mp DB

FISH DISTRIBUTION DATABASE CATALOG/ATLAS CORRECTION FORM

CORRECTION TO: ATLAS CATALOG X

REGION: SEA

MAP: Mt Fairweather D-1

WATERWAY NUMBER: 114-77-11000

DESCRIBE CHANGE(S): Add local name WOLF Point CREEK to DB AWC# 114-77-11000
Add coho salmon to stream to end pt
Shorten arc to lake

CHANGE REQUESTED BY: JOHNSON 10/27/06 DATE

DRAFTED/DIGITIZED BY: [signature] 10/28/08 DATE

REVISION CODE: A-3, B-1, B-5

NOMINATION NUMBER: 08-364

** ATTACH THIS FORM TO EXISTING NOMINATION FORM IN FILE **

(Rev. 05/03)

State of Alaska
Department of Fish and Game
Nomination for Waters
Important to Anadromous Fish

AWC Volume (SE) SC SW W AR IN USGS Quad ~~Scagway A-4~~ MT FAIRWEATHER D-1

Anadromous Water Catalog Number of Waterway 114-77-11000

Name of Waterway Wolf Point Creek USGS name ___ Local name ✓

Addition ✓ Deletion ___ Correction ___ Backup Information ___

For Office Use

Nomination # 95 279	Darrell Shea — Regional Supervisor — Date 12-30-94
Revision Year:	Ed Weiss — 1/5/95
Revision to: Atlas ___ Catalog ___ Both X	J. Grove — Drafted — Date 1/5/95
Revision Code: A-2	

OBSERVATION INFORMATION

Species	Date(s) Observed	Spawning	Rearing	Migration	Anadromous
See attachments					
PINK	SEE ATTACHED				
CHUM	"				
SOCKEYE	"				

IMPORTANT: Provide all supporting documentation that this water body is important for the spawning, rearing or migration of anadromous fish, including: number of fish and life stages observed; sampling methods, sampling duration and area sampled; copies of field notes; etc. Attach a copy of a map showing location of mouth and observed upper extent of each species, as well as any other information such as: specific stream reaches observed as spawning or rearing habitat; locations, types, and heights of any barriers; etc.

Comments:

RECEIVED
JAN 04 1995
STATE OF ALASKA
FISH & GAME
HABITAT & RESTORATION

Name of Observer (please print) Chad Soiseth

Date: 14 Dec. 1994 Signature: Chad Soiseth

Address: NATIONAL PARK SERVICE
GLACIER BAY NATIONAL PARK & PRESERVE
P. O. BOX 140
GUSTAVUS, AK 99826-0140

This certifies that in my best professional judgement and belief the above information is evidence that this waterbody should be included in or deleted from the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes per AS 16.05.870.

Signature of Area Biologist: Niko Bester 12/30/94

Rev. 7/93

Colonization and development of an Alaskan stream community over 28 years

Alexander M Milner[1,2*], Anne L Robertson[3], Kieran A Monaghan[4], Amanda J Veal[5], and Elizabeth A Flory[6]

The application of general successional theory to stream ecosystems has not been widely addressed due to a lack of long-term studies on stream channels at sufficiently large spatial scales. Wolf Point Creek in Glacier Bay, Alaska, a lake-fed stream that began to emerge from under glacial ice in the mid-1940s, offers an opportunity to address this imbalance. We examine the stream's development from 1977 to 2005, with reference to concepts of succession and community assembly. Dispersal constraints have influenced the succession, as non-insect taxa required at least 20 years to colonize. We suggest that tolerance is a major mechanism of macroinvertebrate community assembly. Most taxa, with the exception of the cold-tolerant first colonizers, have persisted within the community following colonization, although relative abundance has changed markedly with time. However, biotic processes do influence colonization and succession. Redd (nest) digging by spawning salmon creates disturbed patches that facilitate the persistence of some early colonizers, and riparian vegetation facilitates colonization by caddisflies and chironomids. We further suggest that both deterministic and stochastic elements influence succession and community assembly in streams. Our study highlights the importance of re-establishing riparian vegetation during stream restoration programs and of increased in-stream habitat complexity from inputs of coarse woody debris to improve nutrient retention, particularly of salmon carcasses.

