the full range of taxon use from each of several sources, including fish, shellfish, marine mammals, terrestrial mammals, and birds (reported in Sepez 2001, in press) shows a high degree of continuity (54% of taxa) in marine resource use over time, particularly in fish (88%) and shellfish (84%). Specifically, consumptive use of 77% of marine taxa (40 of 52 fish, shellfish, and marine mammal taxa) is documented in all three time periods. However, marine mammals show a relatively low degree of continuity (29%) between the datasets. In fact, the majority of marine mammals with evidence of use in the archaeological remains and ethnohistoric accounts have been eliminated from the modern Makah diet.

Of the seventeen marine mammal taxa that were utilized at Ozette prior to AD 1700 and/or in the 1800s only five (29%) are still in use today (Table 9.1). The five taxa that are still used by the Makah today are sea otter (occasional cultural use of furs only, salvaged from incidental and natural mortalities), harbor seal (*Phoca vitulina,* subsistence and cultural use) and California sea lion (*Zalophus californianus*, subsistence and cultural use), gray whale (*Eschrichtius robustus*, subsistence and cultural use) and small delphinid dolphins

Scientific name	Common name	Ozette	Swan	Modern	Change
	Mustelids				
Enhydra lutris	sea otter	√	√	√	**No**
Mustelid taxa used		**1**	**1**	**1**	
	Pinnipeds				
Mirounga angustirostris	elephant seal	√			**Yes**
Phoca vitulina	harbor seal	√	√	√	**No**
Arctocephalus townsendi	Guadalupe fur seal	√	**?**		**Yes**
Callorhinus ursinus	northern fur seal	√	√		**Yes**
Eumetopias jubatus	Steller sea lion	√	√		**Yes**
Zalophus californianus	California sea lion	√	**?**	√	**No**
Pinniped taxa used		**6**	**3-5**	**2**	
	Cetaceans				
Balaenoptera musculus	blue whale		√		**?**
Balaenoptera physalus	finback whale	√	√		**Yes**
Eschrichtius robustus	gray whale	√	√	√	**No**
Eubalaena japonica	right whale	√	√		**Yes**
Megaptera novaeangliae	humpback whale	√	√		**Yes**
Delphindae	porpoises and dolphins	√	√	√	**No**
Globicephala macrorhynchus	pilot whale		√		**?**
Orcinus orca	killer whale	√	√		**Yes**
Physeter macrocephalus	sperm whale	√	√		**Yes**
Pseudorca crassidens	false killer whale	√			**Yes**
Cetecean taxa used		**8**	**9**	**2**	

Table 9.1: Marine mammal taxa with evidence for consumptive use indicated by a check mark for three time periods: c. *AD 1500–1700 (Ozette), in the 1800s (Swan 1870), and in modern times (Sepez 2001, in press). Question marks refer to taxa that were not recognized as distinct species at the time Swan recorded his observations.*

(Delphinidae, occasional subsistence and cultural use, salvaged from incidental fisheries mortalities). Of these taxa, harbor seal is by far the most common modern subsistence item, consumed usually as smoked strips of meat with small pockets of blubber attached and as

rendered oil into which other food items are dipped. Modern cultural use of these marine mammal taxa generally involves use of the fur or hides. In the case of small delphinids, cultural use involves rendering oil that can be used as a lubricant or protectant. For example, the Makah's whaling harpoons used in 1999 were coated with locally produced dolphin oil.

The loss of twelve marine mammal taxa (71%) from Makah consumptive use (or 77% if we discount the sea otter because it is no longer used for subsistence) requires explanation, particularly in the face of much greater consistency in subsistence patterns spanning millennia for other resource categories (*e.g.*, patterns of fish and shellfish use, as discussed in Sepez 2001, in press). Examination of the relative abundance of pinnipeds (TABLE 9.2) and cetaceans (TABLE 9.3) in the archaeological remains sheds some light on the changes. By considering relative abundance in the archaeological remains in comparison to relative abundance in current population estimates, we see likely indications of environmental change, which can be evaluated in terms of other available evidence. Note that the relative abundance of the archaeological remains is based on the number of identified specimens, or NISP. Although there are dozens of different ways to quantify zooarchaeological collections (Lyman 1994), NISP is appropriate in cases where the *relative* abundance of taxa is of interest (Grayson 1979, 1984). A much different quantification methodology would be required if we were trying to estimate the total contribution (caloric or otherwise) of different taxa to the diet (Huelsbeck 1988, 1991). Note also that unidentified delphinids have been omitted from further consideration because it is impossible to arrive at meaningful population estimates for the group as a whole.

