WATERLOGGED

Examples and Procedures for
NORTHWEST COAST
ARCHAEOLOGISTS

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EDITED BY
KATHRYN BERNICK

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Washington State University Press
PO Box 645910
Pullman, Washington 99164-5910
Phone: 800-354-7360
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On the cover: Waterlogged stubs of fish weir stakes on Saratoga Beach, Vancouver Island. *Photo by Stephanie Allester. Map by Kathryn Bernick.*

Contents

Preface and Acknowledgments

"You need to write it down," the lead archaeologist exclaimed while I showed the crew how to clean, label, and prevent damage to a muddy, waterlogged ancient basket. "You aren't going to live forever and we won't know what to do!" I refrained from observing that I did not plan to die anytime soon. I assured them that guidelines were forthcoming, that indeed they were my work-in-progress. *Waterlogged: Examples and Procedures for Northwest Coast Archaeologists* is that publication. It describes how to care for wet wood and wood-fiber artifacts, discusses strategies for locating water-saturated deposits in the field, and gives examples of the kinds of finds and information wet sites provide.

The original plan for this book grew out of workshops I have been presenting intermittently since about 2002. The participants were mainly archaeologists who were anticipating (or dreading) encounters with wet sites, or who had unexpectedly come across one. "Dreading" may be an exaggeration, though for someone without experience the prospect can be daunting. As related in the chapters of this volume, working at a wet site requires some specialized techniques and equipment, but it is not difficult.

My familiarity with wet sites began in 1973 with unexpected finds in water-saturated deposits. Since then, I have excavated in a variety of wet sites from Alaska to Oregon, though mainly in British Columbia, and I have analyzed or advised on the analysis of vegetal artifacts in dozens of assemblages from the Northwest Coast and abroad. I have administered preservative treatment on occasion, acquired basic skills to identify wood species by microscopy, written numerous reports, and published on my wet-site-related work. Why? Wet sites are an inherently important aspect of archaeology, intriguing intellectually, and appealing viscerally for the "license" to play in the mud.

The core contributions to this book originated in a symposium that I organized for the 67th Annual Northwest Anthropological Conference in Bellingham, Washington. The symposium was a success and I sincerely thank conference organizer Sarah Campbell and her assistants. I also thank those who presented at the symposium but for various reasons did not submit papers for the publication: Kelly Bush, Tait Elder, Hartley Odwak, Aviva Finkelstein, and Morgan Bartlett. Dale Croes was a discussant for the symposium.

My greatest debt is to the authors whose work comprises the substance of this volume. I thank each and all for their diligence and attention to detail, tolerance of my editorial eccentricities, and patience with the publication schedule. Each manuscript went through anonymous peer review by someone with expertise in the particular topic, in addition to my review. Subsequently the entire volume and the individual papers were reviewed by two readers for WSU Press. I thank all the reviewers for their thoughtful suggestions to improve the manuscripts and the volume, and the contributing authors for prompt revisions.

Individuals who provided much appreciated advice and practical help for this publishing project include David Archer, Martha Black, Astrida Blukis Onat, Dale Croes, Colin Grier, Robyn Ewing, Dorothy Kennedy, Natasha Lyons, Ken Marr, Alan McMillan, Hartley Odwak, Laura Phillips, Nick Russell, Susan Safyan, Bjorn Simonsen, Ann Stevenson, and Heidi Swierenga. Martin Magne, Patrick Bartier, and staff of the British Columbia Archaeology Branch helped to confirm accuracy of citations to gray literature. The Archaeology Unit of the Royal British Columbia Museum, and especially Grant Keddie and Genevieve Hill, provided logistical assistance.

Radiocarbon age citations follow the Society for American Archaeology's style guide (revised May 2018). Accordingly, radiocarbon dates reported for the first time are given as uncalibrated ages BP based on the Libby ^{14}C half-life, with details provided by the respective laboratories including sample identification number, 1 sigma standard error, material, and whether the date was corrected for isotopic fractionation (a $\delta^{13}C$ value indicates that it was). Laboratory abbreviations conform to those used in the journal *Radiocarbon*. Calibrated dates (corrected by reference to tree-ring curves) are identified as "cal BP" and the first citation includes a reference to the particular calibration program. General reference to archaeological time periods are given in years BP.

Many archaeological sites have more than one name; this volume refers to sites by their English name if that has a long history of use or by their traditional name if known, and also by the site code. Site codes, which are unique, are assigned by government (or other) authorities when a site is officially registered. The Smithsonian Trinomial System used in the U.S. includes alpha-numeric codes for state and county and the site number. In Canada, site codes are based on a map grid system; however, Parks Canada has its own code system.

Concordance of Ethno-Linguistic Group Names

Name in this volume	Synonyms	Linguistic affiliation
Cowichan	Quw'utsun	Coast Salish—Island Halkomelem or Hul'q'umi'num'
Ditidaht	formerly Nitinat	Southern Wakashan
Haida		linguistic isolate
Heiltsuk	formerly Bella Bella	Northern Wakashan
Katzie		Coast Salish—downriver Halkomelem or Halq'em'eylem
Kwakwaka'wakw	Kwawkewlths formerly Kwakiutl	Northern Wakashan
Kwantlen	Qwantlen	Coast Salish—downriver Halkomelem or Halq'em'eylem
Lake Babine Nation (LBN)	formerly Old Fort Band and Fort Babine Band	Athapaskan
Makah		Southern Wakashan
Nlaka'pamux	formerly Thompson	Interior Salish
Nuu-chah-nulth	West Coast formerly Nootka	Southern Wakashan
Sayakwan	Saanȳaa K̲wáan, Sanya Kwan	a southern Tlingit clan
Sechelt	shíshálh, híshálth	Northern Coast Salish
Secwepemc	Tk'emlúpsemc, Shuswap	Interior Salish
Sliammon	Tla'amin, Mainland Comox	Northern Coast Salish
Songhees	Lekwungen, Lkwungen	Northern Straits Salish
Stl'atl'imx	St'át'imcets, formerly Lillooet	Interior Salish
Tlingit	Łingit	
Xaisla	Haisla, Kitamaat	Northern Wakashan

Sources: *Handbook of North American Indians,* Vol. 7, *Northwest Coast* (Suttles ed. 1990), and Vol. 12, *Plateau* (Walker ed. 1998); and online web pages of the respective First Nations and Tribes.

Abbreviations and Acronyms

AMS	Accelerator Mass Spectrometry
BC Parks	British Columbia government agency that manages parks and protected areas
BP	radiocarbon date Before the Present, where "present" = 1950
ca.	circa, approximately
cal BP	calibrated radiocarbon date Before the Present (1950)
cf.	*confer*, compare
GIS	Geographic Information System
GPS	Global Positioning System
LBN	Lake Babine Nation
PEG	polyethylene glycol; also called Carbowax
RBCM	Royal British Columbia Museum
UBC	University of British Columbia

INTRODUCTION:

Wet-Site Archaeology from a Northwest Coast Perspective

Kathryn Bernick

Every archaeologist working on the west coast of North America might encounter waterlogged wood artifacts on their next field expedition. Water-saturated deposits with vegetal materials are being discovered at an accelerating rate on the Northwest Coast and beyond. Archaeologists refer to these as wet sites and to the vegetal artifacts as perishables. Wet sites occur throughout the region, at various depths and in different environmental settings, and they represent a wide range of ages and activities (Bernick 2013). Samuels and Daugherty (1991:4) estimate that 85 percent of the artifacts recovered from the "wet Pompeii" Ozette Village site are wood or bark items that preserved in water-saturated conditions. Such a large proportion of normally perishable items testifies to the tremendous potential contribution of wet sites, and also to the loss a wet site would sustain from the effects of dehydration (in addition to impacts from land alteration). Touted as important for their archaeological content (Menotti and O'Sullivan 2013), the possible presence of wet sites warrants attention from anyone conducting an archaeological assessment, mitigation, or research project.

Waterlogged is unique among current publications on waterlogged sites in the Pacific Northwest. It provides detailed guidelines for practicing archaeologists (How do you go about finding a wet site? What do you do when you find one?), as well as accounts of previously unpublished research. The project examples center on wetlands, wet sites, and perishable artifacts, and discuss the context, methods, and results of the respective investigations (Figure 1). All of the authors were lead investigators of the

projects they describe and they write based on personal experience. Unlike published monographs and site reports about Northwest Coast wet sites (e.g., Bernick 1983; Croes 1995; Croes et al. 2009; Samuels 1991, 1994; Whelchel 2005), this volume presents descriptive content in small doses, each chapter with a different topic and approach. The aim is to give a voice to under-reported projects and to stimulate engagement with wet sites.