Front Ecol Environ 2008; 6(8): 413–419, doi:10.1890/060149

Succession is a key concept in terrestrial ecology (Chapin *et al.* 1994) and its study has revealed mechanisms by which communities are assembled, including the relative roles of deterministic and stochastic pathways. Connell and Slatyer (1977) proposed three models of succession: (1) facilitation, in which early species modify the environment to make it more suitable for later colonizers; (2) tolerance, in which, as the environment changes, established species exhibit a progressive tolerance of invading species; and (3) inhibition, in which early colonizers restrict the invasion of later colonizers. To date, stream ecology has contributed little to general ecological theory (Fisher 1997). Here, we begin to address this imbalance by examining a long-term stream colonization record in the context of successional theory.

Glacier Bay National Park and Preserve in southeast Alaska is a unique natural laboratory for the study of aquatic ecosystems and the processes of primary succession. Rapid glacial recession has created a de-glaciated landscape with a temporal scale of 220 years across a spatial scale of 11 000 km^2, providing a "blank slate" to study changes in species composition (Platt and Connell 2003). We have studied Wolf Point Creek (WPC) in Glacier Bay since 1977, providing the longest continuous record of stream colonization within a primary successional framework (1977 to 2005) of which we are aware. Primary succession can be defined as colonization and subsequent change in dominance within a community at a specific site where no remnants of a biotic community initially exist (Fisher 1983). This differs from secondary succession, in which elements of the original biotic community persist following disturbance. In this study, we focus on macroinvertebrates, copepods (meiobenthic crustaceans retained by a 63-μm sieve), and fish. Colonization and primary succession studies of streams and rivers are rare for these groups, particularly at the spatial scale of entirely new river channels (Fisher 1990; Robertson and Milner 2006). Salmon colonization and establishment within streams represents a major nutrient influx that can influence stream and riparian food webs, thereby potentially influencing succession and community structure (Naiman *et al.* 2002).

There is little understanding of the mechanisms driving succession in stream ecosystems. Here, we address whether the models of succession proposed by Connell and Slatyer (1977) are appropriate to stream ecosystems using invertebrate data collected in WPC over 28 years and whether mechanisms of succession in this system differ from those of other systems. We also examine whether colonization patterns in stream development are deterministic or stochastic. The integration of ecological theory into stream restoration approaches has generally been lacking (Lake *et al.* 2007); we therefore also link our findings on stream succession to implications for stream restoration.

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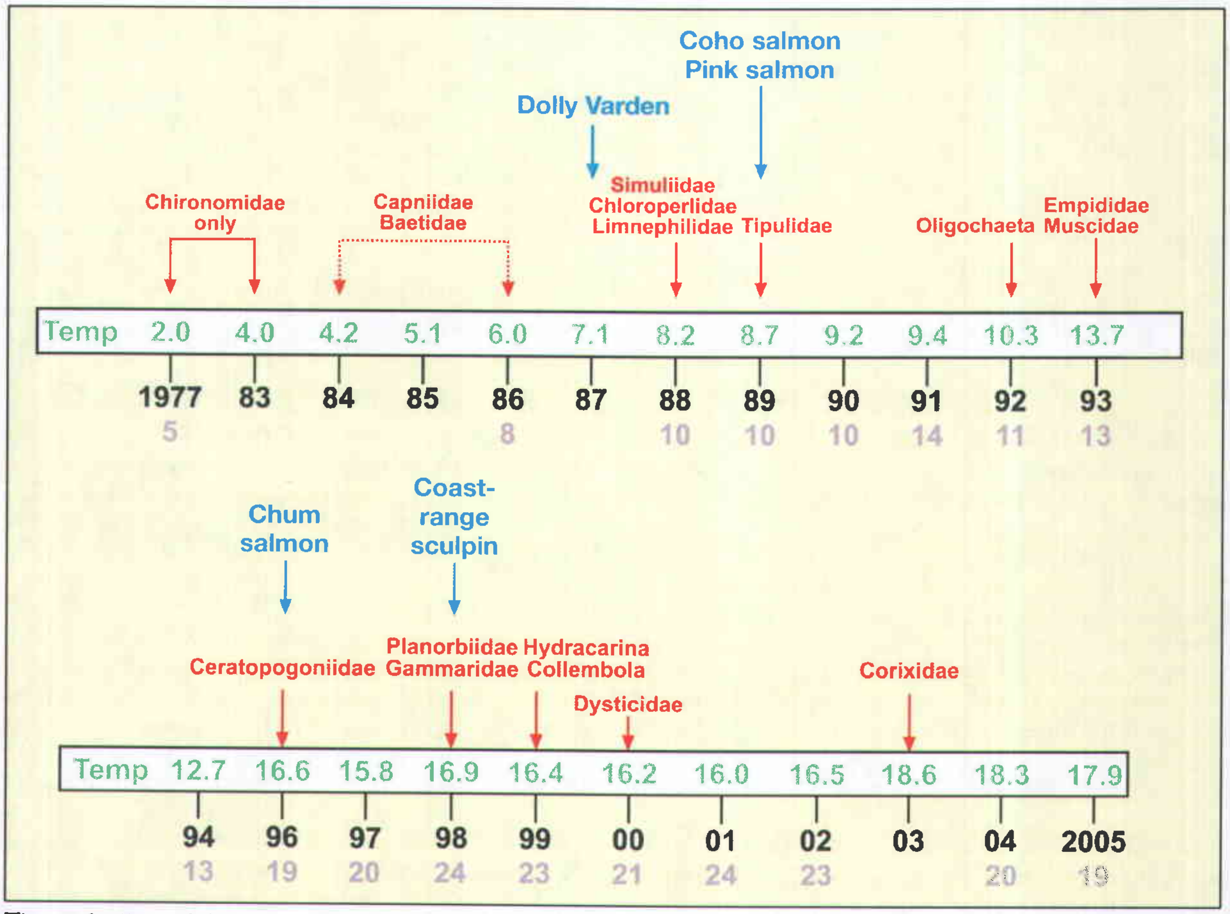