The most striking aspect of the relative abundance of marine mammal taxa from Ozette is the overwhelming dominance (95%) of northern fur seals over all other pinniped taxa, compared to their small contribution to the estimated pinniped population today (1%) (TABLE 9.2). Also notable is the large contribution of gray (50%) and humpback (*Megaptera novaeangliae*; 46%) whales, in approximately equal amounts, to the total NISP of cetaceans (TABLE 9.3). In contrast, humpback whales today comprise a much smaller proportion of the estimated cetacean population totals (2%), while gray whales comprise a greater proportion (81%).

DISCUSSION

The depletion of marine mammal populations through commercial over-harvesting has been well documented (Busch 1985; Springer *et al.* 2003). Although most marine mammal populations in the eastern North Pacific are increasing since the cessation of commercial harvests and eradication programs (Busch 1985; Read and Wade 2000), many of them remain at a level considered to be 'depleted' relative to estimates of historical population levels. Thus, on first examination, it would seem that the most likely explanation for the changing patterns of Makah consumptive use of marine mammals would be primarily ecological in nature: there simply are not enough of these taxa out there anymore to make it economically viable or ecologically responsible to pursue them. However, close examination of the relative abundance data from Ozette indicate that this is not a sufficient explanation in many cases. Anthropogenic factors, embedded in the history of colonial expansion and marine mammal exploitation along the Northwest coast, are deeply intertwined with environmental change. Additionally, cultural and political factors that are separate from anthropogenic environmental change can be critical to interpreting the data.

		archaeological data			population estimates for WA-OR-CA (NW), 2002		
Scientific name	**Common name**	**NISP**	**% of NISP total**	**Source**	**Recent pop. est.**	**% of NW pinnipeds**	**Source**
Phoca vitulina	harbor seal	23	1.59	Etnier 2004	48100	20.87	Caretta 2002
Mirounga angustirostris	elephant seal	2	0.14	Etnier 2004	60547	26.28	Caretta 2002
Eumetopias jubatus	Steller sea lion	10	0.69	Etnier 2004	6555	2.84	Angliss and Lodge 2003
Zalophus californianus	California sea lion	1	0.07	Etnier 2004	109854	47.68	Caretta 2002
Arctocephalus townsendi	Guadalupe fur seal	34	2.35	Etnier 2004	3028	1.31	Caretta 2002
Callorhinus ursinus	northern fur seal	1374	95.15	Etnier 2004	2336	1.01	Caretta 2002
		1444	100.00		230420	100.00	

TABLE 9.2: Relative abundance of pinnipeds at Ozette based on number of mandibles (NISP = number of identified specimens) and from population estimates for Washington (WA), Oregon (OR), and California (CA).

		archaeological data			population estimates for WA-OR-CA (NW), 2002		
Scientific name	**Common name**	**NISP**	**% of NISP total**	**Source**	**Recent pop. est.**	**% of NW ceteceans**	**Source**
Balaenoptera musculus	blue whale	–	–	Huelsbeck 1994	1716	5.24	Caretta *et al.* 2002
Balaenoptera physalus	finback whale	6	0.68	Huelsbeck 1994	1581	4.83	Caretta *et al.* 2002
Eschrichtius robustus	California gray whale	441	50.11	Huelsbeck 1994	26635	81.31	Angliss and Lodge 2003
Eubalaena sieboldii	Pacific right whale	20	2.27	Huelsbeck 1994	20	0.06	Angliss and Lodge 2003
Globicephala macrorhynchus	pilot whale	–	–	Huelsbeck 1994	717	2.19	Caretta *et al.* 2002
Megaptera novaeangliae	humpback whale	406	46.14	Huelsbeck 1994	774	2.36	Caretta *et al.* 2002
Orcinus orca	killer whale	4	0.45	Etnier 2003	287	0.88	Caretta *et al.* 2002
Pseudorca crassidens	false killer whale	1	0.11	Etnier 2003	n.a.	n.a.	n.a.
Physeter macrocephalus	sperm whale	2	0.23	Huelsbeck 1994	1026	3.13	Caretta *et al.* 2002
		880	100.00		32756	100.00	

Table 9.3: Relative abundance of cetaceans at Ozette (NISP = number of identified specimens) and from population estimates for Washington (WA), Oregon (OR), and California (CA). Population estimates are not available for false killer whale.

