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An Accuracy Assessment of ShoreZone Geomorphic Classifications in Taku Inlet and Gastineau Channel, Alaska

by

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December 2011

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

Symbols and Abbreviations

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	log_2, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

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AN ACCURACY ASSESSMENT OF SHOREZONE GEOMORPHIC CLASSIFICATIONS IN TAKU INLET AND GASTINEAU CHANNEL, ALASKA

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ABSTRACT

Nearshore marine areas support critical ecological functions and important habitats for many anadromous and forage fish species; however, only limited information exists on the identification and distribution of nearshore habitats in Southeast Alaska. In 2007, we conducted geomorphic shoreline classification surveys on 80 km of shoreline in Taku Inlet and Gastineau Channel. Our surveys were conducted during extreme low tide events in order to detect changes in predominant geomorphological features in the intertidal zone. After our surveys were completed, our results were compared to the existing ShoreZone data set for the same study area to determine the proportion of accurate geomorphic classification calls made in ShoreZone and to explore where and why differences exist. ShoreZone is a widely used coastal habitat mapping and classification system in the Pacific Northwest and Alaska that allows identification of geological and biological features of the intertidal zone and nearshore environment across extensive geographic areas. Comparisons were made between the 2 data sets based on the minimum mapping unit (12-m segment). We constructed an error matrix where overall accuracy, error of omission, and error of commission were calculated. The Kappa statistic, which reflects the difference between actual agreement and the agreement expected by chance, was also calculated. When comparing ShoreZone classifications to the geomorphic classifications we made, the overall total accuracy of the classification calls in the ShoreZone data set was 24%. The Kappa statistic ($\hat{\kappa}$ = -0.018) indicated that the classifications were not better than if randomly assigned or classified. Results from the validation surveys show significant discrepancies between our classification and the ShoreZone classification. Both classifications included the same basic geomorphic substrate classes; however, they used different criteria for determining which classification calls to make during surveys, which accounts for some of the variability in the results.

Key words: Southeast Alaska, Taku Inlet, Gastineau Channel, geomorphic shoreline classification, ShoreZone.

INTRODUCTION

In 2001, the Alaska Department of Fish and Game (ADF&G), Division of Habitat and Restoration conducted a 2-day workshop in Juneau, with approximately 40 participants representing 18 agencies and organizations (*unpublished, ADF&G, Division of Habitat and Restoration, 2001 Proceedings for the Southeast Alaska Salmon Habitat Condition and Assessment Workshop; available at the Southeast Regional Office, Douglas, Alaska*). The purpose of the workshop was to identify existing knowledge and prioritize information needs (i.e. 'gaps') related to salmonids and their habitats in Southeast Alaska (SEAK). This strategy was considered necessary for conducting accurate habitat condition assessments. The group concluded that little was known about the nearshore marine habitats in SEAK that are important to Pacific salmon (*Oncorhynchus* sp.) and other marine species. Identification and mapping of these areas was considered a high priority for achieving a more comprehensive understanding of salmonid habitat. Anadromous migration corridors were also recognized as a component of critical nearshore marine habitats because of their connectivity with the freshwater environment. Ultimately, the working group reached consensus on the goal of increasing our knowledge of how fish and other organisms respond to, and are dependent on, the full diversity of nearshore marine habitats. Two gaps in conventional wisdom were identified: 1) identification, classification, and mapping of habitats; and 2) species occurrence, distribution, and interactions with these habitats. As a result, ADF&G, federal agencies, and non-governmental organizations (NGO) have continued to work collaboratively toward classifying the physical habitats along the coastlines of SEAK, Cook Inlet, and Prince William Sound as the first step toward elucidating these information needs.

In late 2002, ADF&G and cooperating entities worked toward filling this information gap by contracting a local NGO (Ecotrust) that specialized in spatial analyses to develop a geographic information system (GIS)-based habitat analysis and mapping project for marine waters in SEAK. One of the products resulting from this effort was a spatially-explicit shoreline classification that was developed by merging 3 geographic data sets: 1) the estuarine classes of the National Wetlands Inventory (NWI); 2) the substrate classes from the Environmental Sensitivity Index (ESI); and 3) digital soundings recorded by the National Ocean Service (NOS). The final product was identified as the merged geographic classification. Recognizing that much of the data comprising the merged geographic classification comes from data not actually collected on the ground, ADF&G began conducting ground-truth surveys to assess the accuracy of the GIS-based classification and collect additional habitat information. Ground-truth surveys were conducted to assess the accuracy of the merged geographic classification occurred from 2004–2006.

