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Native American Fisheries of the Northwestern California and Southwestern Oregon Coast: A Synthesis of Fish-Bone Data and Implications for Late Holocene Storage and Socio-Economic Organization

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This paper presents a synthesis of fish-bone data from archaeological sites located in southwestern Oregon and northwestern California to further a better understanding of indigenous fishery use during the Late Holocene. The data reveal a focus on mass-harvested smelt (osmerids) at coastal sites in Humboldt Bay and Del Norte County. Other sites reveal an emphasis on small to medium intertidal fish (e.g., pricklebacks, greenling, rockfish, sculpin) and surfperch, likely taken on an encounter basis. We examine the archaeology of fish and the development of mass-harvest techniques, technology, and storage. We also address the importance of fine-fraction sampling as a means of better understanding Late Holocene coastal subsistence and socio-economic developments in the region

Southwestern Oregon and northwestern California are characterized by a high degree of cultural complexity, as well as environmental diversity and abundance. The dramatic coastline includes rugged and rocky headlands and wide stretches of sandy beaches. Productive estuaries are located at Humboldt Bay and at the mouths of several salmon-rich streams, including the Klamath, Smith, and Rogue rivers. The dense coastal rainforest includes stands of some of the tallest trees in North America, the Coast Redwood, *Sequoia sempervirens*. On its eastern flanks this rainforest is broken by rugged mountain ranges, including the Siskiyou and Klamath mountains. In the King Range National Conservation Area (KRNCA) and other areas south of Cape Mendocino, the coastline is characterized by wide-open coast and sandy beaches, and there are few offshore rocks and headlands compared to the north.

The indigenous peoples who inhabit this landscape include the Tutuni, Takelma, Umpqua, and Chetco of southwestern Oregon, and the Tolowa, Yurok, Hupa, Karuk, Wiyot, Chilula, Mattole, Nongatl, Sinkyone, Bear River, Lassik, and Wailaki of northwestern California. This area has long been recognized as a unique culture area: at contact people lived in substantial dwellings (rectilinear plank houses around and north of Humboldt Bay, and conical slab-lined houses in southern areas) and most ate a lot of salmon, as did many other groups to the north on the Pacific Northwest Coast. Yet they also had many cultural connections with other California indigenous groups, including sociopolitical autonomy and the use of permanent sweathouses by men. Acorns were also a mainstay of the diet, as they were throughout much of California, and were processed using similar intensive methods common to other parts of the state (Basgall 1987; Baumhoff 1963; Gifford 1936; Kroeber 1925).

In regional archaeological studies, salmon are recognized as being a critical element in the resource base; the fishery has long been held to be integral to the development of regional cultures in the Late Holocene, in particular the emergence of Pacific Northwest Coast-style rectilinear plank houses north of Humboldt Bay and a village-based social organization similar to the post-contact patterns observed by early twentieth century ethnographers. This is also a common notion in traditional explanatory frameworks on the Pacific Northwest Coast, where salmon are viewed as providing the economic foundation for many north Pacific hunter-gatherer social institutions (cf. Goddard 1945; Hewes 1947; Kroeber 1925; Kroeber and Barrett 1960). Likewise, many archaeologists have stressed reliance on—and control over—the anadromous fish resource as being critical to understanding the evolution of foraging societies on the north Pacific Rim (cf. Hayden 1992; Hewes 1947; Maschner 1998; Matsui 1996; Schalk 1977). Such an emphasis assumes that salmon can provide a relatively low-cost, high-ranking resource that has great potential for humans—salmon runs are predictable, and people, once organized, can capture and store great quantities of fish, provisioning large numbers of people with a substantial supply of protein.

The notion of salmon as a "prime mover" in the development of northeastern Pacific Rim cultures, however, has come under increasing scrutiny and debate within the past three decades. Regional syntheses throughout the Pacific Northwest Coast and northern California demonstrate that regional patterns are much more complex than previously portrayed—in many cases, diets were more diverse than expected, and while salmon were clearly a staple, their importance varied considerably, and the timing and trajectory of salmon intensification was not uniform (e.g., Ames 1991:941, 1994, 1998; Butler and Campbell 2004; Coupland et al. 2010; Gobalet et al. 2004; Monks 1987; Moss 1993, 2012; Moss and Cannon 2011; Thornton et al. 2010; Tushingham and Bencze 2013; Tushingham and Bettinger 2013; Tveskov and Erlandson 2003).

Our understanding of the pre-contact diet has been greatly enhanced by the application of such systematic methodological and analytical techniques as zooarchaeological analyses (in particular of fish bone), the adoption of fine-mesh screening and flotation analysis, and the stable isotope analysis of bone. Within the present study area, systematic fish-bone analyses and fine-grained recovery techniques are relatively new phenomena. While increasing in number and sophistication, these studies are often scattered and reported in hard-to-find reports and the grey literature.

Here we provide a new synthesis of fish-bone data from archaeological sites in southwestern Oregon and northwestern California, with the goal of providing a more complete picture of fish exploitation in the region. We report on over 18,000 fish bones identified from 30 different samples at 22 sites (mostly from coastal settings) in Curry County, Oregon, and Del Norte, Humboldt, and Mendocino counties in California. While there are gaps in our knowledge and variations in data collection techniques (e.g., screen size), the overall picture that emerges demonstrates that people exploited a diversity of species, not just salmon, and that there was a surprising emphasis on small forage fish (e.g., smelt, herring, sardines, and anchovies) and intertidal fish species. Furthermore, the data reveal regional patterns within the study area—for example, the findings suggest a focus on mass-harvested smelt at coastal sites in Humboldt Bay and Del Norte County, while evidence from other sites reveals an emphasis on small to medium fish (e.g., pricklebacks, greenling, rockfish, sculpin) and surfperch, likely taken on an encounter basis in intertidal zones.

In this paper, we examine the archaeology of fish, and highlight implications for the development of mass-harvest techniques, technology, and storage. We also address the importance of fine-fraction sampling towards a better understanding of Late Holocene coastal subsistence and socio-economic developments in the region. This study contributes to the current discourse regarding fish use in other parts of the northwestern Pacific Rim and California, while providing a framework for future work.

POST-CONTACT ETHNOGRAPHIC DATA

Kroeber and Barrett's (1960) *Fishing Among the Indians of Northwestern California* is the primary comprehensive ethnographicsource for Native American fish use in the region. The work compiled published and unpublished ethnographic data related to fishing for regional tribal groups, with a focus on Yurok, Karuk, Hupa, Tolowa, Wiyot, Chilula, and Whilkut fishing and technology. Kroeber and Barrett (1960) focused on the exploitation of riverine species, with only a short section on coastal fishing, followed by a chapter on shellfish and one on marine mammal hunting. Baumhoff (1963:177) addressed the importance of riverine anadromous fisheries and of fish taken within the "immediate coastal waters," as opposed to pelagic fishing and marine mammal hunting, which were more characteristic of the central and northern Pacific Northwest Coast. Indeed, he found that the aboriginal population was a reflection of fish productivity (measured in "fish miles") in northwestern California, a fact that underscored the importance of salmon in the region. Salmon comprised a primary staple for all groups in the study region south to the Mattole/ Sinkyone area, while acorns and game may have been more important than fish among some interior southern Athabascan groups (Baumhoff 1963:173; Elsasaser 1978:192).

River Fishing

Key river spawning species include king or chinook salmon (*Onchorhynuchus tshawytscha*), silver or coho salmon (*O. kisutch*), chum salmon (*O. keta*), steelhead (*O. mykiss*), cutthroat trout (*O. clarki*), Pacific lamprey (*Entosphenus tridentatus*), white sturgeon (*Asipenser transmontanus*), and candlefish or eulachon (*Thaleichthys pacificus*). All northwest California streams had fall-run king salmon, silver salmon, and steelhead trout, though only the Smith, Klamath and Trinity rivers had a spring run of king salmon as well (Baumhoff 1963:174). Sturgeon, which can reach great sizes, are present in the lower reaches of larger streams when they spawn in February to early March. Sturgeon were speared or harpooned, and captured with lift nets, drifting bag nets, set or gill nets, or through noosing or riding or "wrestling" to shore (Kroeber and Barrett 1960:6, 8, 36, 40, 51, 54, 77, 87). Candlefish were formerly abundant in the lower reaches of the Klamath and Eel rivers. These small fish were highly prized for their oil content and spawned in great numbers, generally in the late winter to mid spring; typical capture methods involved fishing with plunge and scoop nets from shore or from canoes (Kroeber and Barrett 1960:45). According to Melvin Brooks, a Yurok fisherman, people netted candlefish on the lower Klamath up until about 30 years ago, when the run began to decline (Melvin Brooks, personal communication 2009). Today the fish has been virtually extirpated in California rivers and is a threatened species.

Salmon fishing technology involved a wide variety of ingenious fishing implements and facilities, including spears, nets, and weirs or fish dams (Hewes 1947; Kroeber and Barrett 1960; Rostlund 1952). Weirs included both fixed and movable types. Movable weirs were made of woven brush mats that were used where needed and rolled up when fishing was completed (Kroeber and Barrett 1960:29). Fixed weirs were dams made of rock and/or wood and brush, which acted to obstruct fish on their spawning route (Fig. 1). They were V-shaped or straight, and ranged from a simple line of rocks to more complex structures, with impounding corrals and platforms for harvesting fish. Nets varied in style, and included eight conical forms, four flat forms, and one cylindrical type. Some conical nets were staked in the water or were dragged with a canoe. The largest conical net was the lifting type, which was typically used at staging areas or on platforms above strong eddies. The net was attached to an A-frame of poles and fastened to shore to guard against the strong current. Fishermen stood on the platform and lowered the triangular net into the water; once the net contained a fish, it was raised, and the fish was clubbed (Kroeber and Barrett 1960:32). Plunge nets were also mounted on an A-frame, but the poles were longer and were fastened with a head bar. The net was thrust into the water and held either to the side or caught with the head. A hat was worn in the latter case as a protection against the strong current (Kroeber and Barrett 1960:42).

Other fishing equipment included basketry traps, eel pots, gaffs, harpoons (single and double barbed), hooks, gorges, wooden fish clubs and egg mashers, crab claw alarm rattles, fish knives, eel slitters, jaw breakers, floats, sinkers, anchors, net weights, and gauges or shuttles. According to Kroeber and Barrett (1960), there was a general pattern of technological complexity among the Yurok, Hupa, and Karuk. Technological complexity decreased beyond the boundaries of these core groups.