Killer whales

The case of killer whales shows a mix of environmental conditions and culturally and politically mediated values that have changed considerably over time. Today, killer whales are a conspicuous aspect of Northwest Coast ecosystems and cultural iconography. Both the transient killer whale ecotype of the outer coast and the southern resident killer whale ecotype of Puget Sound may be found in Makah territory (Angliss and Lodge 2003). However, the presence of killer whale remains in the Ozette assemblage is limited to 4 isolated teeth (ecotype undetermined: Etnier 2003). Given the absence of any evidence that killer whales were less abundant in the past, the archaeological evidence suggests that they were only occasionally targeted by the Makah. This conclusion is supported by ethnographic accounts recorded by Charles Scammon and James Swan. In the 1860s, Scammon commented that 'the Makah Indians...occasionally pursue and take them [killer whales] about Cape Flattery, in Washington Territory, as they consider their flesh and fat more luxurious than the larger balaenas, or rorquals [baleen whales]' (Scammon 1874). Likewise, Swan also noted that 'As the Makah Indians kill the orca [killer whale] during the summer months, particularly in the vicinity of Flattery Rocks, I think I may be able to secure a good specimen [for the National Museum of Natural History] this summer' (1883, 201).

Fifty years later, however, cultural values seem to have changed slightly among Northwest Coast tribes. Based on informant interviews during 1935–36 with the Nootkans (or Nuu-chah-nulth) of Vancouver Island, who are closely related to the Makah, Philip Drucker noted that 'The killer whale (*qaqawun*) was considered very difficult to capture; young whalers tackled them as a test of skill, but ordinarily they were not hunted. The meat and fat of those taken was eaten, for it was considered good, resembling porpoise' (Drucker 1951, 48–49). Drucker goes on to note some special qualities of this animal:

> Wolves were placed in a special category among all the animals, as possessed of great supernatural powers whether in animal guise or, without their skins, in human form. They were a 'tribe', and lived in a great house under a mountain. There was some peculiar relationship existing between Wolves and Killer Whales; some people believed the latter emerged from the sea to turn into Wolves. Neither animal was considered dangerous to man. In fact, they were more likely to be friendly than most spirits. *There was no prohibition on killing either species of the real animals.* [Drucker 1951,152, emphasis added]

The next change in cultural values is documented in the mid-20th century. Although there is no direct information on Makah attitudes towards killer whales from this time period, the evolution of cultural attitudes towards killer whales has been well-documented for the Northwest Coast region. During this period, dozens of killer whales were captured by public aquariums in a 'drive fishery' for display in captivity (Hoyt 1990). The idea that killer whales were just another marine resource to be utilized was also manifested in their use for target practice by the US and Canadian military, and in the numerous reports of killer whales being shot because of perceived competition with salmon fishermen (Lavigne *et al.* 1999; Osborne 1999).

It is not clear how Makah views towards killer whales may or may not have changed to match or resist the predominant cultural and political views of the region during the mid-20th century. The end of the 20th century, however, saw the rise of whale watching charters in many places along the Northwest Coast (Lavigne *et al.* 1999), though none in Neah Bay. The

industry is largely focused on the pods that circulate in the San Juan Islands in the summer. Thus, once again, killer whales have returned to the regional economic sphere, albeit in a new non-consumptive role. Recently, the southern resident population of killer whales was added to the federal endangered species list in response to recent population declines (50 CFR 224, Nov. 18, 2005). Interestingly, one of the concerns about the population is their exposure to vessel traffic and noise, such as that posed by the whale watching industry (NMFS 2005, 82–89).

Considerable friction developed between the whale watching industry and the Makah Tribe over the 1999 whale hunt, which involved a gray whale. Whale watching vessels were involved in protests and direct action against the Makah. T-shirts worn on the reservation with the slogan 'Eat Willy', in reference to the movie character played by the famous killer whale Keiko, exemplified the conflicting ethnobiological paradigms (Sepez 2002) which shape how these two different cultural traditions see killer whales. Although there is no indication that modern Makah people desire a return to their pattern of occasional consumptive uses of killer whales at this time (the t-shirt was meant to be provocative and humorous), there clearly remains a strong connection to the cultural foundation that categorizes this animal as food.