In 2004, ADF&G contributed funding toward a multiagency collaboration to have "ShoreZone" data collected and mapped for SEAK. ShoreZone is a remote-sensing application used across extensive geographic areas to characterize shorelines based on geomorphology, and includes a qualitative assessment of the flora and fauna observed in the intertidal/subtidal areas. ShoreZone is a useful tool, but it has limitations in that it is qualitative, is ineffective in mapping large flat areas (e.g. estuaries), is subject to omissions attributed to areas covered by water (e.g., tidal fluctuations), and is relatively expensive because of costs associated with helicopter use for image acquisition, especially in remote areas. ShoreZone has been described as "a conservative inventory of the actual distribution of the resources" (Berry et al. 2001). Despite these limitations, the ShoreZone method has been recognized as being a valuable tool for coastal management because it characterizes many biotic and physical aspects of the shoreline over a large geographic area. ShoreZone has been used to classify most of the north Pacific coastline from California to Western Alaska, including over 43,000 km of shoreline in Alaska, from Bristol Bay to the Canadian border in southern SEAK (Coastal and Ocean Resources Inc., http://www.coastalandoceans.com/shorezone.html, accessed September 2010).

The work discussed in this report differs from our previous shoreline classification surveys in that we were able to ground-truth an area of SEAK where ShoreZone data were collected and mapped. This allowed us to assess the accuracy of the ShoreZone data set along an 80-km stretch of shoreline. Prior to the 2007 field season, ShoreZone data for most of SEAK had either not been collected yet or had not become available due to the time-consuming post-processing of the acquired imagery and data.

OBJECTIVES

In 2007, our specific objective was to determine the total accuracy of geomorphic classification in the ShoreZone database for selected study areas in both Taku Inlet and Gastineau Channel.

STUDY AREA

The Taku River is a large, glacial mainland river originating in the Stikine Plateau of northwestern British Columbia, Canada, and emptying into the head of Taku Inlet, approximately 20 km southeast of Juneau, Alaska (Figure 1). Five species of Pacific salmon occur in the Taku watershed, and it is one of the largest producers of Chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch*) salmon in the region (Der Hovanisian and Geiger 2005). The

Taku watershed also produces significant numbers of sockeye (*O. nerka*) and chum (*O. keta*) salmon relative to other stream systems in SEAK, and has documented use by eulachon (*Thaleichthys pacificus*), capelin (*Mallotus villosus*), and Pacific sand lance (*Ammodytes hexapterus*) for spawning in the lower reaches near the estuary (Johnson and Weiss 2007). Data collected in 2007 under a separate, collaborative project with the National Oceanic and Atmospheric Administration (NOAA) indicate that the estuarine environment at the mouth of the river may also provide habitats important to outmigrating juvenile salmon (Lorenz and Schroeder 2010).

The greater project area was split into two discrete study units (Figure 1): 1) the shorelines of Taku Inlet (East Inlet and West Inlet); and 2) the shorelines of Gastineau Channel (North Channel and South Channel). Taku Inlet is a broad, steep fjord with shorelines dominated by steep rocky walls. Gastineau Channel is a narrow marine channel separating the mainland from Douglas Island, and connecting 2 open marine waterways during mid to high tide cycles daily: Stephens Passage/Taku Inlet confluence to the south, and Stephens Passage/Auke Bay to the north. The channel is heavily influenced by glacial rivers and streams originating from the Juneau Ice Field to its northern shores, and is a major travel corridor for large ships, barges and recreational craft to and from Juneau from the southern end.

The bounds of the 2 discrete study units for this project are illustrated in Figure 1, and further defined as follows:

1. The northern extent of the South Channel shoreline starts at the Douglas boat harbor and extends south to Tantallon Point on the southern end of Douglas Island;
2. The northern extent of the North Channel shoreline is at the “Rock Dump” located south of downtown Juneau and extends south to Point Salisbury;
3. The northern extent of the West Inlet is at the Annex Creek Powerhouse and extends south to Point Salisbury; and
4. The northern extent of the East Inlet is at the ADF&G commercial fishing boundary marker and extends south to the southern end of Circle Point.