Coastal Fishing

Generally, much less is documented about coastal fishing. According to Kroeber and Barrett (1960), the emphasis on salmon was simply due to their relative ease of capture and predictable abundance: "In the ocean, the Indians had more difficulty taking fish than in streams. There were undoubtedly more species of salt-water than of riverine fisheries available, but as some of these were never fished for and others were to be seen only

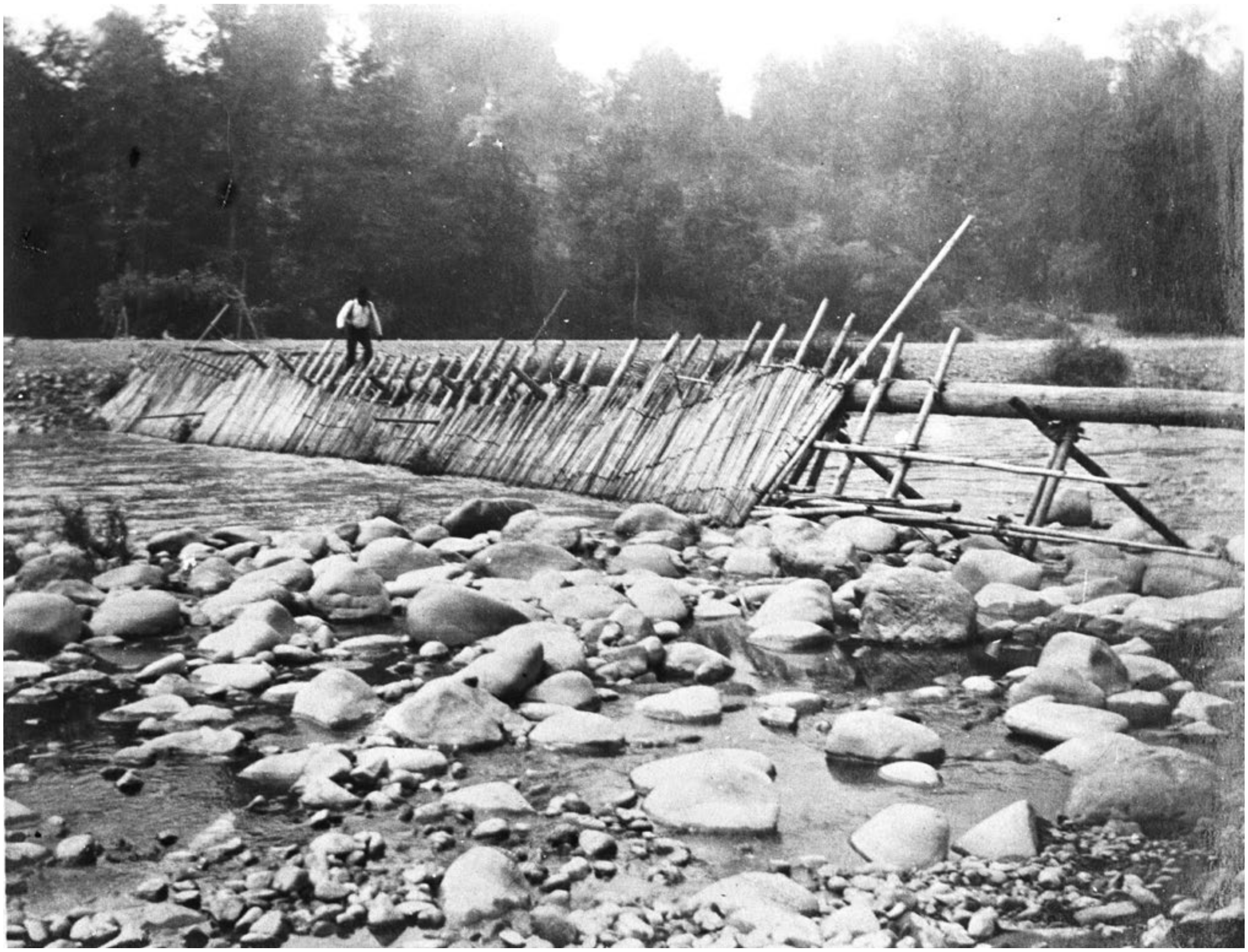

Figure 1. Man walking across top beam of fish dam on the Trinity River, Hoopa Valley. Peter Palmquist/ Yale Collection, Humboldt State University, Image 2012.02.0722.

sporadically, it is unnecessary to list all the species. Both mollusks and mammals were more important to the Indian than fish" (Kroeber and Barrett 1960:6). The authors posit that one exception to this pattern is the Wiyot area of the Humboldt Bay estuary, which "was the only sheltered body of salt water in the region, and more kinds of sea fish were taken there, probably, than in all of the remainder of the coast" (Kroeber and Barrett 1960:6). However, "true pelagic fishing was almost entirely absent, except as noted in speaking of sea fishing and sea-lion hunting" (Kroeber and Barrett 1960:7). In terms of littoral fishing, which included capture on rocky cliffs and sandy beaches, " shore-dwellers took moderate numbers of fish by means of hook and throw line from the rocks along the coast; such rocks also yielded shellfish and seaweeds" (Kroeber and Barrett 1960:7).

Small forage fish (e.g., smelt, herring, sardines, and anchovies) were a particularly abundant and important resource in the region: "The fishing grounds of the Indians were not limited to the rivers, for the ocean shore furnished an abundant supply of fish as well. The Crescent City Herald in 1857 described a school of fish, including smelt, sardines, and other fish so small that ninety could be dipped up with one sweep of a cigar box. The shore at Crescent City was covered with fish a foot deep. Judging from the actions of water fowl, the fish extended three-quarters of a mile seaward, and they were so numerous that three men found it impossible to row a skiff through them" (Loud 1918:238).

Beach spawning smelt (osmerids) were possibly the most important marine food in the diet of north coast groups. Powers (1877:51) referred to them as "silver

Figure 2. Yurok man holding "V-shaped" smelt fishing net.
Ruth Roberts Collection, Humboldt State University, Image 1999.24.0318.

bullion," and Kroeber and Barrett (1960:6) ranked them highest in importance of all sea foods, above shellfish, marine mammals, and pelagic fish, which they judged to be of minimal importance. Beach spawning smelt include *Allosmerus elongates* (whitebait smelt), *Spirinchus starski* (night smelt), *Hypomesus pretiosus* (surf smelt), and *Spirinchus thaleichthys* (longfin smelt). Surf fish were captured in the surf at temporary camps in the late summer, at a time of the year when fish-drying conditions were ideal; i.e., during warmer, less foggy periods, usually between June and July. Probably the best documentation of smelt fishing is associated with the Tolowa (Gould 1966a, 1966b, 1975; see also Tushingham et al. 2013). Surf fish were pursued by the Tolowa during the late summer; villagers moved to a number of temporary special-use camps along the coast. These places were often owned (see below), and were located adjacent to surf smelt spawning grounds, which are limited to certain sandy beaches with conditions favorable to smelt.

Surf fishing technology included V-shaped dip nets (Fig. 2), used by coastal groups such as the Tolowa, Yurok, Wiyot, Mattole, and Sinkyone, and semi-circular arc nets, used in southern areas by such groups as the Kato and Yuki (Driver 1939:312; Hewes 1947). The net was lowered into a wave, and as the tide went out, the fish funneled in and the net was extracted (Gould 1966a, 1966b, 1975; Kroeber and Barrett 1960:44; Tushingham et al. 2013).

Among the Tolowa, once surf fishing was completed, the dried fish were packed and transported back to home-base villages. As surf fish diminished, families would then venture inland to procure acorns and salmon, although surf fishing and the salmon harvest occasionally overlapped, presenting a scheduling conflict (Gould 1966a; Tushingham and Bencze 2013).

Fish Processing and Storage

Ethnographic documentation of fish preparation methods focuses on mass-harvested species. For salmon, preparation methods included splitting and cutting the fish into slices, after which they were smoke or sun dried outdoors or on scaffolds inside family houses. Occasionally there were special drying houses; the Wiyot were noted to have stacked smoked fish in houses "…as with cord wood, for winter" (Driver 1939:315, 381).

Figure 3. Maggie Pilgrim (Yurok) drying surf fish at Luffenholtz Beach (2.3 miles south of Trinidad). 1951 photo by Thelma Moore. Boyle Collection, Humboldt State University, Image 1999.03.1699.

Fish bones were ground, and grease and berries were added for taste. The Tolowa mixed ground fish bones with fish scraps to make hash (Driver 1939:381).

For mass-captured smelt, women dried the fish at temporary camps located on beaches in a process that took about 2–3 days, depending on weather conditions, and then brought the dried fish back to home-base villages for storage, where they were eaten on an "as needed" basis (Fig. 3) (Gould 1966a, 1966b, 1975; Kroeber and Barrett 1960:44; Tushingham et al. 2013). Despite the great majority of fish being dried and transported elsewhere, a smaller number of the fish were eaten immediately and discarded in roasting pit features while people were at the fish camp, and the remains of these fish are sometimes found archaeologically in association with such features at coastal fish camp sites (Tushingham et al. 2013). According to Tolowa and Yurok consultants, bones were not consumed in the traditional preparation of surf smelt, which involved "popping off" the head of the fish and opening it like a book. The innards and vertebral column were then discarded prior to consumption (Melvin and Richard Brooks, personal communication 2009; Tushingham et al. 2013:32–33).

Women directed and performed most fish processing tasks. As described by Gould (1966a) for the Tolowa, women's labor was the link to a man's wealth quest. Women "…bore the brunt of the tedious, day-to-day labor of preparing and storing away food," such as the smoking and drying of fish (Gould 1966a:70). Subsistence items were limited to the amount a man's wife could process. A man with many wives enhanced his prestige by gaining access to more processed and stored food that could then be exchanged for treasures such as dentalia and woodpecker scalps (Gould 1966a:70). Processed and dried fish, along with other stored foods such as acorns and meat, were kept in houses, which functioned as large storage facilities (e.g., Ames et al. 2008; Tushingham 2009). The Sinkyone also used outdoor storage facilities, in addition to the within-house food storage (Driver 1939:316).

Figure 4. Alice Spott (Taylor), sister of Robert Spott, with Harry Roberts on the Klamath River. 1917 photo by Alice Roberts. "Spott Family had ancestral rights to fish nearby" (Armand 2010:16). Ruth Roberts (Palmquist) photograph collection, Humboldt State University, Image E78 C15 R62.

Fishing Rights and Ownership

Like other subsistence pursuits, most fishing in the region was conducted by individuals or small groups. Community-level pursuits (such as large weirs) were relatively uncommon. Some salmon fishing (via weirs) and offshore marine mammal hunting was done collectively, though participation was voluntary. This was similar to smelt fishing; wealthy men typically moved to fish camps when the fish were ready to harvest, and other villagers could join them if they wanted, and while people might fish on the same beach, the spoils of a family's labor belonged to them alone (Gould 1966a).

The construction of some weirs, such as the famous Kepel dam, was a communal endeavor, associated with strictly prescribed ritual (Waterman and Kroeber 1938). At Kepel, a formulist oversaw the construction of ten named sections, which were built by ten groups of men. Each section had a gate with an enclosure where fish were taken with dip nets. The Kepel dam was torn down after ten days; a Deerskin and Jump dance followed. The entire endeavor lasted about 50–60 days, and was "…the most elaborate undertaking of any kind among the tribes of the Northwestern region" (Kroeber and Barrett 1960:12). Most weirs, however, were smaller and less complex, and participation at even the largest weirs was purely voluntary.