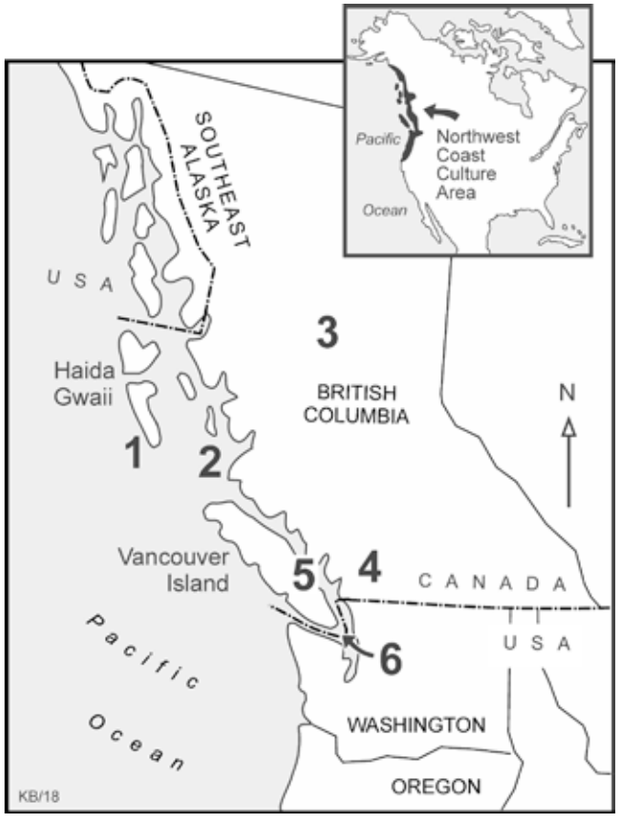

Figure 1. General locations of the sites and study areas discussed in this volume: *1*, Kilgii Gwaay site (Cohen); *2*, Central Coast sites (McLaren, Hawes, et al.); *3*, Babine River (Rahemtulla); *4*, Pitt Polder (Copp et al.) and Stave Delta (McLaren, Bernick, and Gray); *5*, East Coast of Vancouver Island (Cullon and Pratt, and Hill); *6*, Salish Sea (Keddie and many of the sites Eldridge describes). *Map by Kathryn Bernick.*

Waterlogged presents Northwest Coast wet-site archaeology in the early twenty-first century by showcasing a selection of modest projects and research that "everyday" wet-site finds are suited to address. The volume offers general readers, as well as archaeologists, an up-to-date, firsthand account of an intriguing brand of archaeology. At a time when English language publications on wetland and wet-site archaeology are mainly British and primarily oriented toward European sites (e.g., Menotti 2012; Menotti and O'Sullivan 2013), a wet-site archaeology book that is entirely about the Northwest Coast is rare.

WET SITES, WETLANDS, AND MORE

The term "wet site," coined by Washington archaeologist Astrida Blukis Onat, entered the local lexicon in the title of a symposium at the 1974 Northwest Anthropological Conference in Seattle and the resulting publication, *The Excavation of Water-Saturated Archaeological Sites (Wet Sites) on the Northwest Coast of North America* (Croes ed. 1976). Forty years later, "wet site" is entrenched in the Northwest Coast archaeological community and widely used in North America and beyond. It refers to sites that contain waterlogged vegetal cultural material preserved in terrestrial anaerobic (low oxygen) conditions. On occasion, "wet-site archaeology" is used interchangeably with "wetland archaeology"—which is correct in some cases. Wetlands may harbor wet sites though former wetlands do not, and some sites with waterlogged materials, such as Ozette for example, are not in a wetland.

"Wetland archaeology" is attributed to British archaeologist John Coles who introduced the term at the start of his book *The Archaeology of Wetlands* (1984). Coles' further efforts to promote wetland archaeology led to an informal association of archaeologists working in wetlands and waterlogged (wet) sites, as well as international conferences, a website, and publications (see Bryony Coles [2013:907–908] for details). Since an archaeologist may be working at a wet site and a wetland simultaneously, the terms tend to merge, even among those of us who are attuned to semantic nuances. In some respects, the difference in terminology reflects American versus British usage (*cf.*, Nicholas 2001).

There are many types of wetlands, among them swamps, freshwater marshes, wet meadows, fens, bogs, muskeg, estuarine wetlands such as eelgrass beds, and tidal marshes. Scientists define wetlands according to hydrology and vegetation. Both U.S. (EPA 2018) and Canadian (Warner and Rubec 1997) environmental classifications consider wetlands to be areas with water-saturated soils that support vegetation adapted to those conditions (hydrophytes). To be an archaeological wet site, the location must have *cultural* vegetal objects that preserved in those water-saturated conditions. Former, now dried up, wetlands are relevant for investigation of people–wetland relationships in the past, but, strictly speaking, they are not wet sites—dehydration would have destroyed any waterlogged artifacts they may have contained.

The term "organic" should not need definition. However, many Northwest Coast archaeologists use it, incorrectly, to mean specifically vegetal material. Some waterlogged culture-bearing deposits contain bone, antler, and shell materials, as well as wood and bark. Other wet sites lack faunal preservation of any kind and the only preserved organic materials are vegetal. Whereas water is important for plant preservation in anaerobic conditions, bone and shell are more susceptible to acidity. This volume recognizes that organic archaeological materials may be vegetal or faunal and specifies the material where it might be misconstrued.

Technically "perishable" refers to any material that would decay rapidly under normal conditions. In the context of Northwest Coast wet-site archaeology, perishable objects consist of waterlogged vegetal material. Most often this is wood or bark, but non-woody plants may also be represented (Croes ed. 1976; Friedman 2005). Many conservators and archaeologists (e.g., Croes and Hawes 2013; and many authors in this volume) distinguish between "wood" (meaning trunk-wood from a tree or bush) and "fiber" (meaning semi-flexible, long, thin pieces of bark or woody tissue including roots and withes).

A final note on terminology concerns use of the term "dryland" when referring to low-elevation and non-water-saturated terrestrial areas on the landward side of the intertidal zone. The alternative, "upland," is seldom appropriate as it connotes relatively high land away from the coast. Dryland settings are the usual locations for archaeological investigations, and some are on uplands; other dryland settings are at low elevations immediately inland from the beach, riverbank, or marsh edge.

A BRIEF HISTORICAL REVIEW

Wet-site archaeology on the Northwest Coast developed alongside archaeology in general, beginning in the late nineteenth century and gaining momentum in the mid-twentieth century (Matson and Coupland 1995:37–47). Eldridge (this volume) credits Harlan I. Smith as the first archaeologist to deliberately (but unsuccessfully) look for perishable artifacts—in 1898 on Vancouver Island; and Phillip Drucker as the first to find and excavate waterlogged remains—on British Columbia's North Coast in the 1930s (Drucker 1943). In the 1950s Charles Borden found a few vegetal artifacts in water-saturated deposits dating to the past 700 years, at the Musqueam East site (DhRt-2) in Vancouver, British Columbia, and in 1962 University of British Columbia archaeologists recovered waterlogged artifacts from a 1,600-year-old wet component at the Beach Grove site (DgRs-1) in the Fraser Delta (Bernick 1991). In Washington, at the Pedersen #2 site (45SK51) in the Skagit Delta, excavations by the Columbia Archaeological Society in 1959-1962 encountered, but did not fully excavate, a waterlogged log platform and recovered a few adzed stakes (Mattson 1971).

More substantial wet-site excavations by the Washington Archaeological Society at the Biderbost site (45SN100) on the Snoqualmie River east of Seattle were precipitated by discovery of an eroding decorated wooden bowl. Subsequently, from 1960 through the early 1970s, members of the society excavated along the muddy river's edge and recovered numerous 2,000-year-old perishable, and also stone, artifacts (Nordquist 1976). Also in the mid-twentieth century, local residents and collectors salvaged waterlogged baskets and other artifacts from sites near the confluence of the Willamette and Columbia Rivers in Oregon (Newman 1991). Arguably, the best known of the early waterlogged wood finds from the Northwest Coast is a 1,700-year-old atlatl dredged from the Skagit River Delta in Washington in the 1950s. Its artistic merit secured attention from archaeologists and conservators, and its organic composition allowed AMS radiocarbon dating once that became available (Borden 1969; Fladmark et al. 1987). However, without reliable and effective stabilization treatments many of the early finds did not fare well (Figure 2) (Bernick 1991; Croes ed. 1976; Senge and Carrlee 2013).

Figure 2. The most intact of several basket fragments recovered from wet deposits at DfRu-7 on Galiano Island in 1965. *Project photo, courtesy Royal BC Museum.*

Excavations of the "waterlogged Pompeii" Ozette Village site throughout the 1970s changed the fortune of wet sites on the Northwest Coast. As Ames (2005) notes, prominent media attention, photogenic exotic artifacts, and an alluring location made the Ozette wet site visible. Public programs, the museum and research center at Neah Bay, and lavishly illustrated publications (e.g., Kirk 2015) keep Ozette in the public eye, and professional publications bring detailed research results to the archaeological community (Samuels 1991, 1994; Whelchel 2005). The Ozette project coincided with developments in conservation science and the availability of polyethylene glycol (PEG, also called Carbowax) to stabilize waterlogged wood (Croes ed. 1976). Gerald Grosso, the conservator at Ozette, adapted the process of administering the preservative to accommodate remote field-lab conditions, thereby providing a practical recipe for use at other wet sites and greatly improving the condition of perishables recovered in the region (Grosso 1976). PEG treatment methods continue to be refined by conservation scientists, though 40 years later PEG remains the preservative of choice for many conservators treating waterlogged mobile artifacts (Johns 2013).