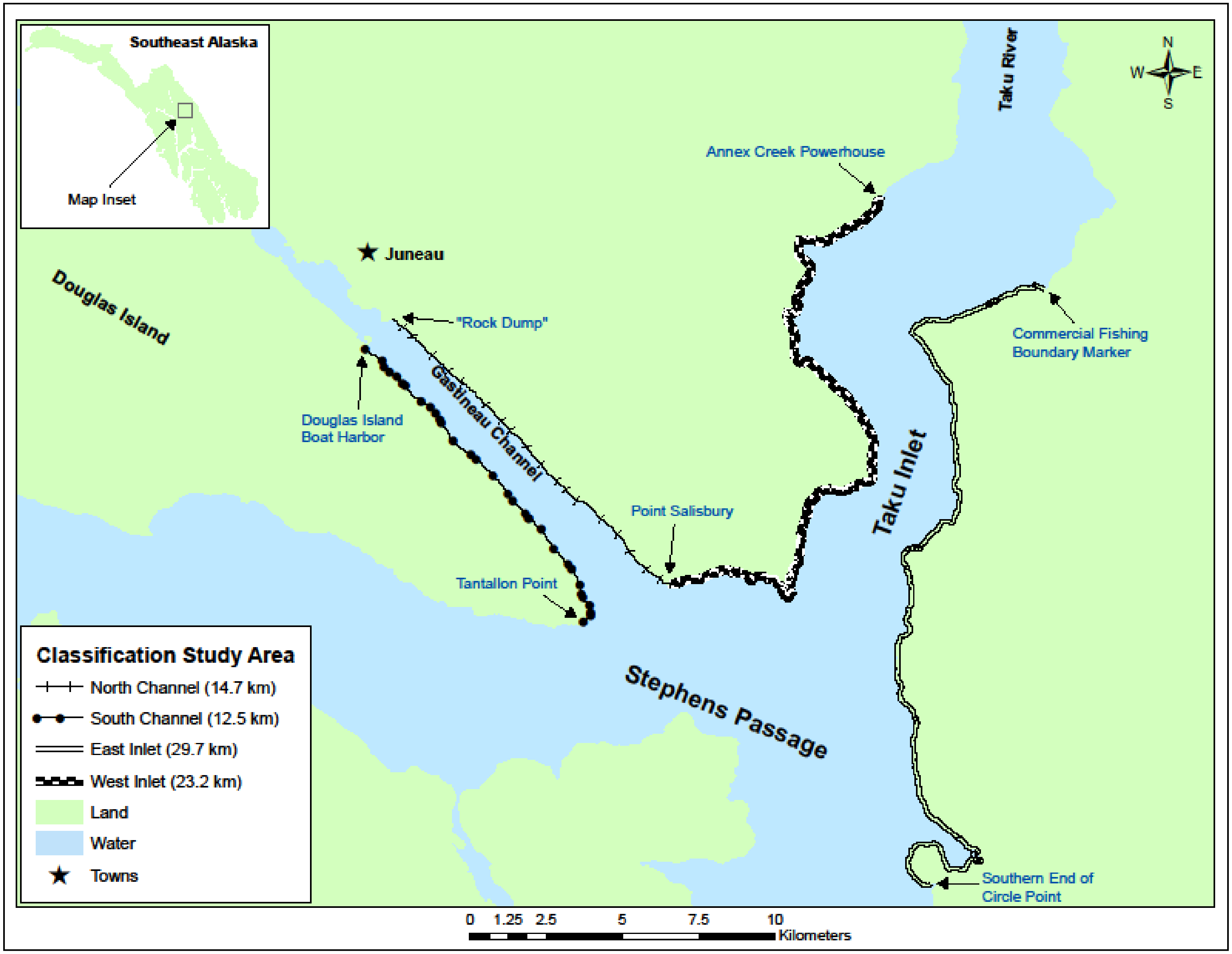

Figure 1.–Map identifying the extent of the 2007 shoreline classification study area in Southeast Alaska.