As with all valuable property and wealth items, rights to productive resource procurement locations (e.g., high-yield fishing spots and oak groves) were owned. There were a finite number of such patches and rights to them were coveted. No matter how abundant a particular resource was, ownership limited access by outside groups or individuals. For example, while ownership rights to productive fishing spots was common (Fig. 4), the number of such places was limited by "environmental factors [which made] some localities suitable for building weirs or setting gill nets, [which had] special combinations of depth of water, current speed, type of bottom. Such places were infrequent" (Drucker 1983:3). Fishing in such high-yield owned locations typically involved a complex technology, including weirs, basketry traps, and lamprey chutes.

Ownership of valuable fishing places could be held by individuals, while others could be jointly owned by unrelated people, or "rented" out to others for a share of the catch (Driver 1939:316–317). In the case of joint ownership, a complex rotation system of rights to fishing locations was followed (Kroeber 1925:33; Kroeber and Barrett 1960:3). As with other owned places and objects, there were specific monetary values and rules associated with valuable fishing spots. For example, the value of a fishing spot might be from one to three dentalia (shell bead money). They could be sold, given away or passed to kin by inheritance. Ownership was not limited to the vicinity of the owner's residence, and might be "far flung" (Kroeber and Barrett 1960:3–4). Among some groups, owners of fishing spots could be held liable if a renter or bystander was injured at these locations (Driver 1939:317). Ownership extended to the use of certain kinds of technology. For example, only wealthy individuals could own and maintain large gill nets. Individuals who did not own anything could still fish—but this was limited to commons areas (low-yield areas open to anyone) where simpler technological items such as harpoons, gaffs and drag nets were employed (Kroeber and Barrett 1960:4).

In summary, ethnographic documentation of fishing in the region points to an overwhelming emphasis on mass-harvested fish, especially river-captured salmon. Much less is known about fishing along the coast. True pelagic fishing was rare, and while littoral or near-shore fishing was more common, the most important coastal fishes were beach-spawning smelt, which were a seasonally abundant and mass-harvested resource. The ethnographic emphasis on riverine fishing is a critical point to keep in mind as we turn to the archaeology of fishing; most of the present archaeological data derive from coastal sites.

THE ARCHAEOLOGY OF FISHING

The origin and antiquity of intensive fishing, involving mass harvest methods, complex technology, and storage in northwestern California and southwestern Oregon, is a question that has been addressed by a number of scholars. For many years, it was assumed to be a very late phenomenon, perhaps related to the emergence of the "Gunther pattern," which was associated with an influx of northern peoples into the area who "brought with them" the skills and technology associated with an intensive riverine and coastal way of life, including the mass harvest and storage of fish (Fredrickson 1984). Models marrying linguistics with archaeological findings, mostly from coastal contexts, widely assumed that these events occurred no earlier than around 1,100 B.P. and as late as 700 B.P., when Algic-speaking peoples such as the Wiyot and Yurok entered the area, perhaps via the Columbia River Basin, displacing *in situ* Hokan-speaking groups (e.g., the Karuk) who were highly mobile, broad spectrum hunter-gatherers with a focus on interior resources (Whistler 1979). Algic speakers were "river adapted," and are posited to have introduced the bow and arrow, the simple harpoon, tobacco-smoking, and grave-pit burning burials to the area. Athabascan speakers, also originating from the north, including the Tolowa, Hupa and Mattole, entered the area around 900–700 B.P. These people were adapted to "rough and forested regions" and introduced some items of technology, including the toggling harpoon and sinew-backed bow (Whistler 1979).

According to Golla (2007), Whistler's dates are too late to account for regional linguistic diversity. He assumes that the Wiyot settled Humboldt Bay around 1,900 B.P., and that the Yurok arrived on the Klamath River between 1,300–1,200 B.P., followed by the Athabaskans who settled the Trinity-Eel drainage no later than 1,200–1,100 B.P. Golla suggests that the "Gunther complex" is not necessarily associated with all Algic speakers, and that its development is likely associated with the arrival of the Yurok.

Hildebrandt and Hayes (1983) posit a more gradual, *in situ* development—salmon and acorns became a focus of subsistence much earlier, by about 3,000 B.P., when more sedentary settlements emerged along rivers. Intensive fishing and the storage of salmon, and an intensified use of acorns, were tied to this more sedentary lifestyle. In this scenario, the coast was intensively occupied later, at the earliest around 1,500–1,000 B.P. (Hildebrandt and Levulett 2002). This was largely because "the origin of coastal resource use along the entire California coast is in large part determined by conditions in the interior" (Hildebrandt and Levulett 2002:318; see also Hildebrandt and Levulett 1997). In other words, the value of inland resources in northwestern California was much greater than that of resources in coastal zones, thus explaining the primacy of inland settlement.

Both the migration and *in situ* models present plausible scenarios, but, until recently, any critical evaluation of their validity was limited by the paucity of archaeological investigations in interior river settings. To further explore these models, Tushingham (2009) conducted studies at a series of archaeological sites located on the Smith River, the ancestral home of the Athabascan-speaking Tolowa. Excavations revealed an 8,500-year sequence of occupation, with evidence for increased settlement and intensive acorn use by around 3,100 B.P. Intensive fishing and the pursuit of coastal resources was much later in time, and coincided with the emergence of plank-house village life at these sites by about 1,250 B.P. Therefore, these events occurred much earlier in Tolowa country than is proposed in the migration model, which posits that the area was not intensively occupied until Athabascan entry around 700 B.P. (Whistler 1979). However, the intensive use and storage of salmon occurred later than is proposed by the *in situ* model (3,000 B.P.; Hildebrandt and Hayes 1983). Tushingham (2009, 2013) has suggested that intensified acorn use and decreased mobility was developing by 3,100 B.P., but that plank houses, which functioned as large, permanent storage facilities, were a key development, and that intensive fishery exploitation, including mass harvesting and large-scale storage, was part and parcel of a way of life that—once introduced (at the latest by 1,250 B.P.)—rapidly spread throughout the region in an emergence that cross-cut ecological zones and involved multiple linguistic communities. Recent work at several key coastal sites in the region is giving us a better understanding of the timing and trajectory of intensive fishing in this area (see discussion below).

A key point is that, as explained by the front-loaded/back-loaded model (Bettinger 1999a, 1999b, 2009), the intensified use of salmon and other "front-loaded" resources involves costs and risks that often go unrecognized. For example, because the bulk storage of salmon involves a significant labor investment on the front end (the work involved prior to storage), it poses a risk for more mobile groups who are not tethered to specific locations and might not use cached food. Therefore, despite the enormous potential of anadromous fish, intensification of the resource may have been delayed, and was likely resisted, because people had an attractive "back-loaded" alternative, acorns—a resource that is easy to procure and store, but costly to prepare for consumption. In other words, acorns, despite having significant back-end processing costs (and higher overall costs compared to salmon), can be put away for storage without much work, and thus are a low-risk alternative for more mobile groups that may not return to stored caches. However, in northwestern California, once people began living in large, semi-subterranean plank houses, the probability of using stored resources immediately increased to the point that salmon and other front-loaded resources could enter the diet (Tushingham 2009; Tushingham and Bettinger 2013).

With this theoretical backdrop in mind, we now turn to direct evidence of fishing in the form of faunal remains. There is no question that fishing has been a major topic in regional scholarly research for some time. Yet, as is the case in other parts of North America, the use of modern recovery techniques and the systematic analysis of fish bone are relatively recent phenomena. The first mention of archaeologically-recovered fish bone is by Loud (1918) at *Tuluwat* (CA-HUM-318/H), but the specimens collected were not analyzed. The earliest formal fish-bone identifications were conducted by Follett (1965) on materials excavated by Gould (1966a) at Point St. George (CA-DNO-11); these data were later reported in Tushingham and Bencze (2013). The earliest modern analyses of fish bone were conducted on materials recovered from sites located within the King Range National Conservation Area, beginning in the 1970s (Levulett 1985; Levulett and Hildebrandt 1987; Waechter 1988, 1990). More recently, there has been a significant uptick in this type of work at sites in Del Norte and Humboldt counties in California, and in Curry County, Oregon (e.g., Hale and Laurie 2012; Minor 2012; Tushingham and Bencze 2013; Tushingham et al. 2013; Tushingham et al. 2015; Whitaker and Tushingham 2011, 2014). The analysis of these data provides significant new insights and is reported below.

STUDY SITES

We assembled fish-bone data from 22 sites from northwestern California and southwestern Oregon to better understand pre-contact fish abundance and consumption patterns (Fig. 5, Table 1). The synthesis includes data from 30 samples involving a total of 18,153 fish bones identified from sites that included villages, field processing stations, and camps (Table 2). Most of the sites date to the Late Prehistoric Period (after 1,500 B.P.). Fish bone recovered from Middle Period (Mendocino Pattern) contexts (3,000–1,500 B.P.) was limited to samples recovered from the Point St. George I (PSG I) deposit at Point St. George (CA-DNO-11, Sample A in Tables 1-2), the Middle Period component at Red Elderberry Place (CA-DNO-26, Sample A), the lower levels of CA-HUM-277 (Sample A), and Trench MT4 deposits at *Tcetxo* (35-CU-42, Sample A). The sample consists primarily of data collected from coastal sites, with only one inland site represented (CA-DNO-26). Recovery methods varied from no screening, to 1/4" and 1/8" screening, to a more modern use of 1/16" fine mesh.

North of Humboldt Bay

The northernmost site considered in the study is *Tcetxo* (35-CU-42), a Chetco coastal village at Brookings Harbor, Oregon that was recently excavated by Minor (2012). Faunal analysis was restricted to samples from two mechanical trenches (MT2 and MT4) due to the large amount of material recovered from the site and the disturbed nature of some areas. The M4 trench (35-CU-42, sample A in Table 1) yielded dates (1,740 ± 30 and 2,010 ± 30 radiocarbon years before present [RCYBP]) indicating use during the Middle Period, while the MT2 trench (35-CU-42, sample B in Table 1) dates later (1,310 ± 30 B.P. and 1,530 ± 30 RCYBP), indicating occupation during the early Late Period. Significantly, both components contained substantial midden, faunal materials, and artifacts similar to those found at later Gunther Pattern sites on the coast of northwestern California, indicating that "lifeways correlative with the Gunther Pattern were practiced as much as 1,000 years earlier than previously estimated" (Minor 2012:111). Identified fish bone in both components at *Tcetxo*, recovered in 1/8" screens, is dominated by rockfish and other fish available in near-shore littoral zones (e.g., surfperch and greenlings), and salmon (Table 2, Fig. 6a). There is a significant increase in the overall numbers of fish in the later component (from n = 592 identified fish in the Middle Period component to n = 1,688 in the Late Period component), and small forage fish (herring; n = 28) appear to be restricted to the later occupation (Table 2). As noted by Minor (2012:106), this suggests a continued emphasis on the local fishery: "With the exception of salmon/trout which could have been caught farther upriver, the fish species represented are typically found in estuaries or in near-shore environments like those available in Chetco Cove."

