TRADITIONAL PHENOLOGICAL KNOWLEDGE OF ABORIGINAL PEOPLES IN BRITISH COLUMBIA

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INTRODUCTION

Phenology is the study of the seasonal timing of life cycle events (Rathcke and Lacey 1985) of organisms. In temperate regions seasonal development is relatively predictable, occurring primarily in response to accumulated heat, and photoperiod. Since phenological events generally occur in a reliable sequence, the occurrence of one event indicating the imminence of another, phenology can be used to time resource related activities. Aboriginal peoples have long recognized these phenological indicators and Traditional Phenological Knowledge (TPK) is evident throughout Traditional Ecological Knowledge and Wisdom (TEKW). In this paper we assess the nature and significance of TPK in British Columbia and the neighboring areas. A survey of the ethnographic literature for British Columbia, Canada and surrounding areas revealed over 140 examples of traditional phenological indicators. This TPK, representing more than 20 linguistic groups, is used to indicate the timing of plant and animal resource availability and abundance, to assess and predict changes in weather and the seasons, and to mark points in peoples' seasonal rounds. Approximately half of these are direct indicators involving the phenology of one species, typically a flowering plant, to signal the onset of a prominent stage in the life cycle (phenophase) of a second species, typically an important resource. The rest are less direct, often embedded in language, and closely linked with traditional conceptions of time and the seasonal round. Consequently TPK, as it is described here, cannot be considered a discrete subset of TEKW, but is interwoven in a larger framework of cultural knowledge and represents a broad yet significant domain of TEKW.

In temperate regions, the triggering of plant and animal development depends on the passing of certain temperature thresholds and changes in photoperiod (Larcher 1983). In the spring most woody plant species (e.g.; shrubs and trees) and perennial herbs (wildflowers) come into flower primarily in response to accumulated heat often measured using growing degree summation (Rathcke and Lacey 1985). One application of phenology is to use organisms that respond predictably to heat as indicator species. Phenological indicators can be thought of as stable biological timepieces that respond to seasonal variation between years (Molitor 1987). Such indicators have become very important proxies to monitor the biological impact of accelerated global warming. In Europe, researchers have used records, kept at a network of phenological gardens, to demonstrate that the length of the growing season has increased by approximately 11 days in the last 30 years (Menzel and Fabijan 1999). Similarly, long-term phenological data reveals a 26-day shift to the earlier onset of spring in Western Canada (Beaubien and Freeland 2000).

Since phenological events generally occur in consistent order, with the arrival of one event predicting the imminence of another, phenological data can also be used as a valuable predictive tool in forestry, agriculture, and fisheries (Caprio 1966; Lieth 1974). Fishermen in Western Canada have long recognized that pickerel (*Esox lucius* L.) run when the southern cottonwood (*Populus balsamifera* L.) releases seed, and, on the East Coast of Canada, fishermen would not fish for shad (*Alosa sapisissima* Wilson) until the saskatoon, or shadbush, (*Amelanchier* spp.) had flowered (Beaubien 1991).

The use of plant and animal development to predict seasonal events is by no means a new practice. When Samuel de Champlain arrived at Cape Cod in 1605, the Wampanoag people informed him that the best time to plant corn was when the white oak (*Quercus alba* L.) leaf was the same size as the footprint of a red squirrel (*Tamiasciurus hudsonicus* Erxleben) (Molitor 1987). On the west coast of Canada, the Nuu-Chah-Nulth peoples of Vancouver Island recognize the correspondence between the ripening of the salmonberries (*Rubus spectabilis* Pursh) and the return of adult sockeye salmon (*Oncorhynchus keta* Walbaum) to freshwater (Bouchard and Kennedy 1990). Phenological knowledge is also significant in the subsistence activities of the Ka'apor peoples of the Amazon (Balée 1993), Pomo and Tubatulabal Peoples in California (Kat Anderson, pers. comm. to NT, 2002), and the Yanyuwa peoples of Northern Australia (Baker 1993).