Northern fur seals

The dramatic change in the relative abundance of northern fur seals in the region and in the Makah diet and economy also requires consideration. First, it must be pointed out that a large, but unknown number of northern fur seals from the Alaskan population migrates through Washington, Oregon, and California (Fiscus 1978), making the current population estimate artificially low (Table 9.2). However, these migrating individuals would have been encountered in low densities, typically far from shore. Second, there is increasing evidence that northern fur seals maintained breeding colonies along the coast of Oregon (Lyman 1988), Washington (Etnier 2002b, 2007; Newsome *et al.* 2007), and British Columbia (Crockford *et al.* 2002) that persisted into the late prehistoric era. Today, the nearest northern fur seal rookery is 1700 km to the south, on San Miguel Island, California (Peterson *et al.* 1968). Although the northern fur seals from the Ozette collections almost certainly derive from a mix of both high-latitude and mid-latitude populations, it seems likely that the overall population of northern fur seals in the eastern North Pacific is much reduced from what it was during the occupation of Ozette.

The timing and cause of this apparent population reduction of northern fur seals is open to debate. It is not known precisely when the putative Washington/British Columbia breeding colonies disappeared (Etnier 2002b, 2007); by the time Scammon and Swan visited Neah Bay in the 1860s and 1870s, there was no knowledge or memory of terrestrial rookeries (but see discussions in Crockford *et al.* 2002 and Swan 1883 regarding the possibility of pup births in kelp beds). Nevertheless, a wide variety of measures of harvest intensity of northern fur seals from the Ozette collections indicates that that resource population was stable throughout most of the occupation sequence (roughly AD 1200–1700: Etnier 2002b, 2007).

The Makah started participating in the pelagic harvest of northern fur seals for the commercial fur market in the 1840s (Scammon 1874), but only at low levels prior to the late 1860s, at which point the Makah invested in large commercial vessels participating in the pelagic harvests in Alaska (Sepez 2001). In fact, northern fur seal abundance in the vicinity of Neah Bay was apparently low prior to the late 1860s (Scammon 1874), suggesting a localized depletion that coincided with development of a global market, after a very long

pattern of local abundance and sustainable harvests. This would mirror the population trends of the severely over-harvested Pribilof Islands fur seal herd in Alaska, brought about largely by the practices of the Russian-American Company in the early years of the 19th century (Busch 1985). Despite increased populations in Alaska today relative to the early 19th century, fur seals in Washington have never returned to their former abundance, and rookeries have never been re-established along the Northwest Coast. Thus, the primary explanation for the long-term change in Makah subsistence use of fur seals is ecological: there are few if any of these seals left in the area for Makahs to eat. However, it is important to note that this ecological change is a proximate cause, and must be understood in terms of its anthropogenic causes, brought about by global political and economic conditions.

Steller sea lions and humpback whales

The Steller sea lion and the humpback whale pose a different kind of explanatory puzzle because the populations of these taxa have been steadily increasing in Washington, Oregon, and California since the cessation of commercial harvests and eradication programs (Busch 1985; Read and Wade 2000). Both were harvested during the Ozette period and during the early historic period, yet despite increasing populations are not harvested today. There is some suggestion that the Makah are interested in re-establishing a subsistence harvest of humpback whales (Sepez in press), but only if the population is at the point that it can withstand low harvest levels. If the harvest rate of gray whales by the Makah over the past decade is any indication, it is unlikely that a small-scale subsistence harvest would have a measurable effect on the populations of the eastern North Pacific stock of humpback whales, which has an estimated potential biological removal level of 4.6 individuals per year (Caretta *et al.* 2006, 166). Nor would a small-scale subsistence harvest likely impact the eastern stock of Steller sea lions, which have an estimated potential biological removal level of 1,967 individuals per year (Angliss and Outlaw 2006, 12).

However, issues surrounding these species are highly politically charged: the *western* stock of Steller sea lions (limited to south-western Alaska) and the eastern North Pacific population of humpback whales are listed as endangered under the Endangered Species Act (Read and Wade 2000), while the eastern stock of Steller sea lions (ranging from south-eastern Alaska to California) is listed as threatened under the same legislation. Most of the eastern stock of Steller sea lions are in Alaska, Oregon and California; there are few in Washington. However, of the Steller sea lions in Washington, the vast majority of them are found in the waters adjacent to the Makah reservation. Humpback whales are also found swimming in Makah waters during their migrations, and it was the noticeable increase in their population in recent years that has spurred talk of a hunt among some tribal members. In other words, both of these species would be relatively easy for Makahs to find and harvest. Low encounter rates cannot explain current Makah avoidance of these species. The most likely explanation for their absence from the modern diet is their political status, rather than their local abundance. Until the legal status of these taxa changes, politically-motivated decisions make it unlikely that the Makah will harvest any of these animals along the Washington coast.