In the early 1960s, Richard Gould excavated over 1,000 cubic meters of soil at the Tolowa village of *Ta'giatun* (CA-DNO-11) at northern Point St. George (Gould 1966a). Excavations revealed two components, Point St. George I (PSG I), a Middle or Mendocino period (3,000–1,500 B.P.) component representing a short-term camp with an associated radiocarbon date of 2,260 ± 210 B.P. (Gould 1972), and Point St. George II (PSG II), a Late or Gunther period (1,500—150 B.P.) occupation, which was associated with the emergence of a sedentary plank-house village at the site. Dramatic differences were observed between the artifact assemblages, features, and faunal remains associated with the two excavated site components, although fish-bone data were limited due to a lack of screening. A sample of fish bone from the site was analyzed by W. I. Follett (1965) and later reported in Tushingham and Bencze (2013). Follett identified a total of 183 fish bones, which also revealed a dramatic difference between site components. Four rockfish bones were identified in Middle Period (PSG I) deposits (Tables 1–2, DNO-11 sample A), including black rockfish (*Sebastodes melanops*; n = 2) and turkey-red rockfish (*Sebastes miniatus*; n = 2). In contrast, Late Period (PSG II) deposits included a wide variety of fish, dominated by rockfishes (n = 128), sculpins (n = 9), Pacific halibut (*Hippoglossus stenolepis*; n = 12), and salmonids (n = 11) (Tables 1–2, DNO-11 sample B). Two pelagic species of fish were identified in the PSG II deposit. These included vermillion rockfish (n = 11) and turkey-red rockfish *(Sebastes ruberrimus*; n = 62), which is notable as these species occur "…in water 30 fathoms or more in depth, over rocky bottom. Such conditions are found in the vicinity of Northwest Seal Rock…some six and one-half miles off Point St. George" (Follett 1965, as cited in Gould 1966a:85). Both Gould (1966a) and later researchers

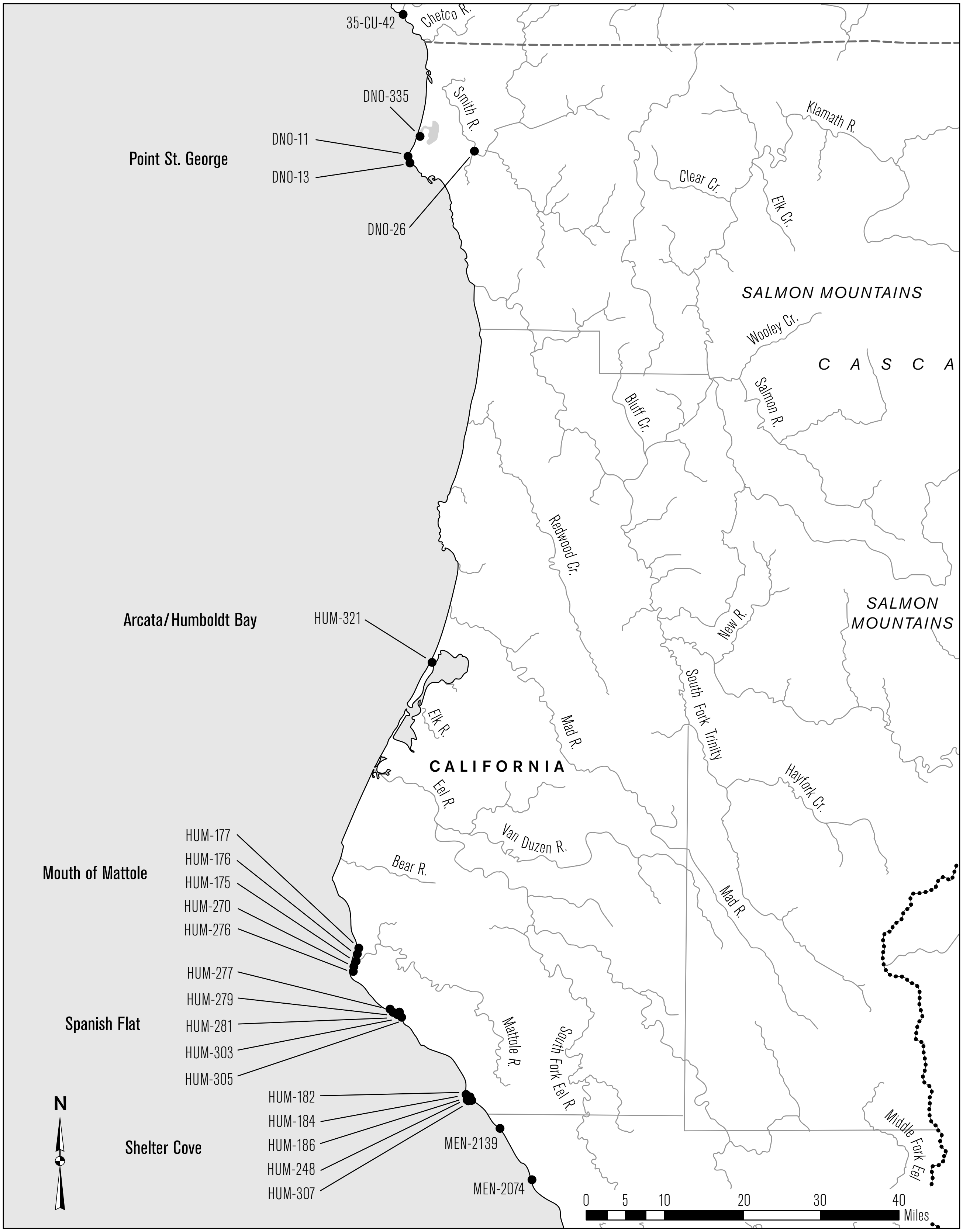

Figure 5. Study sites.

Table 1

SITE SAMPLE SUMMARY

Trinomial	Sample[a]	Site Name	Site Type	Component	Associated conventional radiocarbon dates	Calibrated median dates[b]
Curry County, Oregon						
35-CU-42	A	*Tcetxo*	Residential area	Middle Period (Trench MT4)	2,010 ± 30 B.P. (BETA-320213)	1,910 cal B.P.
					1,740 ± 30 (BETA-320214)	1,653 cal B.P.
35-CU-42	B	*Tcetxo*	Midden	Late Period (Trench MT2)	1,530 ± 30 B.P. (BETA-321113)	1,420 cal B.P.
					1,310 ± 30 B.P. (BETA-321114)	1,253 cal B.P.
Del Norte County						
CA-DNO-335		Sweetwater	Smelt Camp	Late/Contact Period	165 ± 50 B.P. (CAMS-114834)	167 cal B.P.
CA-DNO-26	A	Red Elderberry	Camp	Middle	2,290 ± 35 B.P. (CAMS-114833)	2,317 cal B.P.
					2,935 ± 45 B.P. (CAMS-114832)	3,098 cal B.P.
					3,630 ± 100 B.P. (CAMS-114838)	3,942 cal B.P.
CA-DNO-26	B	Red Elderberry	Village	Late	1,165 ± 50 B.P. (CAMS-114828) (House 3)	1,087 cal B.P.
CA-DNO-26	C	Red Elderberry	Village	Contact[f]		
CA-DNO-11	A	Northern Point St. George	Camp	Middle Period (PSG II)	2,260 ± 210 B.P. (I-04006)	2,282 cal B.P.
CA-DNO-11	B	Northern Point St. George	Village	Late Period (PSG I)		
CA-DNO-11	C	Northern Point St. George	Village	Late Period (PSG I)	1,900 ± 25 B.P. (NOSAMS-86017)	1,137 cal B.P.[d]
					1,980 ± 25 B.P. (NOSAMS-86018)	1,216 cal B.P.[d]
					1,410 ± 25 B.P. (NOSAMS-86019)	658 cal B.P.[d]
					675 ± 25 B.P. (NOSAMS-86020)	651 cal B.P.
CA-DNO-11	D	Northern Point St. George	Village	Late Period (PSG I)	Same as above (DNO-11, sample C)	
CA-DNO-11	E	Northern Point St. George	Village	Late Period (PSG I)	470 ± 40 B.P. (BETA-287650)	880 ± 40 B.P.[d]
					410 ± 40 B.P. (BETA-287651)	830 ± 40 B.P.[d]
					310 ± 40 B.P. (BETA-287652)	360 ± 40 B.P.
					360 ± 40 B.P. (BETA-287653)	770 ± 40 B.P.[d]
CA-DNO-13		Southern Point St. George	Village	Late Period	1,040 ± 25 (NOSAMS OS-78016)	220 cal B.P.[d]
					930 ± 25 (NOSAMS OS-78017)	247 cal B.P.[d]
					910 ± 30 (NOSAMS OS-78018)	220 cal B.P.[d]
Humboldt Bay						
CA-HUM-321		Manila	Village	Late Period	1,810 ± 30 (NOSAMS 83585)	1,050 cal B.P.[d]
					1,810 ± 35 (NOSAMS 83586)	1,050 cal B.P.[d]
					2,070 ± 25 (NOSAMS 83587)	1,309 cal B.P.[d]
Mouth of Mattole						
CA-HUM-175			FPS	Late Period	510 ± 80 B.P. (UCR-1277)	539 cal B.P.
					390 ± 75 (UCR-1278)	427 cal B.P.
CA-HUM-176			FPS	Late Period	320 ± 75 B.P. (UCR-1280)	383 cal B.P.
CA-HUM-177			FPS/Camp	Late Period	2,225 ± 120 B.P. (UGA-2499	2,224 cal B.P.
					1,055 ± 75 B.P. (UGA-2498)	975 cal B.P.
					1,270 ± 100 (UCR-879)	1,185 cal B.P.
					490 ± 60 (UCR-1282)	525 cal B.P.
					380 ± 60 (UCR-1281)	424 cal B.P.
					300 ± 100 (UCR-878)	351 cal B.P.
CA-HUM-270			FPS	Late/ Contact Period	[c]	
CA-HUM-276			Camp	Late Period	390 ± 50 (BETA-12645)	439 cal B.P.
					290 ± 50 (BETA-12643)	376 cal B.P.
					1,270 ± 50 (BETA-12644)	1,211 cal B.P.