This paper is a preliminary effort to assess TEKW that relates to seasonality and phenology in British Columbia, Canada and surrounding regions, and to assess the significance of Traditional Phenological Knowledge (TPK) to the aboriginal peoples in this region. Since many phenological indicators are intimately associated with language, cultural beliefs, and traditional conceptions of time, in order to consider all possible sources of knowledge, we define TPK in a broad sense here. TPK encompasses all knowledge of biological seasonality, including: the observation of life cycle changes in specific plant or animal species to indicate the timing of the onset of growth stages in other species; linguistic references to phenological events; traditional conceptions of time as they relate to seasonal change; and spiritual beliefs about cause and effect relationships of seasonal change.

METHODS

We reviewed published and unpublished literature, noting direct and indirect references to plant and animal phenology. Sources included ethnobotanical monographs, ethnographies, technical reports, and plant-use handbooks. In general, this literature pertained to British Columbia, but published sources from surrounding regions (Alaska, Washington, Montana and Alberta) were also examined . Information on TPK was grouped using a linguistic / cultural classification and is presented and discussed by subcategories of plant [(1) berries, and (2) 'roots,' cambium, and shoots] and animal resources [(1) fish, and (2) mammals, birds and shellfish].

RESULTS AND DISCUSSION

Plant Resources: Berries.– Indicators of the imminence of berry ripening are among the most common phenological indicators used by aboriginal peoples in British Columbia. Phenological events used to signal the onset of berry ripening include life cycle changes in invertebrates, vertebrates, and plants, but predominantly incorporate the flowering or fruiting phenology of a second plant species. Indicators of berry availability include the Nlaka'pamux use of the blooming of wild rose (*Rosa* spp.) as an indication that the soapberries (*Shepherdia canadensis* (L.) Nutt.) are ready to harvest (Turner 1998b). One of the most interesting examples

of phenological knowledge that relates to berry ripening is indirectly encoded in the belief that the singing of the Swainson's thrush (*Hylocichla ustulata* Nutt.), is responsible for ripening the salmonberries (*Rubus spectabilis* Pursh). The Tlingit, Tsimshian, Haida, Haisla, Oweekeno, Squamish, Nuu-chah-nulth, Ditidaht, and Straits Salish all associate the singing of this bird causally with the ripening of salmonberries. This belief is also reflected in the names for the Swainson's thrush and the song of the Swainson's thrush in at least four languages (Haida, Oweekeno, Ditidaht, and Squamish), and encodes the direct TPK that in Coastal British Columbia salmonberry flowers mature and the fruits begin to ripen at approximately the same time (Pojar and MacKinnon 1994) that the Swainson's thrush returns to this part of its breeding range (Campbell et al. 1997).

The prevalence of indicators used to determine when a particular edible berry is ready to harvest underscores the importance of these resources to the aboriginal peoples of British Columbia. Traditionally, berries were one of the most important food resources, and served as an essential winter foodstuff (Turner 1995, 1997a; Thornton 1999). Berries were also extremely important in trade, and as a food gift item in potlatch ceremonies (Turner 1995, 1997a; Thornton 1999). Indicator species that signaled the beginning of the availability of a particular berry crop may have provided human gatherers with an important competitive advantage over other animals consuming the same resource.

Plant Resources: *'Roots' (edible underground plant parts: including rhizomes, bulbs, and swollen roots), Cambium, Shoots, etc*.– In addition to berry resources, there are 16 phenological indicators of the availability of other plant foods and materials that are documented here. These consist of: indicators of the availability of a diverse range of resources, including: roots, bulbs and rhizomes (8), and other plant foods [cambium, shoots, mushrooms, tree sap and seaweed] (5), and plant materials (2). Like the seasonal markers that signal the availability of berries, these indicators mainly involve the flowering or fruiting phenology of a second plant species, but also include several animal indicator species. Examples include: the Okanagan use of the ripening of Douglas-fir (*Pseudotsuga menziesii* (Mirbel.) Franco) pollen cones to signal that ponderosa pine (*Pinus ponderosa* Dougl. ex Loud.) edible cambium was ready to be harvested (Turner et al. 1980); and the Stl'atl'imx use of the blooming of wild rose (*Rosa* spp.) to indicate the best time to collect cedar roots (*Thuja plicata* Donn.) and grass (*Phalaris arundinacea* L.) for basketry (Turner 1992).