The 1970s also saw professional wet-site excavations at other locations on the Northwest Coast. In Washington, in addition to Ozette, there were small projects at several sites dating from the past 1,500 years in the Puget Sound region (Blukis Onat 1976; Munsell 1976a, 1976b), and multi-year investigations of a 2,500–3,000-year-old fishing camp at the mouth of the Hoko River on the Olympic Peninsula (Croes 1995, 2005). The most ambitious wet-site excavations in British Columbia recovered several hundred 3,000-year-old waterlogged artifacts from the Musqueam Northeast site in the Fraser Delta (Archer and Bernick 1990; Borden 1976; Borden and Archer 1974, 1975). Also in the 1970s in British Columbia, there were wet site excavations in Pitt Meadows (Crowe-Swords 1974; Copp et al. this volume), and at the Little Qualicum River Site on the east coast of Vancouver Island (Bernick 1983), the Axeti Site on the Central Coast (Hobler 1976), and at Lachane in Prince Rupert Harbour (Inglis 1976)—none of which produced material older than ca. 2000 BP. Analysis of the often-overwhelming quantities of material recovered by these investigations was not always completed and there are numerous under-reported and unpublished "legacy collections" resting in repositories.

Although systematic excavations at the Sunken Village wet site (35MU4) on Sauvie Island in Oregon did not take place until the 2000s (Croes et al. 2009), a Portland State University project mapped acorn-leaching features visible on the river beach in the late 1970s and 1980s. They also recorded private collections that had been salvaged from the site and successfully nominated it as a National Historic Landmark (Newman 1991). The Carruthers site, first excavated in 1972 and again in the 2000s (Crowe-Swords 1974; Copp et al., this volume), is another example of wet-site re-investigation.

Croes (2013) refers to the 1970s as the heyday of wet-site archaeology on the Northwest Coast and comments on diminished fieldwork in the following decade. I can attest that in Canada, beginning in the early 1980s, there was a unofficial moratorium on wet-site excavations pending greater availability of conservation facilities. The moratorium gradually lost adherents as perishable artifacts continued to appear in eroding river banks and at the bottom of construction excavations (Bernick 2013). Since the early 1990s I have noted a steady increase in the number of wet

sites being discovered throughout the Northwest Coast but a decrease in multi-year research investigations, the wet-site excavations at Qwu'gwes in southern Puget Sound being an exception (Croes ed. 2013). Most of the recent projects are conducted by commercial consulting firms in advance of land alteration, or to salvage materials already unearthed by construction machines. One consequence appears to be discovery of older waterlogged cultural deposits than previous, and at greater depths; for example, the Esquimalt Lagoon site (Eldridge, this volume) and DhRp-52 (Hoffmann et al. 2016). More recently, archaeologists excavating Early and Middle Holocene coastal sites are encountering water-saturated cultural deposits, which extends the age of waterlogged materials back in time (e.g., chapters in this volume by Cohen, and by McLaren, Hawes et al.).

A historical review of Northwest Coast wet sites would not be complete without mention of wood-stake fish traps and weirs. Ever since the publication of Moss et al. (1990) documented that such features can be thousands of years old, there has been subtle competition to see whether Oregon, Washington, British Columbia, or Alaska has the most, the oldest, the largest, more complex features, or previously unreported types (e.g., Byram 2002; Cullon and Pratt, this volume; Elder et al. 2014; Eldridge and Acheson 1992; Greene et al. 2015; Mobley and McCallum 2001; Moss 2013; Moss and Erlandson 1998). A major attraction is that these kinds of sites can be found and recorded without excavation and also radiocarbon dated. Although most of the reported fish-trap / weir sites are on or near the coast, their presence in streams and lakes on the intermontane Plateau is receiving more attention (e.g., Nicholas 2002; Prince 2005, 2014; Rahemtulla, this volume).

The historical trajectory has been increased awareness of and engagement with wet sites, corresponding to development of Northwest Coast archaeology as a whole. Forty years ago, in the introduction to his seminal edited volume, Dale Croes wrote, "All of the 11 wet sites found and excavated to date on the Northwest Coast" (Croes ed. 1976:2). Clearly, the number of known wet sites has vastly increased; if we include fish traps, the total count is probably in the thousands. However, few wet sites have been investigated in detail and very few are published; some of those 11 "original" projects are not yet fully reported.

A MIDDLING GLOBAL POSITION

The Northwest Coast is one of two areas in North America known internationally for having numerous significant wet / wetland sites, the other being Florida (Croes 2013). In my opinion, the Northwest Coast merits that reputation, but only in some aspects. The distinction is especially true for finds in the intertidal zone, where we have a decided lead when it comes to fishing features, especially wood-stake traps and weirs (e.g., Bernick ed. 1998; Moss 2013; also see Cullon and Pratt, this volume). Perhaps with the exception of Japan, the Northwest Coast has a particularly high incidence of basketry and other plant fiber portable artifacts, and many of these were recovered from intertidal middens (Figure 3). Comments singling out waterlogged sediments on the Northwest Coast for their "wealth of organic evidence emphasizing the significance of basketry, nets, and fibers in the material culture of the area" (Bell 2013:474) are common in the international wetland archaeology literature.

However, unlike Europe, the Northwest Coast has produced only a few large wood artifacts or features. The main exceptions are the 300–500 year-old collapsed houses, complete with contents, excavated at Ozette in the 1970s (Samuels 1991). The only other waterlogged houses excavated on the Northwest Coast were uncovered during a coastal survey in the 1930s (Drucker 1943). The only reported watercraft confirmed to be of precontact age are pieces of dugouts recycled as house-wall planks at Ozette (Mauger 1991:65–68), which is a poor showing when compared to hundreds of dugouts and other kinds of boats from other culture areas (Bernick 2017b).

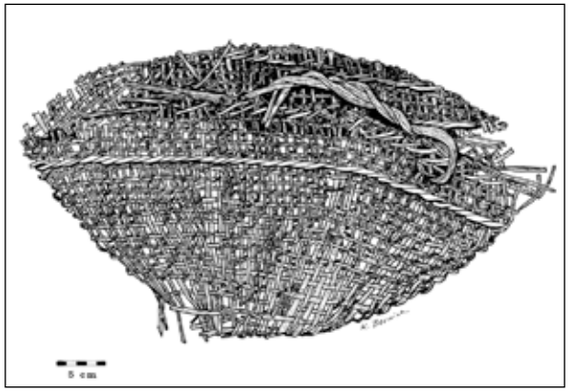

Figure 3. Flattened 3,000-year-old cedar-withe basket with a handle attached to the rim, from the Musqueam Northeast wet site in the Fraser Delta. The top of the other side is folded over to the inside of the basket; the basket base is complete but not visible in this view. Plaited-wrapped-twined weave. DhRt-4:10340. *Drawing by Kathryn Bernick.*

The paucity of large features is particularly noticeable in global perspective. For example, at the 2016 international wetland archaeology conference at the University of Bradford in England, fully one-quarter of the presentations discussed current research of wooden structures in wetlands, in numerous countries and in various ecological settings.

The most popular topic of current research in the international wetland archaeology community appears to be landscapes, that is, human use of present and former wetland environments. This is not a new trend (Nicholas 2001), but the focus seems to be expanding, encompassing larger geographic areas and integrating more specialized, multi-disciplinary analyses (Menotti and O'Sullivan 2013). By contrast, Northwest Coast archaeology is firmly centered in anthropology and, with increasing frequency, highlights relationships to local descendant communities. That trend was clearly evident in the program of the 2017 annual meetings of the Society for American Archaeology held in Vancouver, British Columbia. Croes (2013) suggests that perishable artifacts comprise a particularly attractive aspect of archaeology for indigenous communities because they provide a meaningful personal connection to the past. I suggest that normally perishable artifacts also generate enthusiasm among archaeologists, which contributes to object-oriented descriptive reports of wet-site finds. Nonetheless, landscape perspectives are gaining momentum among dryland archaeologists on the Northwest Coast and adjacent regions (e.g., Rousseau 2017), and wetland environments are also beginning to receive attention (e.g., chapters by Copp et al. and by Hill in this volume). Rahemtulla (this volume) describes a collaborative project, which, though still in its early stages, has the potential to be holistic at a landscape scale, blending community relevancy and academic research.

Despite differences in approach and types of sites being investigated, Northwest Coast wetland / wet-site archaeology shares much with practices in other regions of the world (Menotti and O'Sullivan 2013). Everywhere, these kinds of sites provide information that otherwise would not survive in the archaeological record. Here, on the west coast of North America, wet sites have produced waterlogged artifacts and ecofacts dating from the Early, Middle, and Late Holocene. As documented in the chapters of this volume and the histories they recount, we have a large variety of sites, a wide range of depositional contexts, and many categories of remains that are only partially known. Emerging specializations, such as paleoethnobotany/archaeobotany (e.g., Cohen, this volume) are coming to the fore in wetland contexts worldwide. Archaeological evidence of plant management for food production 3,800 years ago in a British Columbia wetland site provides a glimpse of new directions and important discoveries yet to come (Hoffmann et al. 2016). It seems unlikely that Ozette is the only outstanding wet site in the region. I am confident that remains of ancient wooden dwellings and watercraft are present in a variety of wet sites on the Northwest Coast, and that they, as well as currently unknown types of mobile waterlogged artifacts, will fill gaps in the archaeological record.