Figure 2. *Year of first colonization by fish and macroinvertebrate orders and families with corresponding maximum water temperature. Total number of macroinvertebrate taxa in August for any particular year is given in purple.*

sition by pink salmon, macroinvertebrates were collected from the streambed prior to, during, and after peak redd construction, using six replicate Surber samples in years when salmon abundance was high (1997) and low (1996 and 1998). Duplicate drift samples were collected downstream from observed redds, over a 24-hr period, between the end of July and early September in 1997 and 1998.

Marine-derived nutrient sources

In 1998, marked salmon carcasses were staked into the streambed to investigate their role as a potential food source for macroinvertebrates through direct scavenging. Tagged carcasses were experimentally released to estimate carcass retention. In 1998 and 2004, samples of algae, juvenile fish, and macroinvertebrates were collected for ^{15}N stable isotope analyses, following the approach of Milner *et al.* (2000).

Data analysis

The relationship between macroinvertebrate taxa richness, cumulative macroinvertebrate taxa added to the assemblage, and mean harpacticoid copepod abundance and stream temperature were explored using linear regression analysis. As an estimate of year-to-year community similarity, Jaccard's similarity coefficients were calculated for corresponding year pairs, where a value of 0 indicates no similarity and a value of 1 indicates identical communities. Compositional stability of macroinvertebrate communities (similarity over time with respect to relative taxa abundance) was investigated using Bray–Curtis distances. Bray–Curtis (scale 0 to 1) is a measure of dissimilarity, with high values indicating low compositional stability. To estimate macroinvertebrate persistence, the number of taxa was plotted against year of collection and compared to the number of those taxa still present in 2005.

Results

Water temperature rose from a maximum of 2°C in August 1977 to 18.6°C in August 2003, as the upstream lake increased in size, resulting in an increase in the number of annual degree days for the stream from < 500 Centigrade temperature units (CTU; estimated) to 1945 CTU. In 1977, habitats were initially dominated by riffles and runs, but the frequency of pools and backwaters increased over years. Direct consumption of carcasses by scavenger macroinvertebrates was not observed. Experimental release of tagged salmon carcasses indicated less than 10% retention at relatively low flows, with most carcasses retained within 200 m of the release point, principally (62%) in stream margins.