Other taxa

Not all the taxa under consideration have rich environmental and cultural histories available. In many cases, it is much more difficult to explain what appears to be environmental or

cultural change. For instance, many of the taxa in the Ozette collections or in Swan's accounts were apparently only rarely encountered by the Makah. Among these are the false killer whale (*Pseudorca crassidens*) and the sperm whale (*Physeter macrocephalus*), represented in the Ozette collections by only one or two teeth (TABLE 9.3). Despite the fact that these species are probably currently depleted relative to the population levels that might have been experienced at Ozette, these taxa appear to have never been particularly important, either dietarily or culturally (Swan 1870). However, it is not clear if their avoidance was culturally or ecologically mediated (*i.e.*, through low encounter rates). Likewise, the omission of these taxa from the current diet is, therefore, difficult to interpret.

Interpretation of the exploitation patterns of some pinniped taxa is also not straightforward. Consider, for example, the case of elephant seals (*Mirounga angustirostris*). Today, they rank second in total population estimates for pinnipeds for the aggregated region of Washington, Oregon, and California (TABLE 9.2). In spite of this, their migration patterns only rarely bring them into Washington waters (LeBoeuf *et al.* 1996). Thus, as with false killer whales and sperm whales, their avoidance today is difficult to interpret. Perhaps even more interesting is the case of the pinniped with the highest population estimates, the California sea lion. In addition to being the most abundant pinniped in the region, they are also one of the most commonly encountered pinnipeds along the outer coast of Washington (Gearin *et al.* 2001). This species is occasionally utilized today both for subsistence and cultural uses (Sepez 2001, in press) (TABLE 9.1). Their extremely low relative abundance in the Ozette collections suggests, however, that their local abundance is a relatively recent development (TABLE 9.2).

In terms of the taxa listed by Swan (1870) as part of the Makah diet, two species, in particular, may have been overlooked. Swan documented neither California sea lions nor Guadalupe fur seals (*Arctocephalus townsendi*) in the region, yet both taxa appear in the Ozette collections with low frequencies (Etnier 2002a) (TABLE 9.2). It may have been the case that these taxa were not noted by Swan because they were absent, or rare, in the area at the time he lived with the Makah. However, neither California sea lions nor Guadalupe fur seals were recognized as distinct species until well after Swan recorded his observations (Scammon 1874). Thus, they may have actually been in the area, but not recognized as noteworthy.

CONCLUSION

We have focused our analysis on the continuity and change in subsistence practices among the Makah for several reasons. First, the Makah have the benefit of an ample archaeological and early ethnographic record. Second, the Makah continue to thrive, perhaps due, in part, to their relative isolation and continued reliance on the abundant marine resources of the area. This, coupled with extensive cooperation and openness of the Makah, has allowed continued ethnographic study of their rich culture (Colson 1953; Sepez 2001). But the third, and perhaps most important reason we have focused on subsistence is that it is one of the few characteristics universally shared by human cultures. Thus, in the broader context, patterns of continuity and change can be compared among different Northwest Coast cultures or coastal communities anywhere in the world. Although our analysis has certainly been influenced by ideas of 'environmental possibilism' (Vayda and Rappaport 1983), that possibilism is embedded in the historicity of human culture. The processes which underlie subsistence continuity and change, such as low encounter rates or politically-motivated avoidance, are general processes likely to

be found in other places and other times, while the specific manifestations of continuity and change in Makah subsistence are unique to this culture, and reflect the unique historical conditions of the era.

We have provided an analysis of changing patterns of marine mammal use among the Makah over a period of 500 years. During this time period, the majority of marine mammal taxa have been dropped from use. This pattern stands in stark contrast to the continued use of other marine resources such as fish and shellfish. In most cases, changing patterns of marine mammal use are most likely a consequence of decreased ecological availability. However, politically- and culturally-motivated avoidance of several taxa is also likely, and much of the ecological change can be traced to anthropogenic factors.

The datasets used here are by no means ideal, and a number of biases are possible. Analysis of bones from the Ozette collections, for instance, is potentially confounded by differential identifiability. At the family level, small delphinids appear to have been used consistently across 500 years. This taxonomic lumping may mask considerable variability at the species level across the same time period. In addition, blue whales may have been used at Ozette. If their bones were highly fragmented for use as construction materials, the remains may not have been identifiable, leading to under-representation in the relative abundance indices. Likewise, killer whales were documented by Swan (1870) to be occasionally hunted by the Makah. Killer whales are typically only identified in archaeological collections by their teeth (Etnier 2003). Killer whale teeth, however, also provided a valuable source of ivory for use in tool production (Gifford 1940). Thus, it may be the case that killer whale teeth are under-represented in archaeological collections because of their systematic use as a raw material in tool production (Etnier 2003).