THE VOLUME

The authors of the chapters in this volume are all practicing archaeologists in the Pacific Northwest. Some describe the first-ever waterlogged materials they encountered, others discuss finds from the vantage of previous wet-site experience. Each addresses a different aspect of wet-site archaeology, with attention to field procedures and methods of analysis, as well as summaries of their findings. Part I centers on procedures for discovering and recovering wet-site materials. Morley Eldridge discusses where to look and how to recognize waterlogged deposits. He reviews the conditions under which perishables survive and relates his extensive personal experience testing and excavating wet sites in different geomorphic settings, in British Columbia and Alaska. That is followed by Kathryn Bernick's guidelines for care of waterlogged artifacts in the field and laboratory. She draws on four decades of working with these kinds of materials and concludes with a list of items to have in a field kit for incidental recovery of waterlogged artifacts.

Part II features projects in and about wetlands and about material remains that preserved in waterlogged deposits. Singly and collectively, these examples of modest research speak of the great potential of wet sites and new perspectives on the past. Genevieve Hill discusses the cultural dimension of wet site occurrences in wetlands. Her call for archaeologists to consider indigenous perspectives adds to Eldridge's geomorphic-based criteria for discovering wet sites. That is followed by

an account of excavations at a habitation site in a wetland (Copp et al.). Both these chapters emphasize that draining wetlands impacts cultural remains, as well as the wetland ecosystem. Grant Keddie's examination of wooden fishhooks is an example of information that has survived only in water-saturated deposits. The presence of those hooks and their role in the repertoire of fishing technologies would be unknown were it not for wet-site finds. Taking a different tack, Jenny Cohen looks at botanical remains to understand peoples' interactions with the environment in the ancient past. Her piece combines methods and results, relating how she learned to identify seeds and wood species, and found that the vast majority of her data were preserved through waterlogging.

The chapters in Part III describe unexpected finds. These are examples of what the average archaeologist might come across during routine fieldwork and illustrate the usefulness of having a wet-site kit at hand. Each of these chapters relates a different situation—a significant basketry object eroding from the river beach (McLaren, Bernick, and Gray), and waterlogged weir stakes and perishable artifacts appearing in the middle of an excavation unit (Rahemtulla). Enigmatic wood items including an atlatl, discussed by Duncan McLaren, Kathleen Hawes, and colleagues, were encountered unexpectedly during excavations for other purposes at Early and Middle Holocene coastal sites. In the final chapter, Deidre Cullon and Heather Pratt relate how they found unexpected types of fish-trap features in an unexpected location and discuss their reconstruction of the technology represented.

The contributions as a whole illustrate a pervasive and long-standing preoccupation with fishing, which parallels Ames' (2005:11) characterization of wet-site archaeology on the Northwest Coast. Neither the economic importance of fishing nor the numerous remains of intertidal fish weirs and traps in this region are new conclusions (Moss and Cannon 2011). Yet, the emergence of fishing technologies as a strong theme in this volume was unplanned. None of the chapters discuss faunal remains and only one (Cullon and Pratt) is centered on intertidal wood-stake fishing features—the two commonly cited kinds of archaeological evidence for the prime role of fish in precontact economies (Moss and Cannon 2011).

In *Waterlogged*, fishing is documented through evidence of diverse technologies that connected people to the prey (Figure 4). Cullon and Pratt and also Keddie show that fishing involved knowledge of fish behavior, in addition to the required presence of particular species at a particular location, and availability of tools for harvesting them. Rahemtulla's preliminary findings hint at another variation on fishing (weirs and traps far from the coast). Nearly all the other chapters in the volume describe vegetal fishing-related items, ranging from riverine weirs (Hill; Eldridge) to fishhook parts (McLaren, Hawes, et al.). Moreover, a conventional interpretation would associate the ground slate knives at the Carruthers site with fishing, though Copp et al. propose a wetland plant processing function. These examples extend the existing wet-site contributions to our understanding of fishing technologies on the Northwest coast (e.g., Byram 1998; Moss 2013; Stevenson 1998). They refine interpretations of archaeological evidence and increase the range of empirical evidence.

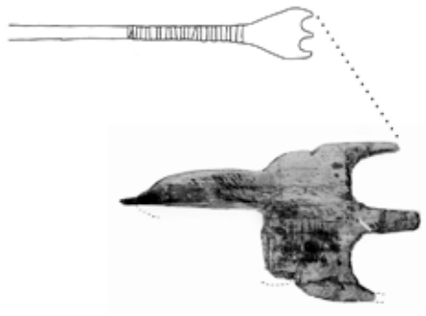

Figure 4. Flat wooden finger-grip from the proximal end of a throwing harpoon used to catch salmon and sturgeon. Broken on one side. Found in 2018 at a wet site in the Fraser Valley. It would have been bound with cherry bark onto the harpoon shaft. Dimensions: 106 x 56 x 8 mm. DhRo-1:W5. *Photo by Brendan Gray; sketch by Kathryn Bernick after ethnographic museum specimen.*

Other than being about wetlands, wet sites, and waterlogged materials, and prominent attention to fishing technologies, the contributions in *Waterlogged* are wide-ranging topically and fall into existing synthetic studies referenced in the respective chapters (also in Menotti and O'Sullivan 2013). Some chapters hover on the edges of themes emerging in regional Northwest Coast archaeology in general. For example, the blurring of culture area "boundaries" exemplified in the chapter that discusses social interaction in the Stave watershed (McLaren, Bernick, and Gray) parallels, in a simplified way, the coastal-interior relations detailed in the recently

published study about finds in a melting glacier in a northern mountain pass (Hebda et al. 2017). Further details about wetland / wet sites and the topics discussed in this volume can be explored by consulting the bibliographic sources at the end of the volume.

PART I:

Discovery and Recovery

Wet Sites: A Guide to Finding Them

Morley Eldridge

Relatively few archaeologists from either the academic or consulting worlds have a record of regularly identifying, investigating, or managing wet-site components during their careers. Many consider wet sites to be very rare and hard to find, and even harder to test, excavate, or deal with the ensuing conservation issues. None of these points is true, though certainly some specific knowledge is required. Wet sites continue to be discovered mainly by serendipity. Most archaeologists consider them to be exotic, rare, and out of the realm of day-to-day practice, despite accumulated evidence to the contrary. Why aren't wet sites identified more often? Perhaps many archaeologists simply aren't thinking about the possibility of their presence or don't know how to go about identifying them. When I approach a bridge or see developments in wetlands, I wonder, "Did they consider wet sites during the archaeological impact assessment?"

This chapter provides guidelines for recognizing circumstances where wet-site material has high potential to be present and how to find it. The conditions where wet sites occur are explored and the links between precontact activities and wetlands are briefly discussed. Examples drawn from personal experience illustrate how the use of touch and smell, as well as visual cues, can help the field observer to identify the right conditions for ancient preserved vegetal material.

WET SITES—A SUBDISCIPLINE OR INTEGRAL TO NORTHWEST COAST ARCHAEOLOGY?

Most archaeologists who do not have a special interest in wet sites assume that Pacific Northwest wet-site archaeology began with the 1971–1981 excavations at Ozette. The archaeology of Ozette, "justifiably one of the

most famous archaeological sites in the world" (Ames and Maschner 1999:111), is reported in numerous publications (e.g., Daugherty and Friedman 1983; Samuels 2006; Samuels ed. 1991, 1994; Whelchel 2005) and highlighted in archaeology textbooks. In fact, wet-site archaeology on the Northwest Coast goes back to a much earlier time, but the early exercises have not been incorporated into most later work. (A history of wet-site investigations in the region is presented in the introduction to this volume.)

Croes (2013:695–696) attributes the first Northwest Coast wet-site archaeology to Phillip Drucker in 1938, when he conducted a relatively large excavation of the preserved remains of one wood house at the Gitga'at refuge site of Qalahahaitk on the Qal River along the North Coast of British Columbia (Drucker 1943; Eldridge 2003). Although Ames and Maschner (1999:23) and Matson and Coupland (1995:41) both refer to Drucker's pre-World War II fieldwork, neither refers to the wet site excavations that formed a significant part of that work. The wet site excavation part of Drucker's project has almost been forgotten by the discipline. However, I put the beginning of wet-site archaeology on the Northwest Coast even earlier, to August 1, 1898, when Harlan I. Smith, working with the Jessup North Pacific Expedition, wrote in a letter to Franz Boas, "If we could but see some of the things that have decayed in the [shell midden] mounds we should know more. Today, we dug in a bog, between a shell heap and a mortar in a huge bowlder [sic], about one hundred feet apart, in hopes the bog waters had preserved some things that decay in shell heaps, but we had no success" (Smith 1898).