For many of the aboriginal peoples of British Columbia, edible underground plant parts, which were gathered and stored in extremely large quantities, served as an important winter resource (Turner 1995, 1997a). Like berries, the developmental timing, and consequently the availability, of many of these 'roots' varies greatly between years. The use of indicators as a cue for the best time to harvest would have allowed for the effective coordination of efficient harvesting activities. Indicators of underground plant part availability appear to have been particularly important to the aboriginal peoples of interior British Columbia, where 'root' crops were among the first plant foods harvested in the spring, and first roots ceremonies celebrating the availability of these foods were an important socio-cultural recognition of the arrival of spring (Bandringa 1999; Hart 1974; Turner et al. 1990).

Animal Resources: *Fish*.– The bulk of all of the phenological signals of animal resource availability that are detailed here relate to the seasonal appearance of fish resources. These include 18 indicators of life cycle timing in fish, more than half of which relate to the phenology and availability of salmon, and most of these involve the use of plant phenology to signal the

timing of a particular spawning migration. Examples include: the Nlaka'pamux use of the leafing of desert currant (*Ribes cereum* Dougl.) as a sign that the steelhead trout (*Oncorhynchus mykiss* Walbaum) are running in the Stein River (Turner et al. 1990); and the Nuu-chah-nulth use of red elderberry (*Sambucus racemosa* L.) blooming as a sign that it is time to fish for halibut (*Hippoglossus stenolepis* Schmidt) (Bouchard and Kennedy 1990).

As with edible underground plant parts and berries, the high number of direct phenological indicators that relate to fish availability highlights the importance of these resources to the aboriginal peoples of British Columbia. Historically, these peoples consumed large quantities of animal protein throughout both the winter and summer months (Chisholm et al. 1983). Fish were also an important item in trade and ceremony (Turner 1995, 1997a. The use of phenological indicators would have provided an effective means of ensuring that harvesting effort was efficiently directed. Furthermore, a mistimed harvest, in addition to reduced yields, could also potentially jeopardize the long-term availability of the resource. For example, harvesting migrating adult salmon too early could preclude adequate escapement for spawning.

Like the phenology and abundance of berry-producing shrubs, fish reproductive phenology, and thus availability, also varies considerably between years. For example, the timing of the chinook (*Oncorhynchus tshawytscha* Walbaum) and coho salmon (*O. kisutch* Walbaum) adult spawning migration into the Big Qualicum River, varied by as much as 5 weeks between 1959 and 1972 (Fraser et al. 1983). Indicators species, particularly plants that are widespread and thus easily observable, would have provided an important cue to the availability of fish, which are inherently more difficult to monitor than plants.

Animal Resources: *Mammals, Birds and Shellfish*.– In addition to indicators signaling the onset of fish abundance, there are also a number of phenological indicators which are used to predict the availability of other animal resources. These include: 12 indicators of vertebrate resources [deer (*Odocoileus hemionus* Rafinesque), bison (*Bison bison* L.), marmot (*Marmota* spp.), harbour seals (*Phoca vitulina* L.), gray whales (*Eschrichtius robustus* Lilljeborg), and seagull eggs (*Larus* spp.)], and two indicators of invertebrate resources: (horse clams (*Tresus capax* Gould) and butter clams (*Saxidomus giganteus* Deshayes). Indicators of the timing of these resources also generally involve the use of plant flowering phenology to signal the best time to gather or hunt. Examples of these indicators include: the Haida utilization of the blooming of cow parsnip (*Heracleum lanatum* Michx.) as a sign that seagull (*Larus* spp.) eggs were no longer good to harvest (Turner 1998a); and the Okanagan use of mock-orange (*Philadelphus lewisii* Pursh) blooming as an indicator that the marmots (*Marmota* spp.) were fat and ready to be hunted (Turner et al. 1980).