Finally, as pointed out by Sepez (in press), the fact that a particular marine mammal taxon is not currently used by the Makah does not preclude their future use, either legally or culturally. The Makah have a long history of exploitation of virtually every marine mammal species extant in the eastern North Pacific. In the case of northern fur seals, that exploitation appears to have been maintained at a sustainable level by the Makah (Etnier 2002b, 2007) until global commercial forces altered the world in which they operated. Given the appropriate ecological conditions, it would not be surprising if the Makah were to expand their use of marine mammals to include more of the taxa that were once used by their ancestors. Such was the case with the gray whale, when it was removed from the endangered species list and soon thereafter pursued by Makahs. However, given that ecological conditions are always set within a nexus of political, economic and cultural influences, we conclude that revival of Makah hunting for other marine mammal taxa would require much more than just a locally abundant supply.

Acknowledgements

The authors would like to extend their appreciation to the staff of the Makah Cultural and Research Center in Neah Bay for assistance with the research presented here. The research was funded by the U.S. EPA STAR Fellowship program, for which both authors are grateful. The views expressed in this article are entirely our own, and do not necessarily reflect the views of NOAA or the National Marine Fisheries Service.

References

Angliss, R. P. and Lodge, K. L. (2003) Alaska marine mammal stock assessments, 2002. *NOAA Technical Memorandum* NMFS-AFSC-144.

Angliss, R. P. and Outlaw, R. B. (2006) Alaska marine mammal stock assessments, 2005. *NOAA Technical Memorandum* NMFS-AFSC-161.

Busch, B. C. (1985) *The War Against the Seals: A History of the North American Seal Fishery*. Kingston, Ontario, McGill-Queens University Press.

Carreta, J. V., Muto, M. M., Barlow, J., Baker, J., Forney, K. A. and Lowry, M. (2002) U.S. Pacific marine mammal stock assessments: 2002. U.S. Department of Commerce, *NOAA Technical Memorandum* NMFS-SWFSC-346.

Carreta, J. V., Forney, K. A., Muto, M. M., Barlow, J., Baker, J., Hanson, B. and Lowry, M. S. (2006) U.S. Pacific marine mammal stock assessments: 2005. U.S. Department of Commerce, *NOAA Technical Memorandum* NMFS-SWFSC-388.

Colson, E. (1953) *The Makah Indians: A Study of an Indian Tribe in Modern American Society*. Minneapolis, University of Minnesota Press.

Crockford, S. J., Frederick, S. G. and Wigen, R. J. (2002) The Cape Flattery fur seal: An extinct species of *Callorhinus* in the eastern North Pacific? *Canadian Journal of Archaeology* 26, 152–174.

Crosby, A. W., Jr. (1986) *Ecological Imperialism: The Biological Expansion of Europe, 900–1900.* New York, Cambridge University Press.

Crumley, C. L. (1994) *Historical Ecology.* Santa Fe, New Mexico, School of American Research Press.

Drucker, P. (1951) The northern and central Nootkan tribes. *Smithsonian Institution Bureau of American Ethnology Bulletin* 144.

Etnier, M. A. (2002a) Occurrences of Guadalupe fur seals (*Arctocephalus townsendi*) on the Washington Coast over the past 500 years. *Marine Mammal Science* 18, 551–557.

Etnier, M. A. (2002b) *The Effects of Human Hunting on Northern Fur Seal (Callorhinus Ursinus) Migration and Breeding Distributions in the Late Holocene.* Unpublished Ph.D. Dissertation. Seattle, University of Washington.

Etnier, M. A. (2003) *Catalogue of Killer Whale Osteological Material in Archaeological Collections*. Final Report to National Marine Mammal Laboratory under contract AB133F-02-SE-1336. Available, National Marine Mammal Laboratory Library, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115.

Etnier, M. A. (2004) The potential of zooarchaeological data to guide pinniped management decisions in the Eastern North Pacific. In R. L. Lyman and K. P. Cannon (eds) *Zooarchaeology and Conservation Biology*, 88–102. Salt Lake City, University of Utah Press.

Etnier, M. A. (2007) Defining and identifying sustainable harvests of resources: Archaeological examples of pinniped harvests in the eastern North Pacific. *Journal for Nature Conservation* 15, 196–207.

Fiscus, C. H. (1978) Northern fur seal. In D. Haley (ed.) *Marine Mammals of Eastern North Pacific and Arctic Waters*, 152–159. Seattle, Pacific Search Press.