Wet-site archaeology, at least sometimes, has been on the minds of archaeologists who work on the Northwest Coast for more than a century. Consideration of wet sites as a normal part of the archaeological record has been accepted slowly. Of the main published syntheses about Northwest Coast archaeology, Moss (2011:35–38, 90–92) has the broadest discussion of wet sites, especially of wood-stake fish weirs and traps. Wet sites are barely mentioned by Ames and Maschner (1999:102–103). Matson and Coupland (1995:45–46) describe wet-site archaeology as a subdiscipline of Northwest Coast archaeology led by Dale Croes and Kathryn Bernick. They discuss various wet sites individually (e.g., 1995:277) and basketry styles grouped by phase or culture type (e.g., 1995:219–221), but with little integration into their discussion of the archaeological record as a whole. The lack of integration of wet sites and wetland archaeology into the mainstream is not unique to the Northwest Coast. Kaeser (2013:830) discusses similar situations in other places and notes that some (European) intellectuals view wetland archaeology with scorn.

As an undergraduate student in 1974, I visited Ozette with a group of students from the University of British Columbia led by David Archer. We walked the boardwalk trail out to the site and watched people using hoses to clear stakes and channeled roof boards and cordage and myriad marvelous, wonderful things. We visited the lab and looked at huge tanks filled with polyethylene glycol solution to preserve the waterlogged materials. The tanks, made by lining simple wood boxes with plastic sheeting, were simple but effective. We got to examine, without barriers, the iconic whale dorsal-fin effigy studded with sea otter teeth. That visit to the Ozette wet site had a profound influence on my concept of what Northwest Coast archaeology is all about. Curiously, I never visited my own university's excavations at the Musqueam Northeast wet site that were going on at this time (Borden and Archer 1974, 1975).

Soon after, Dale Croes' (1976) edited volume on wet sites came out, illustrating their presence throughout the Northwest Coast Culture Area. I visited Kathryn Bernick's 1976 excavations at the Little Qualicum River site (Bernick 1983), and entered graduate school at the University of Victoria with her as something of a mentor. Bernick continued wet-site work with descriptions of perishable assemblages from the Musqueam Northeast and Water Hazard sites (Archer and Bernick 1990; Bernick 1989), and subsequently undertook her seminal research on the distribution of wet sites in the lower Fraser River region of British Columbia (Bernick 1991). Here, she documented that wet-site deposits had been found at many significant previous excavations. These discoveries were often hidden in field notes that discussed reaching the water table, finding waterlogged twisted cordage, basketry fragments, or other preserved vegetal material, and abruptly halting excavations. Somehow, these finds never seem to make it into the published literature and only seldom into unpublished reports.

The efforts of Bernick, Croes, and others to increase awareness of wet sites has influenced subsequent work on the Northwest Coast. Wet sites

are being discovered in increasing numbers. The relative ease of finding and recording exposed wood-stake fish trap remains is likely responsible for their being the largest category of intentional finds (e.g., Byram 2002; Greene et al. 2015; Mobley and McCallum 2001; Moss 2013; also see Cullon and Pratt, this volume). I believe that water-saturated deposits buried by younger sediments are still discovered mainly by serendipity. In the past three decades, I've been quite successful in locating a steady trickle of wet sites. That isn't to say that consultants and scholars outside the cadre of wet-site specialists have not found and investigated wet sites. The discovery and excavation of wet sites in Pitt Polder (Burk et al. 2009) and the wapato garden and house site at DhRp-52 in Katzie territory in the lower Fraser River valley come to mind. This latter, unique site was found during extensive excavations conducted by a First-Nations-owned archaeological consulting company (Hoffmann et al. 2016).

Harlan I. Smith, when he dug in a bog on Vancouver Island, was concerned about obtaining a fuller view of what villages used to contain. The desire to maximize the range of physical materials available for study is still a goal of most archaeological researchers. Smith knew from observing aboriginal houses and villages in the late nineteenth century that the huge range of what could be seen would not normally preserve in shell middens. Bone, antler, and shell preserve in shell middens; without shell, coastal soil tends to be acidic and stone artifacts are dominant. For example, less than 15 percent of the objects found at the Pompeii-like Ozette Village wet site had stone, bone, or shell components that could be expected to preserve in shell middens (Samuels and Daugherty 1991:4). Normally, some 85 percent would completely vanish and this would include entire classes of objects of economic and social importance—all storage and cooking vessels, for instance.

Smith's (1898) excavations likely drew on information current at that time in Europe, where wet-site materials were being found in peat bogs. "Bog bodies" is a term used since 1871 for European mummified human remains and their associated leather clothing and wood artifacts found in peat bogs (van der Sanden 2013), and Smith, almost certainly, would have been familiar with these spectacular finds. He also would have been aware of the craze for "lake dweller" wet sites that swept Europe in the late nineteenth century (Arnold 2013; Kaeser 2013; Leuzinger 2013).

CONDITIONS WHERE WET SITES SURVIVE

Wood, bark, and grasses are normally perishable. They will decay within a few years or decades if exposed to moisture and oxygen. However, if these materials are in an environment that effectively completely excludes one or the other, they can survive almost indefinitely (Johns 2013). Hair, wool, fur, leather, skin, sinew, keratin (e.g., mountain goat horn), and other materials were also present in the traditional technological repertoire. Of these, leather and skin will occasionally preserve in high tannin environments, such as peat bogs, through a process of tanning or re-tanning (Painter 1995), while only extreme aridity or a permanently frozen environment will preserve the remainder.

There has been limited discussion in the wet-site literature about the environmental conditions that preserve normally perishable materials. Most authors refer simply to "anaerobic conditions" (e.g., Johns 2013:665). The geomorphic processes by which a deposit becomes anaerobic has received little attention. Some of the best information is from England. Corfield (1998) discusses geographic locations likely to contain permanently waterlogged cultural materials, noting that stable water tables can preserve buried cultural perishable materials even in landscapes that are not noticeably wet at present. He notes that preservation can occur in a wide variety of wetlands, estuaries, intertidal zones, lakes, rivers, floodplains, and so on. Corfield goes on to describe the varying hydraulic conductivity, soil characteristics, water balance, water chemistry, mineralization, and microbiology that contribute to preservation (or lack thereof).

Croes (2013:703–704) suggests that on the Northwest Coast peat-based wet sites are rare and that most wet sites in this culture area occur in oxygen-depleted groundwater aquifer-based locations. The oxygen depletion Croes links ultimately to the mountainous terrain of the region. This dichotomy between peats and aquifers in my opinion would likely not stand up to detailed scrutiny. Several Northwest Coast wet sites that I have worked on included peat deposits, and I know of others in addition to the few that Croes notes as exceptions.

European archaeologists seem to have a view beyond the site to entire wetlands or landscapes, and, perhaps consequently, a more holistic view

bundling waterlogged and non-preserved remains and paleoenvironmental data. This is reflected in many of the introductory editorial essays in the book *Hidden Dimensions* (Bernick ed. 1998), and at various levels of discussion in *The Oxford Handbook of Wetland Archaeology* (Menotti and O'Sullivan 2013). Brunning (2013) describes the techniques used in several wide-area and decade-long wetland inventory projects undertaken in Britain. These range from targeting features exposed by peat cutting (especially trackways), to walking grid patterns over former wetlands now used for agriculture ("field walking"), combined with aerial photograph interpretation. Perishables are not mentioned specifically in the large-scale inventories among the "discrete spreads of artifacts" found on the surface as the peaty soil degraded (Brunning 2013:454), but there seems to have been an assumption that buried waterlogged cultural materials would be present in many of these places. In some cases, auger tests or small excavations were carried out and these presumably would have found the wet material. The work in much of Britain and Ireland is now mainly reactive. Archaeological work is often limited to an initial partial inventory, since the scale of destruction of the wetlands is so massive and the resources for archaeology so limited (Brunning 2013:455–457).

Bell (2013) provides a geological summary of the process of sedimentation of fine particles in the lower intertidal zone, and the growth of peats in the uppermost intertidal (both of which can seal off vegetal objects from oxygen and preserve them), the effects of sea level change resulting in marine transgression and regression, and coastal geomorphological processes such as dendritic channeling and stepped platform creation. Bell recommends archaeological fieldwork methods for intertidal locations to include planning using tide tables, obtaining aerial photographs that can be geo-referenced, and using GPS, differential GPS, terrestrial lidar scanning, and video documentation to obtain data quickly during the brief tidal windows when features in the low intertidal zone may be exposed. He also recommends working immediately following storms to capitalize on archaeological features being briefly uncovered from mobile sediment.

Moss (2011:90) notes that wood and fiber technologies preserve well in wet anaerobic sites on the Northwest Coast, but that the caves in this region are much wetter than many caves in the dry Great Basin and Southwest Culture Areas of North America where fibers are often preserved. While this may be true over millennia, some Northwest Coast rockshelters and caves are sufficiently dry to preserve fiber artifacts from at least the protohistoric and early contact periods (e.g., Bernick 1998a; Chechik and Hutchcroft 1986).