Screen Size	Fish Bone Analyst	References
1/8"	Julie A. Ricks	Minor (2012)
1/8"	Julie A. Ricks	Minor (2012)
1/16"	Timothy Carpenter	Tushingham et al. (2013)
1/8"[e]	Amy Spurling & Timothy Carpenter	Tushingham (2009)
1/8" & 1/16"	Amy Spurling & Timothy Carpenter	Tushingham (2009)
1/8" & 1/16"	Amy Spurling & Timothy Carpenter	Tushingham (2009)
none	W.I. Follett	Gould (1966); Follett (1965); Tushingham and Bencze (2013)
none	W.I. Follett	Gould (1966); Follett (1965); Tushingham and Bencze (2013)
1/4"	Kenneth Gobalet	Whitaker and Tushingham (2011, 2014)
1/16"	Kenneth Gobalet	Whitaker and Tushingham (2011, 2014)
1/16"	Kenneth Gobalet	Hale and Laurie (2012)
1/16"	Kenneth Gobalet	Tushingham and Bencze (2013)
1/16"	Justin Hopt	Tushingham et al. (2015)
1/8"	Kenneth Gobalet	Levulett (1985); Hildebrandt and Levulett (2002)
1/8"	Kenneth Gobalet	Levulett (1985); Hildebrandt and Levulett (2002)
1/8"	Kenneth Gobalet	Levulett (1985); Hildebrandt and Levulett (2002)
1/4" & 1/8"	James P. Quinn	Levulett and Hildebrandt 1987
1/4"	James P. Quinn	Levulett and Hildebrandt 1987

(Hildebrandt 1981, 1984; Jobson and Hildebrandt 1980) concluded that the presence of these species indicated that people were fishing at distant locations in large, seaworthy canoes—a conclusion that was rejected by both Hudson (1981) and Lyman (1991, 1995).

Additional work at northern Point St. George (CA-DNO-11) includes recent studies by Whitaker and Tushingham (2011, 2014), and by Hale and Laurie (2012). Fish bone was identified in both 1/4" screened samples (Whitaker and Tushingham 2011; CA-DNO-11 sample C in Tables 1–2) and in 1/16" samples taken by Whitaker and Tushingham (2011; CA-DNO-11, Sample D in Tables 1–2) and by Hale and Laurie (2012; CA-DNO-11, Sample E in Tables 1–2). The application of fine-grained techniques resulted in the identification of considerably more fish bones than were recovered by Gould (1966a), especially those of small forage fish, including smelt (Table 2). These studies also included eight AMS radiocarbon dates, all falling within the Late Period (Table 1).

Recent studies at the nearby village of *Tatitun* (CA-DNO-13), located at the southern end of Point St. George, employed fine-grained methods, in contrast to Gould's earlier work (Tushingham and Bencze 2013). The residents of the village of *Ta'giatun* (CA-DNO-11) moved to *Tatitun* after a plague ravaged their community, an event that Gould (1966a) estimated to have occurred sometime between the 1700s and early 1800s. Flotation analysis of 12 liters of soil revealed the presence of a diverse number of fish, shellfish, and burned nuts seeds (including bay laurel, acorn, and hazelnut from the interior). Three recent AMS radiocarbon dates indicate that CA-DNO-13 was in use from the late 1500s to early 1700s

Table 1 (*Continued*)

SITE SAMPLE SUMMARY

Trinomial	Sample[a]	Site Name	Site Type	Component	Associated conventional radiocarbon dates	Calibrated median dates[b]
Spanish Flat						
CA-HUM-277	A		FPS	Middle Period	2,505 ± 85 (UCR-1290)	2,573 cal B.P.
					2,515 ± 80 B.P. (UCR-1291)	2,580 cal B.P.
CA-HUM-277	B		Residential area	Late Period	1,725 ± 75 B.P. (UCR-1288)	1,643 cal B.P.
					1,640 ± 170 B.P. (UCR-1289)	1,560 cal B.P.
					980 ± 100 (UCR-1287)	886 cal B.P.
CA-HUM-279			FPS	Late Period		
CA-HUM-281			FPS	Late Period		
CA-HUM-303			FPS	Late Period		
CA-HUM-305			FPS	Late Period		
Shelter Cove						
CA-HUM-182			FPS	Late Period	880 ± 70 B.P. (UCR-1284)	804 cal B.P.
					633 ± 70 B.P. (UCR-1283)	606 cal B.P.
CA-HUM-184			FPS	Late Period		
CA-HUM-186			FPS	Late Period		
CA-HUM-248			FPS	Late Period	860 ± 70 B.P. (UCR-1286)	784 cal B.P.
					220 ± 65 B.P. (UCR-1285)	207 cal B.P.
CA-HUM-307			FPS	Late Period		
Mendocino County						
CA-MEN-2139		Whale Gulch	Camp	Late Period	110 ± 70 B.P. (BETA-25114)	133 cal B.P.
					170 ± 70 B.P. (BETA-24301)	170 cal B.P.
					450 ± 70 B.P. (BETA-25115)	488 cal B.P.
CA-MEN-2074		Jackass Creek	FPS	Undated[f]		

[a]Sample Reference (see Table 2); FPS = Food processing station.
[b]Radiocarbon dates calibrated using Calib 7.1 software.
[c]Occupation likely during A.D. 1800s; radiocarbon date "indistinguishable from the modern references of 1,950 B.P." (Levulett and Hildebrandt 1987:168).
[d]Radiocarbon dates on shellfish, corrected for the marine reservoir effect using a Delta R correction of 316 ± 85 years.
[e]Some column sampling
[f]Diagnostic artifacts and documentary evidence suggest date of A.D. 1850 – 1902 (Tushingham 2009, 2013)

(Table 1). The application of fine-grained methods led to the discovery of an astonishing number of small forage fish bones. The fish bone assemblage (n = 2,824) includes a wide variety of identified taxa, but is overwhelmingly dominated by smelt (n = 2,791) (Table 2).

Smelt bones were also identified in an eight-liter sample taken from a roasting pit feature associated with Sweetwater (CA-DNO-335), a smelt fish camp. Sweetwater was first recorded ethnographically as *tawašnašrən*, 'Sweetwater Place,' a camp site with several houses and a sweat house (Drucker 1937:228), that was used by the Tolowa community until about the 1930s (Tushingham et al. 2013). Without prior ethnohistoric information, archaeological recognition of smelt camps can be difficult, because most of the smelt were dried for storage and transported back to home villages. Smelt bones, however, can be recovered in the remains of roasting pits or hearths—features associated with the cooking and immediate consumption of fish and other collected resources while at the fish camps. These features are important because they not only provide a means of associating coastal sites with the mass harvest of smelt, they also offer an extremely rich snapshot of what people were eating while at these temporary camps. The Sweetwater roasting pit dates to 167 cal B.P. (Table 1). All recovered fish bones (n = 2,385) were identifiable

Screen Size	Fish Bone Analyst	References
1/8"	Kenneth Gobalet	Levulett (1985); Hildebrandt and Levulett (2002)
1/8"	Kenneth Gobalet	Levulett (1985); Hildebrandt and Levulett (2002)
1/8"	Kenneth Gobalet	Levulett (1985)
1/8"	Kenneth Gobalet	Levulett (1985)
1/4"	James P. Quinn	Waechter (1990)
1/4"[e]	James P. Quinn	Waechter (1990)
1/8"	Kenneth Gobalet	Levulett (1985); Hildebrandt and Levulett (2002)
1/8"	Kenneth Gobalet	
1/8"	Kenneth Gobalet	Levulett (1985)
1/8"	Kenneth Gobalet	Levulett (1985); Hildebrandt and Levulett (2002)
1/4" & 1/8"	James P. Quinn	Levulett and Hildebrandt 1987
1/4"?	James P. Quinn	Waechter (1988)
1/4"?	James P. Quinn	Waechter (1988)

as (or compared favorably to) surf smelt (*Hypomesus pretiosus*) (Table 2), confirming that this mass-harvested species was the target species. Both cranial and post-cranial bones were recovered in the feature, which is consistent with the traditional preparation of surf smelt. According to Yurok and Tolowa consultants Melvin and Richard Brooks (personal communication 2009), the head of the fish was popped off, the body opened like a book, and the innards and the vertebral column removed prior to consumption.

Chvn-su'lh-dvn (*TcuncuLtun*), Red Elderberry Place (CA-DNO-26), a Tolowa village site along the Smith River, is to date the only non-coastal site with identified fish bone in northwestern California (Tushingham 2009, 2013). Faunal bone recovery is poor in inland settings, and despite the excavation of 95 cubic meters of soil (1/8" screening) and significant floatation studies, fish remains were scant. However, with the exception of a single *Squatina californica* (Angel shark or "monk fish") tooth, possibly used as an ornament or tool, all other fish bones (n = 55) recovered from CA-DNO-26 were identified as belonging to the family Salmonidae (Table 2). Most salmon bones (n = 50; 93%) were found in Late Period houses, and nearly all (n = 49) came from House 3, indicating a consumption and storage of fish within the domestic dwelling (Tushingham 2009:122). Salmon bones were also recovered in Middle Period deposits (n = 3) and in a Contact Period sweathouse (n = 2).

Humboldt Bay

The earliest mention of fish bone recovered at an archaeological site in the region comes from the pioneering work of Llewellyn Loud at the site of *Tuluwat* (CA-HUM-67/H), located on Indian Island (Loud 1918). Only 146 pieces of fish bone were collected (Loud 1918:396). However, none of these has been identified to species, and the sample does not include the "pocket of fish bone" found at the site (Loud 1918:396). Despite these limitations, small fish bone was revealed during post-excavation screening of nine soil samples (Loud 1918:345), and Loud concludes that "the Wiyot were preeminently a fisher folk, and no doubt the prehistoric people of this region were the same, as is evidenced by the quantities of fish bones in the excavated site.... As a rule the fish bones were evenly distributed throughout the mound, usually in such small fragments that they were inconspicuous. However, their presence was made plain by putting the mound material through screens.... At the depth of three and a quarter feet there were pockets of fish scales too conspicuous to need screening"(Loud 1918:238–239).