METHODS

ASSESSMENT OF THE SHOREZONE DATA SET

ShoreZone Classification

ShoreZone data acquisition occurred in the summer during extreme low tides to optimize detection of the flora growing across the beach faces below the shoreline. A helicopter was employed to acquire video imagery of the shoreline, while the audio band of the video camera system captured the observer's narration (Harney et al. 2007).

The ShoreZone data set does not have a specific and consistent spatial resolution associated with the video imagery captured during flights or the resulting mapped classification. When flying the shoreline to acquire imagery for ShoreZone, video imagery is collected continuously, and still photo images are captured occasionally. On the video imagery it is possible to resolve objects as small as individual boulders (>25 cm), and on the still photos it is possible to resolve objects as small as individual cobbles (6–25 cm), which suggests the data set has high spatial resolution. However, the digital rendering (i.e., via a GIS) of the shoreline on which the ShoreZone data are mapped has a scale of 1:63,000, which results in an unknown resolution for the ShoreZone data set. In the current SEAK ShoreZone data set, the average along-shore unit length is 200–250 m, and the shortest unit length is 10 m (J. R. Harper, Marine Geologist and President of Coastal and Ocean Resources, Inc., Victoria B. C., Canada, personal communication, January 28, 2008).

The ShoreZone classification includes "BC Classes" (derived from Howes et al. (1994) classification system that was applied in coastal British Columbia) to describe the shoretype of each shoreline segment. BC Classes are identified numerically, based primarily on substrate type, across-shore width and slope. To make comparisons between the ShoreZone data set and the present study conducted by ADF&G, BC classes were translated into the same basic geomorphic classes used by ADF&G staff (Table 1). See Harney et al. (2007) for details of the ShoreZone classification protocol used in their surveys.

ADF&G Classification – Nearshore Marine

Shoreline surveys were used to assess the accuracy of the existing ShoreZone geomorphic classification. The shoreline was assessed and classified based on dominant substrate composition.

The shoreline substrate classification surveys took place within 2 hours on either side of the extreme low tide (i.e. spring tide) so that the maximum area of intertidal and subtidal substrates and biota were exposed during the time of the survey (Petersen et al. 2002). The area of shoreline being classified included everything between the upper limit of marine (i.e. tidal) influence, which was indicated by the lower extent of terrestrial vegetation and/or upper extent of the *Verrucaria* lichen band that inhabits the splash zone. The water's edge at the time of the survey determined the lower extent of the shoreline being classified.

The dominant geomorphological characteristic of each along-shore segment was used to designate a classification to each segment in the study area. Table 1 includes the substrate classes that observers selected from during surveys for the present study.

Table 1.–Substrate class definitions used during the present Alaska Department of Fish and Game (ADF&G) study compared to definitions used for ShoreZone surveys.

Substrate class comparison	ADF&G (present study) definition	ShoreZone definition
"Rock"	Shoreline composed of bedrock substrate.	Rock substrate dominates the intertidal zone of the unit, with little or no unconsolidated sediment or organics present.
"Mixed"/"rock & sediment"	Shoreline composed of bedrock and sediment, which includes bedrock/sand, bedrock/gravel, bedrock/sand/gravel, etc.	When a unit consists of a beach with ≥25% rock outcrops/platforms, the substrate class should be coded to reflect the influence that the rock has on the unit ("rock & sediment").
"Sediment"	Shoreline composed of sand, gravel, cobble, boulder, or any combination of mobile sediments.	When a unit consists of a beach with ≤25% rock outcrops/platforms, the substrate class should be coded to emphasize the beach sediment ("sediment").
"Organic"	Shoreline composed of organic material, which includes marshes and estuaries.	Organics and vegetation dominate the unit; may characterize units with large marshes in the supratidal zone (if the marsh represents >50% of the combined supratidal and intertidal area of the unit), even if the unit has another dominant intertidal feature such as a wide tidal flat or sand beach. This "50% rule" may be ignored and an "Organic" code applied if a significant amount of marsh infringes on the intertidal zone.
"Anthropogenic"	Human altered shorelines, which include rip rap, docks, seawalls, breakwaters, etc.	Units that exhibit >50% human alteration in the intertidal zone will be classified as anthropogenically-altered.
"Channel"	No definition for this substrate class.	Current dominated units; usually occur in channels between islands or at constricted entrances to large lagoons, bays, or inlets. Water movement will be visible within the channel but not outside the channel. The biota tends to be lush within these channels. This class does not occur in estuaries.
"Glacier"	No definition for this substrate class.	Ice dominates the intertidal zone.