FINDING WET SITES—EXAMPLES OF APPROACHES, TIPS, AND TECHNIQUES

This section provides examples of how I (and the staff of my consulting company, Millennia Research Limited) went about searching for wet sites. (For site locations, see Figure 1.) My simple approach combines geomorphological setting and methods. Each example describes a location where the right environment was present to create and preserve a wet site and the approach or methods used to actually identify that a wet site was present. Readers can use the information to build their own awareness of wet sites and ensure that consideration of their possible presence is incorporated in inventories and impact assessments.

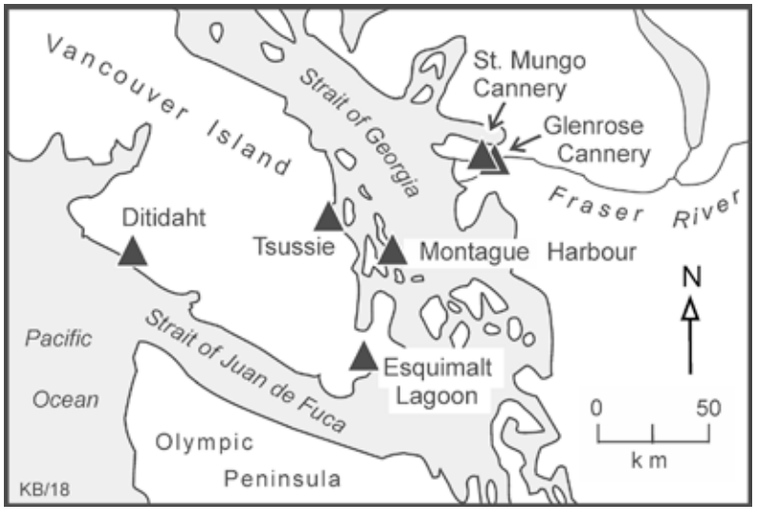

Figure 1. Locations of British Columbia wet sites discussed in this chapter. Prince William Sound is about 2,000 km to the northwest, in Alaska. *Map by Kathryn Bernick.*

Marsh plus Intertidal Zones Flanking a Known Shell Midden—Montague Harbour

I first systematically looked for the presence of a wet site in the spring of 1989 during reexamination of archaeological sites in Montague Harbour Provincial Park on Galiano Island, which is situated in the Strait of Georgia between Vancouver and Victoria (Eldridge 1989). Don Mitchell had undertaken major archaeological excavations at a number of sites in the park in the 1960s (Mitchell 1971). At the Montague Harbour site, DfRu-13, he had stopped excavating upon encountering the water table, before reaching the bottom of archaeological deposits. The field notes mention preserved botanical material found in a small test dug into the wet lower layer, but nothing that was clearly cultural (Mitchell 1964, July 3).

When asked by BC Parks to reevaluate the site and make recommendations for long-term management, I guessed that waterlogged materials might occur just outside the previously established shell-midden limits, either on the marine side beneath the beach surface, or within a freshwater or brackish marsh that had formed on the inland side of the midden. Sufficient midden had accumulated to change water flow dynamics, as Mitchell (1971:78) had noted. Mitchell (1971:67, 88) had also argued for sea level changes following the early occupation, suggesting that they had caused taphonomic changes in the midden (the leaching out of calcareous shell during a period of subsidence). In order to determine if wet-site deposits might exist at the flanks of the midden ridge, we used a backhoe to test the marsh on the inland side. We found no wet-site material, but we did find preserved noncultural plant material, as well as fire-broken rocks, charcoal, and scattered shell fragments. Auger tests beneath the beach revealed that intact midden, including hearths, lay just a few centimeters beneath the thin beach sand, but, again, no wet site.

Our confirmation of intertidal midden deposits at Montague Harbour encouraged Norman Easton to follow up with more intertidal testing. He kept going farther out and lower, undertaking Canada's first subtidal archaeological excavation of cultural material in a drowned landscape (Easton 1992; Easton and Moore 1991). The exploration of archaeological remains in subsidence zones has continued, with house remains found in the intertidal zone in some of the other Gulf Islands (Fedje, Sumpter, and Southon 2009).

Object Lessons

- Test the margins of shell middens, especially in wetlands, for cultural materials.
- Don't be discouraged by negative results; persistently test high potential wetlands.

Deltaic and Mudslide Environments plus Large Shell Middens—Glenrose Cannery and St. Mungo Cannery Sites

My first real chance to work on wet sites directly came in 1990 after the discovery of 4,000-year-old basketry and other perishables at the Glenrose Cannery archaeological site (DgRr-6). Glenrose is located on the Fraser River at the base of a high ridge of land that the Fraser delta engulfed as it aggraded during the Holocene. The site location has changed from an inlet mouth, to an estuary, to a river channel margin (Matson 1976).

In one remarkable week my small crew (which included Kathryn Bernick) tested the beach in front of the Glenrose shell midden (Eldridge 1991). The dryland midden had been investigated over several years, and many meters' depth of cultural deposits (spanning 8,000 years of history) were documented (Matson 1976). The beach had never been tested by an archaeologist. There we found hundreds of aligned wood stakes, thousands of adze- and chisel-cut wood chips, basketry, and wood and bark items, as well as the same types of stone, bone, and shell artifacts found in the dryland part of the site (Eldridge 1991; 2017). The wet site likely holds hundreds of baskets and millions of wood chips.

In this case, the wet site was discovered by some of the many relic collectors who frequented the beach looking for the artifacts that, up until that time, were thought to have washed out from the riverbank. The collectors had found a complex woven bark artifact that clearly demonstrated preserved fiber artifacts were present, and this find further suggested that not all the artifacts found on the beach were redeposited from their original context. Our excavations revealed thin layers of shell hash (essentially intertidal shell midden) separated by laminated silty clay (Figure 2). The shell hash contained preserved botanical material. The beach had a slightly fetid smell that was strong in the shell hash layers.

Figure 2. Intact cultural deposits with perishable materials were uncovered a few centimeters below the beach surface in the low-intertidal zone at the Glenrose Cannery site. *Photo by Kathryn Bernick, 1991.*

A geo-archaeological study conducted in conjunction with the beach excavations determined that the shell hash layers were separated by layers of slow-moving Fraser River water, and that the entire sequence had been buried at one time by one or more major mudslides. The mudslide overburden had since been washed away, leaving scattered large rocks over much of the wet-site surface (Harper 1990).

One year later in 1991 the sequence repeated itself a short distance downstream from Glenrose, at the St. Mungo Cannery site (DgRr-2). Multiple major excavation projects by several archaeologists in the dryland shell midden had failed to recognize intertidal wet-site deposits. One investigator found a preserved wooden woodworking wedge in or near the intertidal zone, but argued that this did not represent a wet site (Ham et al. 1986:appendix 1:53). At St. Mungo, an archaeology undergraduate student found the additional wet-site material after attending a lecture on wet sites. My company was privileged to undertake an investigation

of what little remained of the wet site (Eldridge and Fisher 1997b). The project was remarkable for having to be excavated at night during the lower diurnal tide cycle, and in November when Fraser River water volumes are low. A combination of low river levels and low tides are necessary to work in the intertidal zone on the lower stretch of the Fraser River. Spring daytime low tides usually are accompanied by high river volume, and the water level is too high to work on the middle and low beach areas. For the St. Mungo wet site, a geo-archaeological assessment showed that the cultural material was laid down in a slough or backwater with intermittent flood deposits, and these deposits were then covered by mudslides (Reimer 1991). Indeed, previous archaeological investigations in the dryland site area had found widespread evidence for small mudflows and slides (Ham et al. 1986).

Many archaeologists had visited the beaches fronting these two sites in the 1960s, 1970s, and 1980s. Why did they miss the wet-site components? Some visits may have taken place when the tide was too high, or when a mobile silt drape obscured the cultural material. But this could not have been the case at all times. There were hundreds of wood stakes visible on the beach in front of both sites, and the shell hash layers with preserved botanical material were visible in small patches bare of overlying sand or drapes of silt. Artifact collectors regularly worked the beaches. I believe that the archaeologists who had visited these beaches were simply unaware of the potential for *intact* cultural materials of any type, including stone, in the intertidal zone, and had not seen what was "hiding in plain sight."

Object Lessons

- Be aware of the potential for wet sites, especially at or near dryland sites.
- Schedule fieldwork for low tides and low river volumes.
- Your nose can help in searching for wet sites: if it smells fetid or sulfurous (like mudflats at low tide) there are likely anaerobic conditions and it's a good place for wood preservation!
- Ensure that approaches to archaeological inventory incorporate examination of wetlands or saturated deposits whenever there is a potential for cultural remains in them.

Semi-Protected Ocean Beach and Peat—49SEW68, Prince William Sound

In 1990, working with the Exxon Valdez cultural resource program, I found a major wet site in Prince William Sound, Alaska (technically this is a little outside the Northwest Coast Culture Area). The previous year, after the 1989 *Exxon Valdez* oil spill, the archaeologists on the shoreline cleanup assessment teams were given a synopsis of Prince William Sound archaeology and instructions on where to look for archaeological material. Because much of the sound had been uplifted by 2–10 m vertically during the 1964 earthquake, the archaeologists were advised to concentrate on the upper intertidal zone; it was assumed that the current middle and low intertidal zones were deeply submerged prior to the earthquake (Mobley et al. 1990).