Table 2

FISH BONE DATA

Scientific Name	Common Name	35-CU-42 (A)	35-CU-42 (B)	DNO-335	DNO-26 (A)	DNO-26 (B)	DNO-26 (C)	DNO-11 (A)	DNO-11 (B)	DNO-11 (C)	DNO-11 (D)	DNO-11 (E)	DNO-13	HUM-321	HUM-177	HUM-176	HUM-175	HUM-270
Acipenseridae																		
Acipenser medirostris	Green Sturgeon	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Atherinidae																		
Atherinids	Silverside	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Atherinopsida																		
Atherinopsis californiensis	Jacksmelt	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Clupeidae																		
Clupeids	Herring and sardine	–	–	–	–	–	–	–	–	–	10	–	–	389	–	–	–	–
Clupea pallasii	Pacific Herring	–	28	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Sardinops sagax	California pilchard	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–
Cottidae																		
Cottids	Sculpin	2	3	–	–	–	–	–	–	–	3	–	–	19	–	–	–	–
Enophrys bison	Buffalo sculpin	2	6	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1
Hemilepidotus hemilepidotus	Irish Lord / Bullhead	–	–	–	–	–	–	–	1	–	–	–	–	4	2	–	2	–
Scorpaenichthys marmoratus	Cabezon	22	27	–	–	–	–	–	18	6	1	–	–	–	5	2	6	18
Embiotocidae																		
Embiotocids	Surfperch	3	34	–	–	–	–	–	–	32	5	–	3	14	–	–	–	–
Amphistichus rhodoterus	Redtail surfperch	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
Damalichthys vacca	Pile surfperch	–	10	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Cymatogaster aggregata	Shiner surfperch	2	25	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Embiotoca lateralis	Striped seaperch	42	102	–	–	–	–	–	2	2	1	1	–	–	3	4	–	–
Rhacochilus toxotes	Rubberlip seaperch	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–
Engraulidae																		
Engraulis mordax	Californian anchovy	–	–	–	–	–	–	–	–	–	39	1	2	–	–	–	–	–
Gadidae																		
Gadids	Cods	–	3	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–
Microgadus proximus	Pacific tomcod	18	67	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Gobiesocidae																		
Gobiesox meandricus	Northern clingfish	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–
Hemitripteridae																		
Nautichthys oculofasciatus	Sailfin sculpin	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Hexagrammidae																		
Hexagrammos sp.	Greenlings	47	104	–	–	–	–	–	–	–	8	–	3	40	–	–	–	1
Hexagrammos decagrammus	Kelp greenling	–	–	–	–	–	–	–	1	–	–	–	–	–	2	4	–	4
Ophiodon elongatus	Lingcod	15	43	–	–	–	–	–	1	6	1	–	–	–	2	1	8	1
Hexagrammos lagocephalus	Rock greenling	–	–	–	–	–	–	–	–	13	9	–	–	–	5	5	–	3
Lamnidae																		
Lamna ditropis	Salmon shark	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Merlucciidae																		
Merlucciids	Hake	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Merluccius productus	North Pacific hake	–	–	–	–	–	–	–	1	5	–	1	1	–	–	–	–	1
Myliobatidae																		
Myliobatis californica	Bat ray	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

HUM-276	HUM-277 (A)	HUM-277 (B)	HUM-279	HUM-281	HUM-303	HUM-305a	HUM-182	HUM-184	HUM-186	HUM-248	HUM-307[b]	MEN-2139	MEN-2074	Total
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	1	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	1	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**399**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**29**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**27**
1	–	1	4	36	–	–	1	–	6	–	–	–	–	**59**
–	–	7	2	19	–	–	3	–	–	–	–	–	–	**40**
14	9	88	90	229	8	66	85	2	8	6	16	15	1	**742**
1	–	–	–	–	9	1	–	–	–	–	–	–	1	**103**
–	–	–	1	2	–	–	–	–	–	–	–	–	–	**4**
–	–	–	1	–	–	–	5	–	–	–	–	–	–	**16**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**27**
2	5	37	15	14	–	–	85	1	23	34	4	–	–	**377**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**42**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**6**
–	–	–	–	–	–	–	–	–	–	–	–	–	–	**85**
–	5	62	1	11	–	–	–	–	1	1	–	–	–	**83**
–	–	–	–	1	–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	1	–	–	–	–	–	1	3	**208**
–	2	56	80	17	3	3	10	–	3	–	–	–	–	**185**
1	7	21	16	64	4	4	14	–	14	1	–	10	8	**242**
–	–	22	36	55	–	–	5	–	1	1	11	–	–	**166**
–	–	1	–	–	–	–	–	–	–	–	–	–	–	**1**
–	–	–	–	–	–	–	–	–	–	–	–	1	–	**1**
–	1	34	–	1	–	–	16	–	4	–	–	–	–	**65**
–	–	–	–	3	–	–	–	–	–	–	–	–	–	**3**

Recent work at the Manila site (CA-HUM-321) at Humboldt Bay has revealed early evidence of smelt fishing and intensive shellfish procurement on the North Coast of California (Tushingham et al. 2015). The site is a shell mound owned by the Blue Lake Rancheria near the small, unincorporated town of Manila on Humboldt Bay, located about three miles northwest of CA-HUM-67/H. Collaborative research at the site included flotation and fine-grained analysis of materials. Fish bones analyzed from the site, recovered in 1/16" screens, are overwhelmingly dominated by osmerid (smelt) bones (n = 3075, Table 2; Fig. 6c). The diversity of remains, including stored resources such as smelt, indicate that CA-HUM-321 represents a midden associated with a residential base. All of the occupation levels, including the basal deposit dating to 1,309 cal B.P. (Table 1), contain a variety of foods and provide evidence that the mass harvest and possibly bulk storage of small forage fish was an important procurement strategy by the early Late Period (Tushingham 2011; Tushingham et al. 2015).

South of Humboldt Bay

The earliest modern analyses of fish bone in the study area involve materials recovered from sites located south of Humboldt Bay, and include work done by Levulett and Hildebrandt (1987), Levulett (1985), and Waechter (1988, 1990). Several archaeological sites located in southwestern Humboldt County and northwest Mendocino County were investigated; they are notably similar in age, site content, and location, and are bounded by the mouth of the Mattole River to the north and Jackass Creek to the south (Fig. 1).

These sites are single-component Late Period food processing stations (FPS) or seasonal camps (Table 1). The sites do not indicate a residential occupation, with the exception of CA-HUM-177, which may be remnant of the *bekeno'adin* encampment (Levulett 1985). Another outlier is CA-HUM-

Table 2 (*Continued*)

FISH BONE DATA

Scientific Name	Common Name	35-CU-42 (A)	35-CU-42 (B)	DNO-335	DNO-26 (A)	DNO-26 (B)	DNO-26 (C)	DNO-11 (A)	DNO-11 (B)	DNO-11 (C)	DNO-11 (D)	DNO-11 (E)	DNO-13	HUM-321	HUM-177	HUM-176	HUM-175	HUM-270
Osmeridae																		
Osmerids	Smelt	–	–	1,094	–	–	–	–	–	–	2,595	116	2,791	3,075	–	–	–	–
Hypomesus pretiosus	Surf smelt	–	–	1,291	–	–	–	–	–	–	40	–	–	–	–	–	–	–
Spirinchus sp.	Night or longfin smelt	–	–	–	–	–	–	–	–	–	6	–	–	–	–	–	–	–
Thaleichthys pacificus	Eulachon	–	–	–	–	–	–	–	–	–	4	–	–	–	–	–	–	–
Paralichthyidae																		
Citharichthys sordidus	Pacific sanddab	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Pholidae																		
Apodichthys flavidus	Penpoint gunnel	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
Pleuronectidae																		
Pleuronectiformes	Flatfish	–	–	–	–	–	–	–	–	–	–	–	2	4	–	–	–	–
Eopsetta jordani	Petrale sole	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Platichthys stellatus	Starry flounder	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
*Hippoglossus stenolepi*s	Pacific Halibut	–	–	–	–	–	–	–	12	–	–	–	–	–	–	–	–	–
Rajidae																		
Rajids	Skates and rays	–	–	–	–	–	–	–	–	5	2	–	–	–	–	–	–	–
Raja sp.	Skate	–	–	–	–	–	–	–	–	1	5	3	–	–	–	–	–	–
Raja binoculata	Big skate	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Salmonidae																		
Oncorhynchus sp.	Salmon	35	114	–	3	50	2	–	–	3	9	–	4	–	–	–	–	–
Salmo gairdneri	Rainbow trout/steelhead	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Oncorhynchus kisutch	Coho salmon	–	–	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–
Oncorhynchus tshawytscha	Chinook salmon	–	–	–	–	–	–	–	3	–	–	–	–	–	2	1	–	–
Sebastidae																		
Sebastes sp.	Rockfish	404	1,121	–	–	–	–	–	–	167	13	–	4	1	1	3	1	–
Sebastes flavidus	Yellowtail rockfish	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–
Sebastes melanops	Black rockfish	–	–	–	–	–	–	2	50	–	–	–	–	–	–	–	–	–
Sebastes miniatus	Vermillion rockfish	–	–	–	–	–	–	–	11	–	–	–	–	–	–	–	–	–
Sebastes paucispinis	Bocaccio	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–
Sebastes ruberrimus	Turkey-red rockfish	–	–	–	–	–	–	2	62	–	–	–	–	–	–	-	–	–
Stichaeidae																		
Stichaeids	Prickleback	–	–	–	–	–	–	–	–	3	–	–	2	–	–	–	–	–
Anoplarchus purpurescens	High cockscomb	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Cebidichthys violaceus	Monkeyface prickleback	–	–	–	–	–	–	–	–	1	–	–	3	–	–	–	–	–
Xiphister sp.	Prickleback	–	–	–	–	–	–	–	–	1	5	1	6	–	–	–	–	–
Xiphister mucosa	Rock prickleback	–	–	–	–	–	–	–	–	–	–	–	–	–	5	2	4	22
Squatinidae																		
Squatina californica	Pacific angel shark	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–
Triakidae																		
Triakidae	Hound shark	–	–	–	–	–	–	–	–	–	–	–	–	6	–	–	–	–
Triakis semifasciata	Leopard shark	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Galeorhinus zyopterus	Soupfin shark	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–
Mustelus henlei	Brown smooth-hound	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	TOTAL	**592**	**1,688**	**2,385**	**3**	**51**	**2**	**4**	**179**	**246**	**2,758**	**123**	**2,824**	**3,555**	**29**	**22**	**21**	**51**

[a]Total for HUM-305 does not inc lude 11 "shark or ray" bones not identified to species/ family.

[b]Total for HUM-307 does not include 2 "shark" bones not identified to species/family.

HUM-276	HUM-277 (A)	HUM-277 (B)	HUM-279	HUM-281	HUM-303	HUM-305[a]	HUM-182	HUM-184	HUM-186	HUM-248	HUM-307[b]	MEN-2139	MEN-2074	Total
–	–	–	–	–	–	–	–	–	–	–	–	–	–	9,671
–	–	–	–	–	–	–	–	–	–	–	–	–	–	1,331
–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
–	–	–	–	–	–	–	–	–	–	–	–	–	–	4
–	–	1	–	–	–	–	–	–	1	–	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
–	–	1	–	–	–	–	–	–	–	–	–	–	–	1
–	–	–	–	–	–	–	–	–	1	–	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	12
–	–	–	–	–	–	–	–	–	–	–	–	–	–	7
–	–	–	–	–	–	–	–	–	–	–	–	–	–	9
–	–	2	–	7	–	–	–	–	–	–	–	–	–	9
2	–	–	–	–	2	–	–	–	–	–	–	1	5	230
–	–	–	–	–	–	–	1	–	–	–	–	–	1	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	8
–	–	–	–	1	–	–	1	–	–	–	–	–	–	8
–	4	17	4	4	2	–	3	–	2	2	–	2	5	1,760
–	–	–	–	–	–	–	–	–	–	–	–	–	–	3
–	–	–	–	–	–	–	–	–	–	–	–	–	–	52
–	–	–	–	–	–	–	–	–	–	–	–	–	–	11
–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
–	–	–	–	–	–	–	–	–	–	–	–	–	–	64
–	–	–	–	–	1	19	–	–	–	–	–	3	41	69
–	–	–	–	–		–	–	–	–	–	–	–	–	1
–	–	3	–	–	4	19	2	–	1	–	–	–	–	33
–	–	–	–	–	–	–	–	–	–	–	–	–	–	13
26	87	1,099	181	276	5	52	48	2	26	3	60	–	–	1,898
–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
–	–	–	–	–	–	–	–	–	–	–	–	–	–	6
–	–	–	–	–	–	–	4	–	–	–	–	–	–	4
–	–	–	–	–	–	–	–	–	–	–	–	–	–	2
–	–	–	–	9	–	–	–	–	–	–	–	–	–	9
47	120	1,452	431	749	40	165	283	5	91	48	91	33	65	18,153

277, a site at Spanish Flat that contains both Middle and Late Period components (Table 1). The stratigraphic division of the fish bone samples reported here (Samples A and B in Table 2) is based on component definitions detailed in Levulett (1985:152–153), specifically at the 100 centimeters below surface (cmbs) level in excavation unit 3N/5W, based on radiocarbon dates and associated levels. The southernmost sites considered in this study—Whale Gulch (CA-MEN-2139) and Jackass Creek (CA-MEN-2074)—are located in northern Mendocino County. Whale Gulch is a Late Period camp, while Jackass Creek (as yet undated) is interpreted as a food processing station (Waechter 1988).