Fiskin, M. (1979) Whale Bone Studies. In J. E. Mauger (ed.) *Ozette Archaeological Project, Interim Final Report, Phase XIII*, vol. 68, 40–45. Pullman, Washington Archaeological Research Center, Washington State University.

Fiskin, M. (1980) Whale bone studies. In J. E. Mauger (ed.) *Ozette Archaeological Project, Interim Final Report, Phase XIII*, vol. 97. Pullman, Washington Archaeological Research Center, Washington State University.

Gearin, P. J., Jeffries, S. J., DeLong, R. L. and Gosho, M. E. (2001) *Update on California Sea Lion Captures and Surveys in Puget Sound, Washington*. Unpublished manuscript. Available, NOAA, National Marine Fisheries Service, 7600 Sand Point Way NE, Seattle, 98115.

Gifford, E. W. (1940) Californian Bone Artifacts. *University of California Anthropological Records* 3, 153–237.

Grayson, D. K. (1979) On the quantification of vertebrate archaeofaunas. In M. B. Schiffer (ed.) *Advances in Archaeological Method and Theory*, vol. 2, 199–237. New York, Academic Press.

Grayson, D. K. (1981) A critical view of the use of archaeological vertebrates in paleoenvironmental reconstruction. *Journal of Ethnobiology* 1, 28–38.

Grayson, D. K. (1984) *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. New York, Academic Press.

Gunther, E. (1936) A preliminary report on the zoological knowledge of the Makah. In R. Lowie (ed.) *Essays in Anthropology,* 105–118. Berkeley, University of California Press.

Gustafson, C. E. (1968) Prehistoric use of fur seals: Evidence from the Olympic coast of Washington. *Science* 161, 49–51.

Holm, P., Smith, T. D. and Starkey, D. J. (eds) (2001) *The Exploited Seas: New Directions for Marine Environmental History.* St. John's, Newfoundland, International Maritime Economic History Association.

Hoyt, E. (1990) *Orca: The Whale Called Killer.* New York, E. P. Dutton.

Huelsbeck, D. R. (1983) *Mammals and Fish in the Subsistence Economy of Ozette*. Unpublished Ph.D. Dissertation. Pullman, Washington, Washington State University.

Huelsbeck, D. R. (1988) Whaling in the precontact economy of the central Northwest Coast. *Arctic Anthropology* 25, 1–15.

Huelsbeck, D. R. (1991) Faunal remains and consumer behavior: What is being measured? *Historical Archaeology* 25, 62–76.

Huelsbeck, D. R. (1994a) Mammals and fish in the subsistence economy of Ozette. In S. R. Samuels (ed.) *Ozette Archaeological Project Research Reports. Volume 2. Fauna*, 17–91. Reports of Investigations, Vol. 66. Pullman, Department of Anthropology, Washington State University and Seattle, National Park Service, Pacific Northwest Regional Office.

Huelsbeck, D. R. (1994b) The utilization of whales at Ozette. In S. R. Samuels (ed.) *Ozette Archaeological Project Research Reports. Volume 2. Fauna*, 265–303. Reports of Investigations, Vol. 66. Pullman, Department of Anthropology, Washington State University and Seattle, National Park Service, Pacific Northwest Regional Office.

Jackson, J. B. C., Kirby, M. X., Berger, W. H., Bjorndal, K. A., Botsford, L. W., Bourque, B. J., Bradbury, R. H., Cooke, R., Erlandson, J., Estes, J. A., Hughes, T. P., Kidwell, S., Lange, C. B., Lenihan, H. S., Pandolfi, J. M., Peterson, C. H., Steneck, R. S., Tegner, M. J. and Warner, R. R. (2001) Historical overfishing and the recent collapse of coastal ecosystems. *Science* 293, 629–637.

Kay, C. E. (1994) Aboriginal overkill: The role of Native Americans in structuring western ecosystems. *Human Nature* 5, 359–398.

Lavigne, D. M., Scheffer, V. B. and Kellert, S. R. (1999) The evolution of North American attitudes toward marine mammals. In J. R. Twiss, Jr. and R. R. Reeves (eds) *Conservation and Management of Marine Mammals,* 10–47. Washington, DC, Smithsonian Institution Press.

LeBoeuf, B. J., Morris, P. A., Blackwell, S. B., Crocker, D. E. and Costa, D. P. (1996) Diving behavior of juvenile northern elephant seals. *Canadian Journal of Zoology* 74, 1632–1644.