My first visit to the islands in Prince William Sound involved looking at the remains of a drowned forest that had been reported by beach cleanup workers—stumps and roots embedded in a peat matrix in the mid-intertidal zone. There was no associated cultural material and no culturally modified trees, but this gave me some insight that the tectonic history of the area must be complex. Even with a large amount of uplift in 1964, there must have been earlier subsidence of even greater magnitude. I did not fully absorb this or the significance to the search instructions we had been given until much later. At any rate, it wasn't until August 1990 that several intertidal wet sites were found by scheduled revisit to site 49SEW68 (Haggarty et al. 1991:148, 168–169).

The location of the wet site was originally recorded as an archaeological site by Frederica de Laguna. In the intertidal zone, she had found lithic artifacts that she assumed had been washed away from a midden that was no longer present (de Laguna 1956). The revisits by Exxon Valdez cultural resource program crews to 49SEW68 in 1989 and 1990 had revealed some fire-broken rocks in the intertidal zone and some culturally modified trees on the "dryland" backshore; but all visits had been made during high tides. Colleague Bruce Ream and I also arrived at high tide; but while walking along the beach wrack line I could see soggy sticks and what appeared to be lumps of peat among the kelp and eelgrass litter. There were more of these tumbling around in the swash zone. One stick appeared to have cut marks, but it was too battered to be sure. Some of the small wood pieces washing about looked like stone-adze-cut wood chips but, again, I couldn't be sure because the surfaces were somewhat eroded from water rolling. Nonetheless, the wood appeared ancient and waterlogged, and I thought it highly likely that a wet site was present. We returned at a lower tide. The helicopter landed on a little estuary around the corner from where we had seen the promising materials, and immediately we found a wood-stake fish weir in the creek—the first found in Prince William Sound (49SEW502). Walking down the beach we encountered a low scarp of actively eroding peat, with peat covered by rock armor above the scarp. I spotted a rope grommet (the collar from the top of a wood wedge) that had washed loose from the peat, and the wedge itself appeared a short distance away. We continued to find other objects, including a remarkable carved, notched, and recurved wood object. Scorch marks, perhaps from a steaming process or fire-hardening, were evident on different parts of this bow-like artifact, which we concluded might be a part of a kayak or umiak.

Object Lessons

- Think in the long term about what the environment might have been like, considering processes such as sea level changes, deltaic infilling, and anthropogenic developments.
- Be aware of the presence of peat, even if loosened, and that it could be eroding from a nearby location.
- Learn what peat looks and feels like. Peat looks rather like a jumble of long fibers and half rotten hay. When it occurs in the intertidal zone, you can often feel it before you see it. It is frequently covered by a layer of sand or even gravel or rocks. The beach will have a noticeably springy feel and if you look carefully or dig a small shovel test to get through the surface layer, you can soon establish whether peat is present.
- Learn how to recognize cut wood chips and waterlogged wood.

Wood-Stake Fish Weirs and Traps

Many of the wet site artifacts I have found, from all parts of the Northwest Coast, have been wood stakes from fish weirs. Some have been closely spaced stakes in obvious alignments. Up one memorable creek on Haida Gwaii, the stakes were nearly a meter tall where recent erosion had washed away the

fine silts into which they had been pounded. More often, stakes are barely visible blackened nubs that protrude from the creek bottom or beach by only one or two centimeters (see Cullon and Pratt Figure 2, this volume).

Fish traps and weirs are relatively easy to find, and can occur in a wide range of environments from small river channels to relatively exposed ocean beaches. They must be actively sought. You have to walk the banks of estuarine channels or wade the channels themselves at low tide to find them, and many archaeologists are overly anxious to bypass muddy intertidal beaches to get to that intriguing dryland to see if there are house depressions or shell midden exposures there.

Object Lessons

- Stakes (and other wood objects) may be blackened where they have been exposed to oxygen.
- Stakes are often obscured by attached seaweed. In this case, there might be an alignment of little clumps of seaweed to catch one's attention.
- Stakes that have become dislodged and are no longer in situ, may be lying on the surface of small river bars with the sharpened end plainly visible.
- Be aware of the possibility that other artifacts may be found at weir sites (such as the woven hat at the Wapato Creek site [Munsell 1976b]).
- Remember to take radiocarbon date samples from stakes if your permit allows; consider taking samples for dendrochronological cross-dating from large elements.

Tidal Lake plus Large Midden—Ditidaht Sites

The 1992 discovery of two interesting wet sites on the west coast of Vancouver Island in Ditidaht territory came about using a different set of criteria. In the case of *wikpalhuus* (DeSf-9) and *hit'ilhta7sak* (DeSf-10) (Eldridge 1992; Eldridge and Fisher 1997a), very large shell middens had been recorded by other archaeologists. These middens were well over 100 m long and about 50 m wide and had deposits many meters deep, composed almost entirely of millions of California mussel shells. They had been occupied for long periods, uninterrupted, until the 1960s. At both sites, small creeks flowed along the back side of the midden and then turned to enter the brackish and tidal Nitinat Lake. The sites are located on the lakeshore. They had been well mapped and the site boundaries were clearly indicated. For each site, the front edge of the midden had been drawn along the base of the midden slope. The area between the base of the slope and the shoreline, outside the site boundary, seemed similar to the type of landform Harlan I. Smith had tested in 1898 (although the distances were compressed).

We reasoned that if we could find a wet site, it would be similar to Bernick's (1991) findings for the lower Fraser River region, where many known sites contain waterlogged perishable materials. It would also validate Croes' prediction that "every sizeable shell midden site along the Northwest Coast, if explored with the intention of finding a waterlogged area, would exhibit a wet-site area with preservation of wood and fiber" (Croes 2013:695). And so it proved here. The creek at the rear of the site had no obvious wet-site material, though investigation was limited to shallow testing due to the extreme difficulty in excavating there. Initial shovel tests dug at the base of the midden slope right beside the lake to a depth of more than one meter and well below the water table yielded abundant chisel- or adze-cut wood chips and a whittled piece of yew wood (Eldridge 1992). In subsequent modest-scale hydraulic excavations undertaken in 1994 for the Ditidaht First

Figure 3. Wooden arrow point from a Ditidaht wet site on the west coast of Vancouver Island. Dimensions: 21.7 x 1.1 x 1.55 cm (DeSf-10:32). *2018 photo courtesy Royal British Columbia Museum.*

Nation, basketry, cordage, and wood artifacts, as well as stone, bone, and shell artifacts, and faunal remains were found. Figure 3 shows one of the wood objects, photographed after conservation treatment (Eldridge and Fisher 1997a).

Object Lessons

- Consider where waterlogged perishable artifacts are likely to be preserved adjacent to villages or camps.
- Consider where testing for this will be relatively easy (e.g., without having to remove with hand tools two or three meters of overlying cultural material in order to reach the water-saturated deposit).
- Place tests accounting for both sets of factors.

Longshore Marine Spit—Esquimalt Lagoon Wet Site

The Esquimalt Lagoon site (DcRu-74) on southern Vancouver Island was discovered in 2003 by one of my staff, D'Ann Owens, taking a scenic route to work. On seeing large excavation equipment and black soils in spoil heaps at the end of the Holberg Peninsula (the gravel spit that cuts off the lagoon from the sea), she stopped to investigate. She saw fire-broken rocks and charcoal in the slurry of wet sediments that had been dug up during the initial seven-meter-deep excavations for a sewer pump house. When she reported it to the British Columbia Archaeology Branch, there was initial reluctance to accept that the rock was cultural. There was no recorded archaeological site within several hundred meters of the location. I went down to the site with her and met the provincial regulator there. Everyone agreed that it really was fire-broken rock. Furthermore, there was a lot of saturated, fragile wood mixed in with the spoil, and a distinctive sulfurous odor indicative of anaerobic conditions. I considered a wet site likely.

We monitored further construction excavations and found cultural material from immediately below the road asphalt to a depth of about four meters. Cultural layers were separated from one another by thick deposits of cobbles and gravels. Interestingly, both peat layers and gravel aquifer layers contained preserved wood artifacts at this site. The deepest layers we were able to excavate from inside metal caissons. The site contained

3,000-year-old bentwood fishhooks (see Keddie, this volume), wooden woodworking wedges, basketry, and a finely carved wood chisel handle (Eldridge 2008; Mathews and Dady 2004).

In this case, prosaic fire-broken rocks were the key to establishing that something cultural was present in the first place, while identifying waterlogged wood and other organic materials led to the suspicion of a wet site even though no cultural vegetal material appeared to be present. However, when construction excavations resumed, we were prepared to find and deal with the wet-site material.