Fish-bone recovery methods varied at these sites, and included 1/4", 1/8", and 1/16" screening (Table 1). The results indicate that the site occupants relied heavily on intertidal fish species (Table 2), and while their proportion varies, the fish that are most frequently represented are sculpins, greenlings, pricklebacks, and surfperch (Figs. 6d–g). This is consistent with the original interpretation of these sites as largely short-term Late Period occupations focused on intertidal fishing and shellfish gathering (Levulett 1985). As mentioned earlier, CA-HUM-277 is the only site in this area with well-dated Middle and Late Period occupations. In later times, when the site was associated with "an intensively utilized residential area occupied primarily during the spring-summer months" (Levulett 1985:154), fish bone results indicate an increase in the number and diversity of fish taken, although the focus appears to have remained on the capture of intertidal taxa (Table 2, CA-HUM-277, samples A and B).

REGIONAL TRENDS

While there are a number of issues involving the present data set (e.g., variation in recovery techniques, the low number of fish-bone analyses conducted at archaeological sites

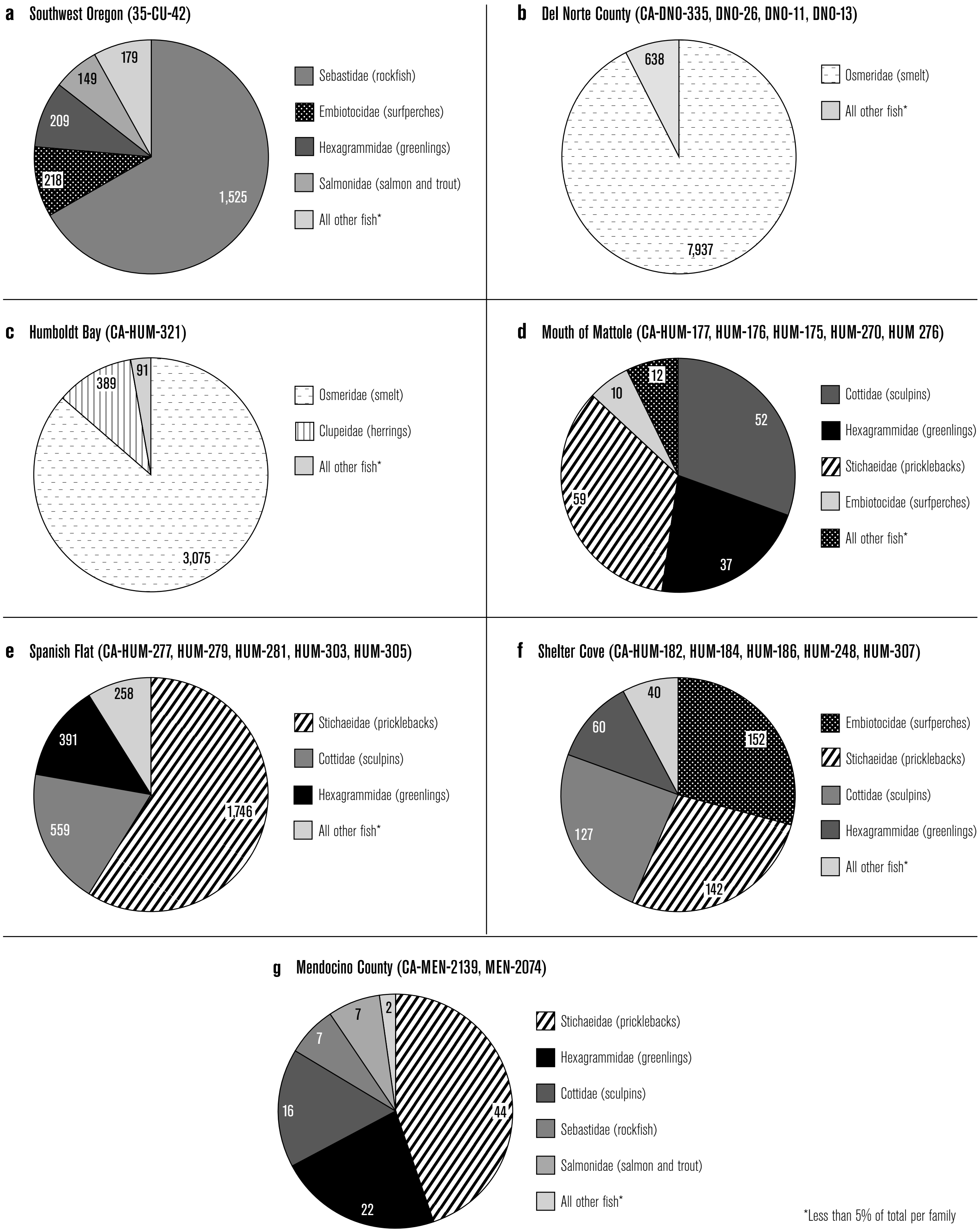

Figure 6. Percent contribution of fish from sites in (a) Curry County, Oregon; (b) Del Norte County; (c) Humboldt Bay; (d) Mouth of the Mattole; (e) Spanish Flat; (f) Shelter Cove; and (g) Mendocino County.

in areas located between Del Norte County and the mouth of the Mattole River, and a paucity of inland site data), this synthesis does reveal some intriguing patterns of fisheries exploitation within the region (Fig. 6). Our discussion, however, is tempered by between-sample variation in screen sizes and recovery techniques, an issue we turn to in the following section.

Archaeological sites in coastal Del Norte County (Table 2, Fig. 6b) and Humboldt Bay (Table 2, Fig. 6c) are overwhelmingly dominated by osmerids (smelt), comprising 92.6% (Del Norte County sites) and 86.5% (Humboldt Bay) of the fish bone recovered in these places. Other identified fish taxa include other small forage fish (e.g., herring, sardines, and anchovy), surfperch, intertidal fishes (e.g., greenlings, hake, pricklebacks) and some rockfish. Notably, salmonids are relatively rare in coastal Del Norte County sites (and absent at CA-HUM-321), and pelagic fish—including Turkey-red and Vermillion rockfish—are few in number and are limited to Gould's unscreened excavations at Point St. George (samples CA-DNO-11A and B in Table 2; Gould 1966a). Overall, the picture that emerges is one involving an emphasis on mass-harvested species—salmon at inland settings (as is the case at Red Elderberry Place, CA-DNO-26), and small forage fish at the coastal and estuarine sites. These mass-harvested fish were supplemented by fish taken on an encounter basis, primarily in intertidal zones, but these played a minor role in subsistence pursuits. This contrasts sharply with data collected from archaeological sites in Oregon and southwestern Humboldt and Mendocino counties.

The *Tcetxo* (35-CU-42) fish assemblage (Table 2, Fig. 6a) is dominated by fish from rocky outcrops within the littoral zone (e.g., rockfish, greenlings, and surfperch), which contribute 85.6% of the assemblage. Of all the coastal sites considered in the study, 35-CU-42 has the highest overall count of salmonids (n=149; 6.5% of the site sample). Sites south of Humboldt Bay (Table 2, Fig. 6d–g) also demonstrate an emphasis on intertidal/littoral zone fishing.

Screen Size and Faunal Bone Recovery Rates

It has long been recognized that fine-mesh screening is necessary to prevent bias in the analysis of fish bone (Casteel 1972, 1976a, 1976b). While large-bodied fish are often assumed to be the preferred target species, the application of fine-grained techniques has revealed the importance of small fish in the diet of Native Californians (Fitch 1969, 1972; Gobalet 1989; Gobalet et al. 2004; Tushingham and Bencze 2013; Tushingham et al. 2013).

Existing archaeological data suggest an overwhelming dominance of smelt in the Humboldt Bay and Del Norte county sites and their near absence in samples collected from other coastal sites further south. As well, the findings suggest similarities in marine resource exploitation between *Tcetxo* (35-CU-42) and southern coastal sites, with fish-bone assemblages largely comprised of intertidal fish species. This may be attributable to variations in screen size recovery techniques. Most of the fish bones from the Del Norte County and Humboldt Bay studies were recovered with fine-grained sampling techniques employing 1/16"screens, while most other studies used 1/8" (or larger) screens (Table 1).

The question thus arises, could the patterning described above be simply due to variation in screen size? Smelt bone vertebrae can be recovered in 1/8"samples; however, recent studies indicate that the use of 1/16" screens affords the best chance of recovering very small fish. For example, at the Sweetwater smelt camp 90.2% of the identified 2,382 smelt bones were recovered in 1/16" or smaller mesh screens (Tushingham et al. 2013:33, 35). The remainder were recovered in 1/8" screens (n=224; 9.4%) and 1/4" screens (n=10; 0.4%). As identifications typically focus on fish vertebrae, the likelihood of identifying smelt with screens larger than 1/16" is probably even lower. In the same study, which included identification of cranial and post cranial remains, a total of 1,053 smelt vertebrae was identified; of these, only 42 (4.0% of vertebrae) were found in the 1/8" screens, and none was recovered in the 1/4" screens.

The importance of screen size is also demonstrated by considering fish bone studies from Late Period deposits at northern Point St. George (CA-DNO-11), deposits that were excavated by different researchers using a variety of techniques (Fig.7). Clearly, there is a bias toward larger fish in samples with no screening (Fig. 7a) and 1/4" screening (Fig. 7b). This situation is completely reversed when soils are submitted to 1/16" screening (Fig. 7c), where overall fish counts are very high and dominated by small forage fish.