Lyman, R. L. (1988) Zoogeography of Oregon coast marine mammals: The last 3,000 years. *Marine Mammal Science* 4, 247–264.

Lyman, R. L. (1994) Quantitative units and terminology in zooarchaeology. *American Antiquity* 59, 36–71.

Lyman, R. L. and Cannon, K.P. (eds) (2004) *Zooarchaeology and Conservation Biology*. Salt Lake City, University of Utah Press.

Mauger, J. E. (1991) Shed-roof houses at Ozette and in a regional perspective. In S. R. Samuels (ed.) Ozette *Archaeological Project Research Reports. Volume 1. House Structure and Floor Midden,*

17–91. Reports of Investigations, Vol. 63. Pullman, Department of Anthropology, Washington State University and Seattle, National Park Service, Pacific Northwest Regional Office.

National Marine Fisheries Service (NMFS) (2005) *Proposed Conservation Plan for Southern Resident Killer Whales (Orcinus orca).* Seattle, National Marine Fisheries Service, Northwest Regional Ofice.

Newsome, S. D., Etnier, M. A., Gifford-Gonzalez, D., Phillips, D. L., van Tuinen, M., Hadley, E. A., Costa, D. P., Kennett, D. J., Guilderson, T. P. and Koch, P. L. (2007). The shifting baseline of northern fur seal ecology in the Northeast Pacific Ocean. *Proceedings of the National Academy of Sciences* 104, 9709–9714.

Osborne, R. W. (1999) *A Historical Ecology of Salish Sea 'Resident' Killer Whales (Orcinus Orca) with Implications for Management*. Unpublished Ph.D. Dissertation. University of Victoria.

Peterson, R. S., LeBoeuf, B. J. and DeLong, R. L. (1968) Fur seals from the Bering Sea breeding in California. *Nature* 219, 899–901.

Ramenofsky, A. F. (1987) *Vectors of death: The archaeology of European contact*. Albuquerque, University of New Mexico Press.

Read, A. J. and Wade, P. R. (2000) Status of marine mammals in the United States. *Conservation Biology* 14, 929–940.

Samuels, S. R. (ed.) (1991) *Ozette Archaeological Project Research Reports Volume 1: House Structure and Floor Midden.* Reports of Investigations, Vol. 63. Pullman, Department of Anthropology, Washington State University and Seattle, National Park Service, Pacific Northwest Regional Office.

Samuels, S. R. (ed.) (1994) *Ozette Archaeological Project Research Reports Volume 2. Fauna.* Reports of Investigations, Vol. 66. Pullman, Department of Anthropology, Washington State University and Seattle, National Park Service, Pacific Northwest Regional Office.

Scammon, C. M. (1874) *The Marine Mammals of The North-Western Coast of North America, Described and Illustrated: Together with an Account of the American Whale-Fishery*. San Francisco, J. H. Carmany and Company.

Sepez, J. (2001) *Political and Social Ecology of Contemporary Makah Hunting, Fishing, and Shellfish Collecting Practices*. Unpublished Ph.D. Dissertation. Seattle, University of Washington.

Sepez, J. (2002) Treaty Rights and the Right to Culture: Native American Subsistence Issues in US Law. *Cultural Dynamics* 14(2), 143–159.

Sepez, J. (in press) Historical ecology of Makah subsistence foraging patterns. *Journal of Ethnobiology* 28(2).

Sepez-Aradanas, J. and Tweedie, A. (1999) Makah harpoons vs. media hype: Cultural stereotypes, academic research, and public policy. *Oregon Humanities*, Fall 1999, 48–53.

Springer, A. M., Estes, J. A., van Vliet, G. B., Williams, T. M., Doak, D. F., Danner, E. M., Forney, K. A. and Pfister, B. (2003) Sequential megafaunal collapse in the North Pacific Ocean: An ongoing legacy of industrial whaling? *Proceedings of the National Academy of Sciences* 100, 12223–12228.

Swan, J. G. (1870) The Indians of Cape Flattery, at the entrance of the Straight of Fuca, Washington territory. *Smithsonian Institution Contributions to Knowledge* 220, article 8, 1–105.

Swan, J. G. (1883) Report of investigations at Neah Bay, Wash., respecting the habits of fur seals of that vicinity, and to arrange for procuring specimens of skeletons of cetacea. *Bulletin of the United States Fish Commission* III, 201–207.

Vayda, A. P. and Rappaport, R. A. (1983) Ecology, cultural and noncultural. In G. L. Young (ed.) *Origins of Human Ecology*, 124–150. Stroudsburg, PA., Hutchinson Ross.