Discussion

The colonization and succession of the macroinvertebrate community within WPC is the longest documented such sequence in a stream environment and major taxonomic groups were still colonizing at least 40 years after the stream formed. In contrast, Minshall *et al.* (1983) estimated that recolonization of the original taxa in the Teton River, Idaho, took 3 years, following a major flood that initiated primary succession and, in an Oregon stream impacted by the Mount St Helens eruption, over 200 taxa were found after 10 years (Anderson 1992). We suggest that the relatively long time period over which invertebrate colonization occurs at WPC is due to the dominant roles of water temperature, dispersal limitation, and geomorphological habitat in this recently deglaciated and isolated environment. Water temperature was an important determinant for the colonization of many macroinvertebrate taxa in WPC, particularly temperature limitations imposed when remnant ice still influenced the stream during deglaciation and maximum temperature did not exceed 10 °C. In contrast, water temperature was not a major variable in the Teton River and in streams around Mount St Helens. Unlike Fisher (1983), who considered that succession and community assemblage in streams is entirely stochastic, we believe, based on studies in WPC and elsewhere (Milner *et al.* 2001), that a deterministic element to community assembly and succession exists in the initial stages of development in post-glacial streams, when water temperature is low. However, it is unclear whether the macroinvertebrate assemblages of other streams, formed due to ice recession, would follow the same trajectory as that at WPC, as water temperature increases and more colonizers arrive. In other words, is the successional pathway in these new streams