In any case, it is notable that despite the absence of smelt, some small fish (herring) were identified at *Tcetxo*

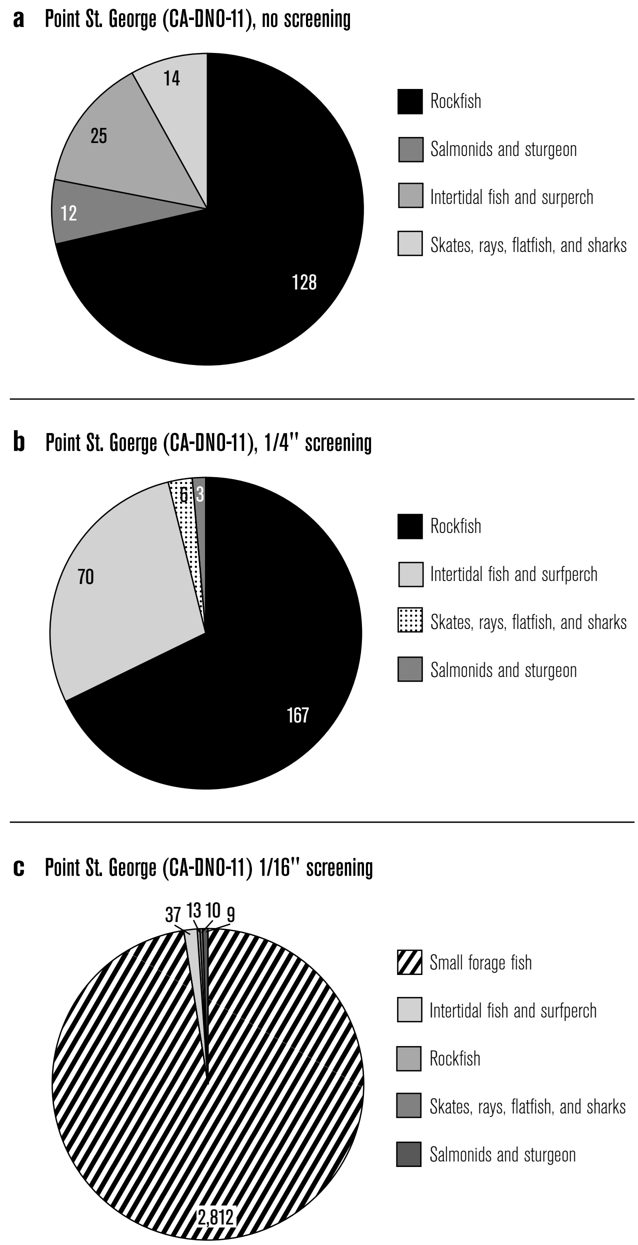

Figure 7. Variation in screen size results for fish bone identified in Late Period dating samples from northern Point St. George (CA-DNO-11). (a) Fish bone with no screening, sample B in Tables 1 and 2 (Follett 1965; Gould 1966; Tushingham and Bencze 2013); (b) Fish bone from 1/4" screening, sample C in Tables 1 and 2 (Whitaker and Tushingham 2011, 2014); (c) Fish bone from 1/16" screening, samples D and E in Tables 1 and 2 (Hale and Laurie 2012; Whitaker and Tushingham 2011, 2014).

(35-CU-42) in 1/8" screens. At sites south of Humboldt Bay, which are largely food processing stations and temporary camps, if small mass-harvested fish were captured for storage in these areas, they might have been simply transported and discarded at home-base villages located elsewhere (although under such circumstances smelt bones can be recovered at temporary camps in roasting pit features—see Tushingham et al. 2013). Levulett (1985:483) hypothesized that despite the clear importance of sardine and smelt fishing by historical native groups, the "scarcity or lack of these species in the coastal KRNCA archaeological sites is not surprising. These small fish were smoked and eaten whole, without evisceration; therefore, bone remains are not likely to occur. One adult sardine bone was recovered from CA-HUM-177A, a Mattole archaeological site. The bone was probably introduced as the stomach content of a butchered sea lion." While eulachon may have been smoked or otherwise rendered, surf smelt, at least in northern areas, were not typically smoked and eaten whole. In contrast, Yurok and Tolowa fishers removed all bones prior to eating, a pattern documented archaeologically in Del Norte County (Tushingham et al. 2013). Clearly, additional sampling with smaller screen sizes will help us answer some of these outstanding questions regarding the importance of small forage fish in the region.

DISCUSSION AND CONCLUSIONS

Ethnographic documentation of fishing in northwestern California and southwestern Oregon indicates a great emphasis on mass-harvested fish, particularly of seasonally captured salmonids. Traditional archaeological models reflect this view, and regard salmon as critical to the development of intensive foraging systems in the region. The archaeological data synthesized here are almost exclusively from coastal settings and therefore contribute to our understanding of fish use in these places.

While salmon figures prominently in regional explanatory frameworks, the present data suggest that along the coast a wide range of fish were important to indigenous peoples living in northwestern California and southwestern Oregon. Salmon was certainly a focus at the inland site of Red Elderberry Place (CA-DNO-26); however, with the exception of *Tcetxo* (35-CU-42), there is a paucity of salmon bones at most coastal sites. The low number of salmon bones recovered at these sites may be partially explained by seasonal round 1 storage patterns;

coastal villagers likely mass-harvested and processed salmon at temporary camps along rivers, where they were filleted and then transported back to coastal sites (Tushingham and Bencze 2013:69).

Another mass-harvested fish that was clearly important is smelt. This is certainly true at coastal sites in Del Norte County and Humboldt Bay, and possibly at other sites, but this remains equivocal until 1/16" screening is more widely applied. In terms of *encounter* fish, the focus throughout the region seems not to have been on large pelagic fish but on smaller fish such as surfperch and fish that were available in the rocky intertidal and near-shore areas. While fish were caught offshore with lines often baited with surf fish or mussels on hooks and gorges (Driver 1939), the majority of these fish can be collected in rocky tidal pools, a common practice ethnographically: "Here the older men, as well as the women, sought out codfish and other species which might have been stranded when the tides receded" (Kroeber and Barrett 1960:89). Most of these fishes are solitary species that were likely fished one at a time, on an encounter basis. They are relatively easy to procure, and they may have been collected while people were harvesting shellfish in the same habitat (Tushingham and Bencze 2013:69–70).

The development of mass-harvest techniques and technology and large-scale storage appears to be related to the establishment of sedentary to semi-sedentary plank-house villages in the study area. Rectilinear plank houses, which function as large storage facilities, are documented by 1,250 B.P. at the Red Elderberry Site (CA-DNO-26), and they are related to an increase in the mass capture and bulk storage of salmon at river locations (Tushingham 2009, 2013). Recent work at sites in Del Norte County and at Humboldt Bay indicate a similar pattern in the use of coastal resources around the same time. At Point St. George (CA-DNO-11), Whitaker and Tushingham (2011, 2014) found some of the earliest evidence to date of the intensive use of this area of the coast, with archaeological deposits containing significant shell midden, a wide variety of marine resources, and plant processing equipment radiocarbon dated to 1,137 and 1,214 cal B.P. Similar findings have been documented at the Manila site (CA-HUM-321), with evidence of intensive shellfish exploitation and the mass harvest of smelt at the basal levels of the site, which date to 1,309 cal B.P. Significantly, both of these sites contain large amounts of smelt bones by the early Late Period, suggesting that the mass harvest and storage of this fish was as important as salmon fishing may have been in inland settings.

These studies indicate that by 1,300–1,100 years ago, people were engaged in logistical and storage strategies that relied on intensive shellfish procurement, marine mammal hunting, and fishing of mass-harvested species (smelt, salmon), both on the coast and along the interior rivers. People living in interior regions were focused on available resources such as acorns and salmon, but organizationally, the shift was the same after they began to live in large, permanent plank-house villages. Whether on the coast or along rivers, diet breadth expanded, and home-base villages served as large-scale storage tethering points for a wide variety of foods (many of which were logistically procured and mass harvested from distant locations; Tushingham and Bencze 2013).

Future work with well-dated Middle Period deposits is essential to better understand hunter-gatherer subsistence-settlement trends on the north coast. However, it should be mentioned that there are a number of sites that date to earlier than 1,300 B.P. that have been investigated with modern screening techniques, yet have not produced evidence of intensive fishing or shellfish procurement (Hildebrandt and Levulett 2002:309). Such Middle Period sites include the earlier component of CA-HUM-277, reviewed here (Levulett 1985), CA-HUM-351 at Humboldt Bay (Eidsness 1993), and CA-HUM-177B, located at the mouth of the Mattole River (Levulett and Hildebrandt 1987).

An important exception to this pattern is early evidence of coastal fishing that has emerged through the work of Minor (2012) at *Tcetxo*, where fish bone—dominated by near-shore littoral fish (e.g., rockfish, surfperch, and greenlings) and salmon—was recovered from Middle and Late Period site components, indicating the developed use of these fisheries as early as 2,000 years ago. Minor (2012:111) argues that the presence of elements typically associated with the Gunther Pattern in the Middle Period component at *Tcetxo* (i.e., substantial midden and faunal materials including fish bone, and certain artifacts) is an indication that intensive coastal lifeways—typically held to be characteristic of the Gunther Pattern—occur much earlier than previously recognized.

Additional work employing small (1/16") screen size sampling is also essential to better understand the importance of small forage fish. Indeed, a greater emphasis on fine-grained methods has shown that smaller fish may be as important as salmonids. At present, other than pilot work at the Manila site, CA-HUM-321 (Tushingham et al. 2015), there are few fine-scale studies of fish bone from archaeological sites from south of Point St. George, Del Norte County, to the mouth of the Mattole River. Further work at coastal sites located in Del Norte, Humboldt, and Mendocino counties would also allow us to better understand regional patterns in the acquisition of fish resources. Such work does not require large-scale excavation, and there exist significant collections from sites along the coast that were excavated with modern methods (i.e., screening and soil sampling), including Stone Lagoon (CA-HUM-129), a Late Period site with significant amounts of fish bone that has yet to be analyzed (Milburn et al. 1979). Valuable data could also be derived from the analysis of fish bone from column samples excavated by Minor (2012) at *Tcetxo*, and by Levulett (1985) and Whitaker (2008) from sites in the King Range, southern Humboldt County, which would help to answer some of our open questions regarding the importance of small forage fish in this area.

To be certain, the earliest people to inhabit the region exploited fish, but to what extent and how this varied in relationship to other foods remains poorly understood. It can be said, however, that the intensive use of fish, including the mass harvest and storage of salmonids and forage fish, was in place by about 1,300–1,100 B.P. at sites in Del Norte County and on Humboldt Bay. There is mounting evidence that human use of the smelt fishery was significant, and the mass harvest of this fish—notably associated with sophisticated mass-capture techniques and technology, seasonal scheduling, the logistical procurement of resources, and bulk storage strategies—was in place as early as 1,300 years ago. There is significant evidence of fisheries exploitation even earlier at *Tcetxo*, where local taxa (intertidal species and salmon) were captured by about 2,000 years ago (Minor 2012). While we are just beginning to understand the archaeology of fish in this area, and there are limitations in the data at hand, this synthesis provides a framework for future studies regarding patterns of fishery development along the north Pacific coast.

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