Object Lessons

- Fire-broken rocks have a ubiquitous presence in most Northwest Coast archaeological sites.
- The presence of punky wood and other vegetal material, a sulfurous smell, and fire-broken rocks combined to indicate high likelihood of a wet site.
- The gravel longshore spit initially did not seem to be a location with high potential for wet sites, but anaerobic conditions were found in multiple layers.

Estuarine Wetlands—Tsussie Wet Site

While undertaking a 2006 impact assessment of new water and sewer lines and flood control engineering works on the Tsussie Indian Reserve on southeastern Vancouver Island, one of my staff (Darcy Mathews) took the time to carefully examine spoil from earlier geotechnical tests situated away from the obvious shell midden (Mathews 2006). Some of these tests were located on the floodplain away from the better drained lands (Figure 4). Darcy is very observant. A number of small, parallel, striped fragments caught his eye. He was not familiar with these but he thought they might be basket fragments and he photographed them. I confirmed from the photos that the vegetal materials were split withes, and that the striped pattern is characteristic of basketry. The dark and light striped appearance can result from differential exposure when weaving elements pass over and under one another and the underlying portions of the element are protected from becoming darkened. Unraveled, the partly protected elements have dark and light stripes. The auger used for the geotechnical

Figure 4. Poorly drained wetland near a village site; excellent wet site potential! Inset shows pieces of basketry elements found on the surface in spoil from geotechnical tests. Tsussie wet site (DfRw-85), Vancouver Island. *Millennia Research Ltd. project photos, 2006.*

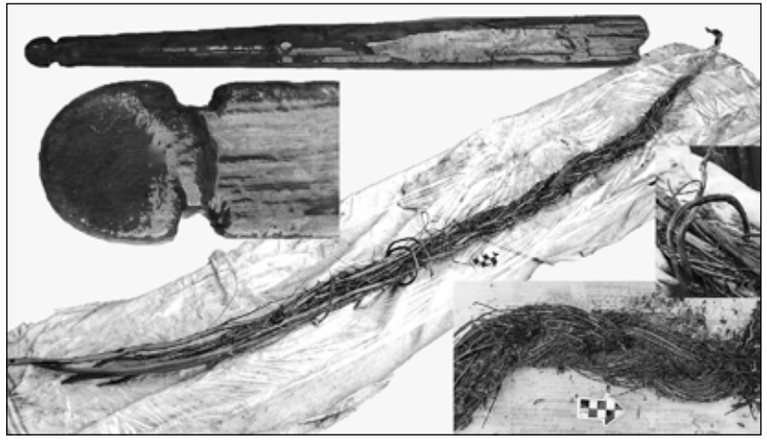

Figure 5. Waterlogged wood artifacts from the Tsussie wet site: *top left*, bow fragment (32 cm long) and detail of the notched end (DfRw-85:184); *center*, tied and bundled Douglas-fir withes (DfRw-85:174), portion in the photo 175 cm long; *bottom right*, details of the braided and tie sections. Scale length 5 cm. Ken Marr, Royal British Columbia Museum botany curator, identified the bow wood as Pacific dogwood (*Cornus nuttallii*). *Millennia Research Ltd. photos.*

testing apparently had passed through a basket. It was difficult to justify a high archaeological significance rating from such seemingly insignificant fragments, but we nevertheless recommended archaeological monitoring for the drainage ditches that were to be excavated.

Monitoring excavator work in 2012 confirmed that a rich deposit of preserved botanical material was present at the site (DfRw-85). We recovered baskets; long Douglas-fir branches still with the needles attached, braided together, the stems tied, and apparently stored underwater; and a rare (except at Ozette) wood bow (Figure 5). Fortunately, only a small fraction of the wet site was disturbed by the development.

Object Lessons

- Observe available exposures, even from small amounts of spoil left from previous geotechnical testing, and even "off site" if it is within a wetland.
- Photograph and otherwise document any botanical remains that look unusual, even if you are unsure if they are cultural, and have them checked by an expert.
- Ensure monitoring of wetland excavations in proximity to known dryland sites.

FINAL COMMENTS

Archaeologists have long been encouraged to consider and actively look for wet sites. Wet sites provide archaeology with the potential to find the 85 percent of traditional technology that was made from botanical material, and detailed information on local environmental conditions during past occupations. The amount of information encoded into composite or additive artifacts tends to be much greater for perishable than non-perishable material. Thus wet sites are particularly valuable both for scientific study and for cultural renewal for descendant communities (e.g., Carriere and Croes 2018). The most critical step to finding wet sites, whether during the course of academic research or consulting work, is to be aware of the possibility of their presence in the first place. That awareness will lead to actively searching for archaeological material, to

finding visible remains, and to testing programs (including examination of geotechnical test logs) that can find wet sites.

Wet sites require a depositional and burial environment that has been consistently in an anaerobic condition. Such conditions can occur in a wide range of geomorphological environments, from coastal to riverine to lacustrine to extensive bogs and wetlands. Cultural items must be in sufficiently high density to detect their presence. The extensive muskeg bogs of northern Canada and Alaska must contain huge numbers of lost hunting weapons and equipment, but their density will be so low that using normal archaeological methods to find them would be futile. The most obvious solution to this is to concentrate the search in bog exposures near known high-density cultural materials, that is, near dryland archaeological sites that have already been identified.

This chapter has described how I found and identified wet sites in a variety of environments. For general application, the approaches, tips, and techniques can be combined into considerations of where and how to look and what to look for. Logistical factors are also pertinent. Where tides or river levels are a factor, fieldwork must be scheduled to be able to access potential wet sites. A combination of vegetal material, a sulfurous smell, and fire-broken rocks indicate a high likelihood of a wet site and probably would justify additional testing even if nothing more is found at an exposure or in a small test.

Where to look. Use any geomorphological knowledge to consider if permanently saturated layers might be present in a landscape. A large variety of landforms may contain wet sites. Think in the long term about what the environment might have been like throughout the late Pleistocene and Holocene, considering processes such as sea level changes, deltaic infilling, and anthropogenic developments. Any preexisting geotechnical coring log that mentions "saturated" or "peat" is a red flag for further consideration. Not every saturated deposit has high archaeological potential, though. Proximity to dryland archaeological layers, or at a known locus for traditional resource extraction (such as fishing or tule gathering), is also necessary in order to merit high archaeological wet site potential.

What to look for. Fire-broken rocks occur in both dryland and saturated contexts at most Northwest Coast archaeological sites, and are often the first cultural remains that can be clearly identified during inventory.

Fire-broken rocks in any saturated setting are a key indicator that cultural materials are present, and that some may be vegetal. Wood chips are the fire-broken rocks of wet sites—they are ubiquitous where precontact woodworking of any kind is likely to have taken place, and they are often the first indication that more diverse vegetal items are also likely to be present. Wood stakes can often be found protruding in streambeds or estuarine sands. The tops are often blackened or have seaweed attachments. Peat forms in poorly drained coastal environments and is a good preserver of vegetal cultural material. And, of course, look for any unusual patterning in natural materials.

How to look. Exposures and erosion are your allies, whether natural or cultural—they destroy wet sites, but they also can reveal wet sites without the need for exhaustive hand or machine testing. River cut banks can reveal deeply buried saturated cultural layers. Make full use of any prior excavations—even old "cuttings" from geotechnical cores can reveal a wet site. Photograph any botanical remains that look unusual, at different scales (context and detail), and otherwise document them, even if you are unsure whether they are cultural, and have them checked by an expert. Use your nose to identify anaerobic conditions. There will often be a sulfurous "rotten egg" rank smell. Feel the consistency of the ground beneath your feet. If there is some "spring" to the surface, there may be peat buried under a thin layer of sands or gravels. Be persistent—wet sites are not as rare as we once thought, but they aren't everywhere either, even in areas with the right preservation conditions. Consistent observation of saturated deposits will greatly increase the odds of finding wet sites.

Recovering and Caring for Wet Perishable Artifacts: Strategies and Procedures

Kathryn Bernick

Control the water, document everything in the field, line up the specialists and maintain good records, prepare for conservation, and expect the unexpected" (Doran 2013:493). The preceding "mantra for wet-site investigations" expresses the essence of this chapter, at least the field-related portion. Glen H. Doran, who is internationally renowned for his wet site work in Florida, offers it at the conclusion of his excellent essay on excavating wet sites, in *The Oxford Handbook of Wetland Archaeology*. Here, I review procedures for post-field interim care of waterlogged artifacts, as well as field recovery, through the lens of personal experience on the Northwest Coast. In this sequel to Eldridge's tips for discovering wet sites, I address the question, "What do you do after finding one?"

This chapter provides guidance to archaeologists who have had little or no involvement with wet sites but who may come across waterlogged materials. Some of the procedures outlined here I learned from conservators, others I innovated to accommodate my mainly low-budget, low-tech projects over the past four decades. I also draw on the content of workshops that I have presented to professional archaeologists, field crews, and students, with particular attention to questions posed by participants. I address small finds rather than structural elements, though the principles for object care are the same. Archaeology of the Northwest Coast Culture Area comprises the discussion context and primary area of my experience, but many of the suggestions for excavating and safeguarding waterlogged materials have broader relevance.