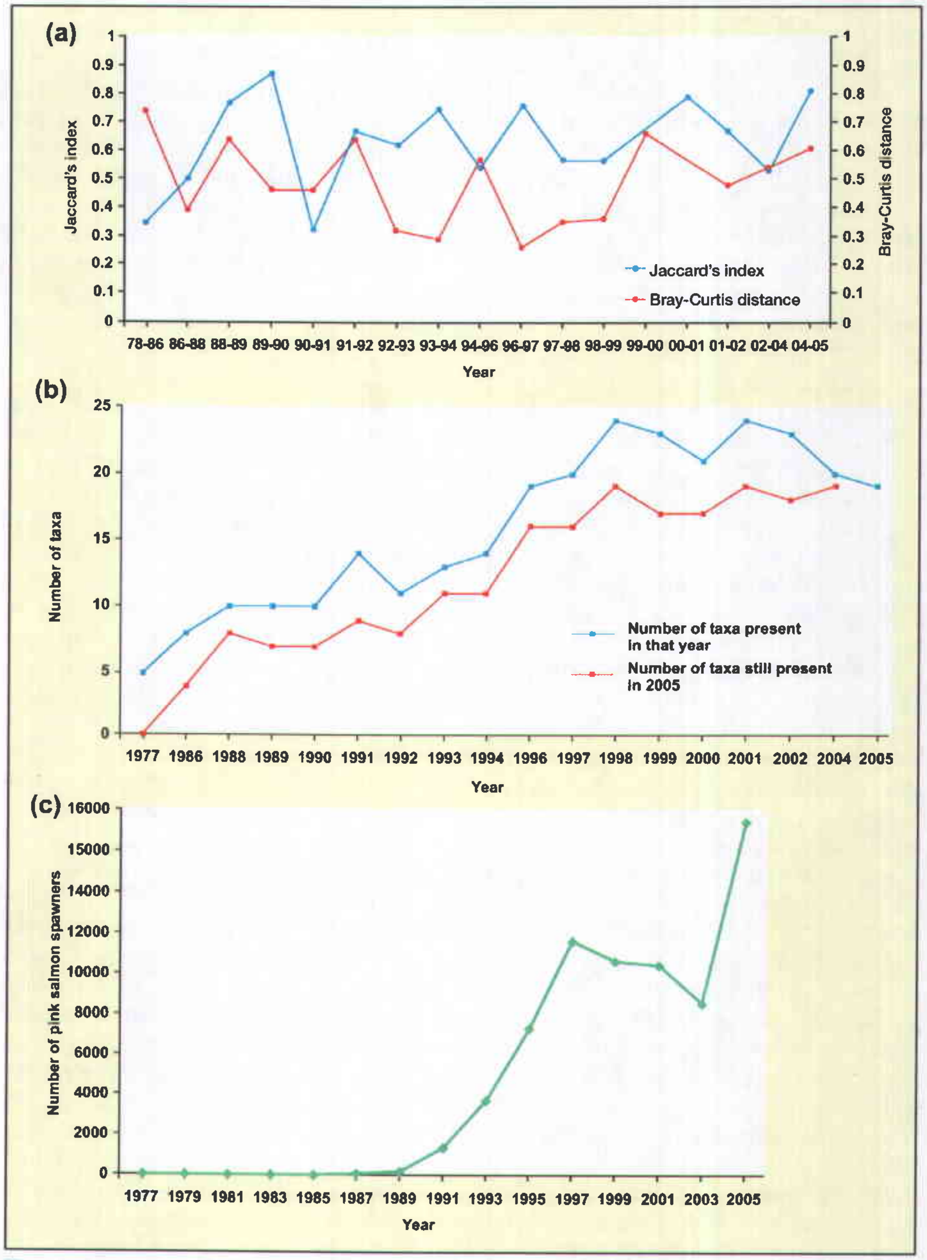

Figure 3. *(a) Jaccard's Similarity Index values for year pairs, with higher values indicating greater similarity of the macroinvertebrate communities from year to year, and Bray–Curtis distances for year pairs with higher values, indicating lower compositional stability. (b) A comparison of the number of taxa for any particular year with the number of those taxa still present in 2005. (c) The number of spawning pink salmon in odd years from 1977 to 2005.*

barriers may make dispersal difficult. In such cases, assistance may be necessary to enhance dispersal. We have shown that development of riparian vegetation is essential for the establishment of some riverine taxa. Increases in habitat heterogeneity are also necessary for the establishment of macroinvertebrate taxa associated with slower flowing habitats and for meiofauna. The stochastic nature of later successional stages indicates that the stream macroinvertebrate community will not necessarily return to the pre-disturbance community following restoration.

Our study also illustrates that, where a new stream channel with suitable habitat is formed, or access to previously inaccessible habitat is created (eg above a dam), pink salmon establish substantial populations from a small colonizing population of spawners within a few generations. The recent creation of new stream habitat, linked to climate change and local conditions, has been extensive along the coast of southeastern and south–central Alaska. Although many of these streams are relatively short in length, potential recruitment of new salmon stocks is substantial, at a time when other stocks in the Pacific Northwest are threatened by human activity (Nelson *et al.* 1991).

Although salmon colonization should enhance benthic food webs through incorporation of marine-derived nutrients, WPC does not retain carcasses, which are flushed back to the estuary by heavy rains in September and October, as demonstrated by retention experiments. Hence, recommendations for salmon carcass additions in the Pacific Northwest to mitigate losses of salmon-derived nutrients in streams (Compton *et al.* 2006) must consider the varying ability of watersheds to retain these additions. Retention ability in older Glacier Bay streams arises from marginal habitats, pools, and, in particular, coarse woody debris (CWD; Milner and Gloyne-Phillips 2005). Negligible amounts of CWD are present in WPC, as terrestrial succession has not yet progressed to a stage where recruitment of larger trees (cottonwoods and spruce) into the stream allows debris to accumulate. We estimate that this may take a further 60 to 80 years. Mechanisms to improve retention may have to be considered in streams where floodplain vegetation is regenerating or being planted in restoration efforts (eg the introduction of large pieces of CWD). Our long-term study has increased our understanding of the processes by which stream ecosystems develop and thus can improve the effectiveness and predictability of stream ecosystem restoration as suggested by Lake *et al.* (2007).

Acknowledgements

We thank the many people who have assisted our research at Wolf Point Creek over the past 28 years, including S Conn, L Brown, M Dauber, S Mackinson, M McDermott, C McNeill, I Phillips, J Smith, and C Soiseth. We thank M Winterbourn and G Streveler for discussion of earlier versions of this manuscript. This paper would not have been possible without J Luthy, skipper of the Park vessel MV *Nunatak*, who supported our remote field camps in Glacier Bay for many years.