Phenology in Relation to Time and the Seasonal Round.– In addition to what can be called direct indicators, where the phenology of one species is used to signal the onset of another phenophase in a second species (typically an important resource), there is also extensive Traditional Phenological Knowledge encoded in language and words with etymological reference to phenological events. Most of these lexically marked seasonal indicators are inextricably linked with traditional conceptions of time and the seasonal round. Eighty-four words in 21 languages, which make reference to a range of phenological events and discrete time periods, are described here. Of these, 35 are related to the phenology of plant resources, 26 of which relate to berries; and 49 are associated with animal phenology, 39 of which relate to fish. Examples include: the Squamish name for the time period corresponding to August (***temt'ák̲a7***), which is derived from the name for salal (*Gaultheria shallon* Pursh) (***t'ák̲a7ay***) and is glossed as 'when

the salal berries ripen' (Bouchard and Turner 1976); and the Oweekeno name for the time period corresponding to April (***tcaHsAm***), which is derived from the word for eulachon (*Thaleichtys pacificus* Richardson) (***tcaHan***), and literally means 'eulachon moon' (Compton 1993).

The First Foods ceremonies of many aboriginal peoples of British Columbia, in which harvesting and food use prescriptions were ritually enacted and the availability of a particular food was recognized and celebrated, similarly exemplify an understanding of plant and animal development that is encoded in spiritual beliefs and ritual (Compton 1993; Johnson 1997; Thornton 1999; Turner 1995, 1997a, Turner et al. 2000). For example, the Hanaksiala of the Northwest Coast of British Columbia celebrated the New Year (***h'isλàm hs_h'snx***) when the riceroot (*Fritillaria camschatcensis* (L.) Ker-Gawl) flowered (around the end of March), and performed a ceremonial flower dance in which "costumes were covered with flowers of the Nootka rose, salmonberry, blueberries, riceroot and any other plants that were blooming then." (Compton 1993:197).

Importance of Traditional Phenological Knowledge.– The large number of phenological indicators used by many cultural groups, as documented in literature sources, highlights the overall importance of TPK to the Aboriginal Peoples of British Columbia and the surrounding regions. The over 140 examples of phenological knowledge described hereundoubtedly represent only a small subset of the TPK that was used by over 20 linguistic / cultural groups. In British Columbia and the surrounding regions TPK was used as a means to ensure that adequate plant and animal resources were collected from across a large landscape, where annual variability in phenology would have had a considerable impact on the availability and abundance of these organisms. In British Columbia TPK may have been particularly important because the traditional homelands of many cultural groups are extremely heterogeneous, and plant and animal resources were separated by great distances and or elevations. TPK proxies that allowed indigenous peoples to accurately predict when a given resource was available without observing it directly would have increased the overall efficiency and effectiveness of subsistence activities.

Traditional Phenological Knowledge (TPK) is an extremely important component of the Traditional Ecological Knowledge and Wisdom (TEKW) of the aboriginal peoples of British Columbia. Phenological Knowledge in British Columbia represents a significant domain of TEKW that shaped seasonal movements, subsistence activities, ritual, ceremony, language and cultural beliefs. Intimately linked with traditional conceptions of time and the seasonal round, TPK was also impacted by a much broader framework of cultural knowledge.

This type of TEKW represents another layer of the sophisticated understandings of the natural world that was required of indigenous peoples living within their traditional territories. TPK is particularly significant because it underscores the complexity and depth of Traditional Knowledge of the environment, which in the case of TPK integrates detailed information from a number of 'disciplines', such as ornithology, meteorology, ecology, botany, and ichthyology and links them together with human activities in a complex ethnoecological web.

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