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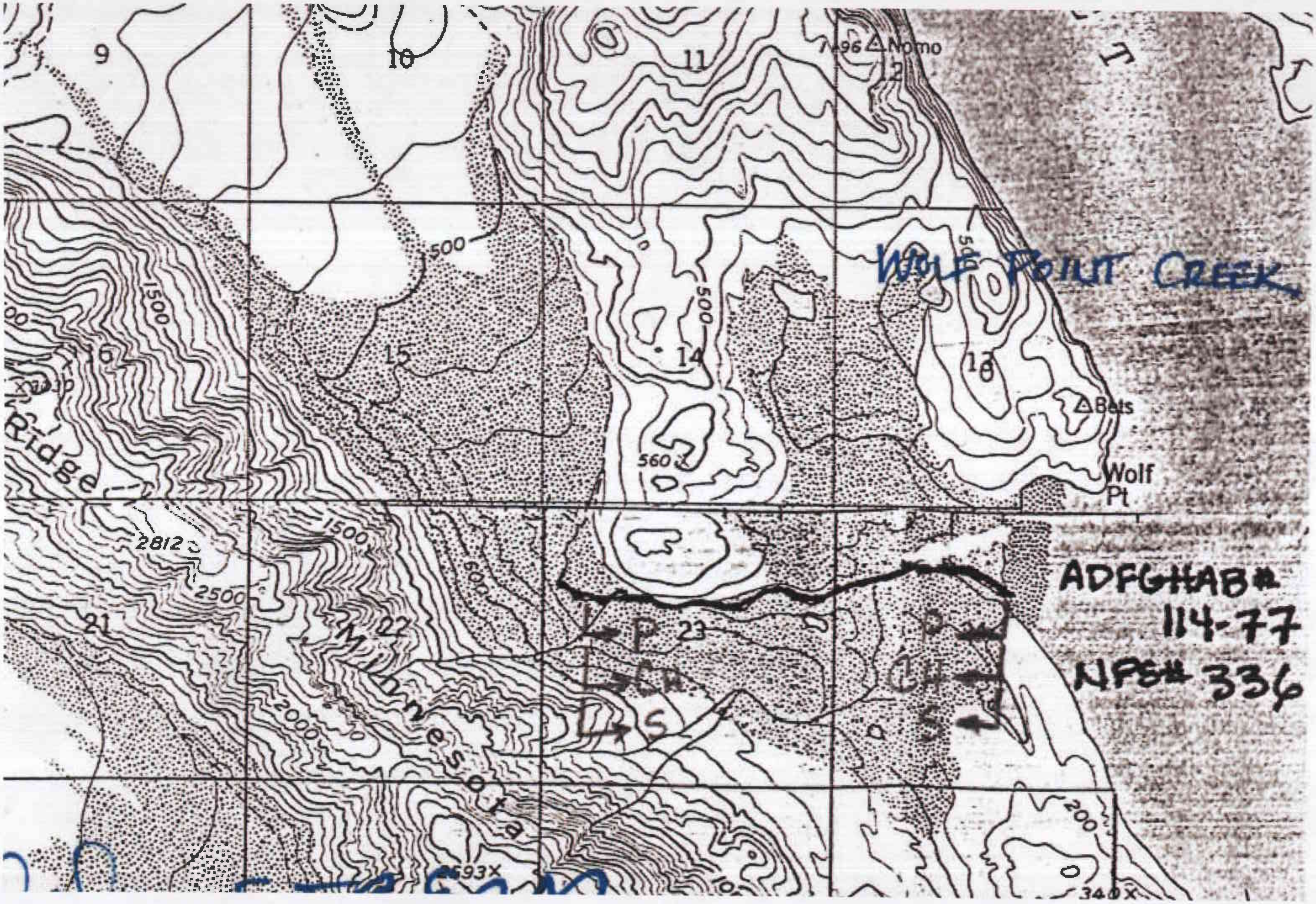
136°9'10"W, 59°0'15"N
Wolf Pt
Bets
Minnesota
Stump Cove
10
14
15
19
22
23
24
25
26
30
500
560
1000
1500
2000
2500
2812
2593
200
60



Wolf Point Creek
ADFG HAB#
114-77
NPS# 336
Wolf Pt
Bets
Nomo
Ridge
Minnesota
2812
2500
2000
1500
500
560
200
2693X
340X
P
CH
S
9
10
11
12
13
14
15
16
21
22
23


end
Go
114-77-1100
58.994879,
Image © 2008 TerraMetrics
Google
lat 59.001242° lon -136.188961°
elev 214 ft
Eye alt 12663 ft