Shoreline classification surveys were conducted from the water by means of a skiff. The surveys started at a “break” (point along the shoreline where there was a change in dominant substrate), and continued parallel to the shoreline in order to detect changes in predominant geomorphological features. For our protocol, a stretch of shoreline exhibiting homogenous substrate composition was required to be ≥100 m in length in order to be classified as a unique segment. The dominant geomorphological characteristic was used to classify each along-shore segment in the study area. The substrate classes that observers selected from are identified in Table 1.

A Global Positioning System (GPS) waypoint was marked at each break point. The associated waypoint number and estimated horizontal error of the coordinates were recorded. Observers then obtained an azimuth (to the nearest degree) to the break point on the beach using a magnetic compass (set to magnetic north) by sighting from the skiff to the break along the shoreline (above the beach face) and measured the associated distance (to the nearest 0.5 m) with a laser rangefinder. The process was repeated for the corresponding break at the other end of the shoreclass segment being surveyed; in some cases where the shoreclass segment was short (e.g., <125 m), we documented both breaks from a single waypoint by collecting an azimuth and distance for each segment break at that point.

A third waypoint was recorded at a location between the two break points of a shoreclass segment. That additional waypoint was coded as ‘SCV’ (shoreclass verification point), which was at a point along the shoreline that was representative of the dominant substrate features observed throughout the entire segment. The SCV was the point where a geomorphologic shoreclass was designated for the segment.

Accuracy Assessment

After ground-truth surveys were completed, geomorphic classification determinations made from a boat were compared to the ShoreZone data set to determine the proportion of accurate geomorphic classifications made in ShoreZone. Comparisons were made by dividing the shoreline into 12-m segments, which was the minimum mapping unit for our boat surveys (12-m GPS accuracy was the lowest [least accurate] observed when collecting waypoints during the present study).

An error matrix was constructed where overall accuracy, error of omission, and error of commission were calculated following Congalton and Green (1999) (Table 2). An error of commission is a measure of the ability to discriminate within a class, and an error of omission measures between-class discrimination. Accuracy was also calculated for each of the four sub-areas (east and west Taku Inlet and north and south Gastineau Channel) (Table 3).

Table 2.–Comparison between the Alaska Department of Fish and Game (ADF&G) geomorphic classification and the ShoreZone geomorphic classification for the shoreline in Taku Inlet and Gastineau Channel, Southeast Alaska.

		Geomorphic class determined from ADF&G shoreline boat survey									
		Anthro	Channel	Mixed	Organic	Rock	Sediment	Total	Total	Errors of commission	User's accuracy
Geomorphic class determined from ShoreZone database	Anthro	0	0	0	0	7	0	7	0%	100%	0%
	Channel	0	0	9	0	8	0	17	0%	100%	0%
	Mixed	0	0	743	0	1,160	940	2,843	43%	74%	26%
	Organic	10	0	246	0	347	532	1,135	17%	100%	0%
	Rock	0	0	1	0	12	35	48	1%	75%	25%
	Sediment	2	0	762	0	1,010	854	2,628	39%	68%	32%
Total		12	0	1,761	0	2,544	2,361	6,678	100%		
Total (%)		0%	0%	26%	0%	38%	35%		100%		
Errors of omission		100%		58%		100%	64%				
Producer's accuracy		0%		42%		0%	36%				

Table 3.–The overall accuracy, in each of the four sub-areas, of classification determinations in the ShoreZone data set when compared to the geomorphic classifications made in the present study.

Location	Accuracy (%)
East Inlet	10%
West Inlet	25%
North Channel	29%
South Channel	51%
All areas combined	24%

The error matrix structure was:

		Geomorphic class determined from ADF&G shoreline ground survey (*j*)				
		1	*2*	*3*	…	*k*
Geomorphic class determined from ShoreZone database (*i*)	*1*	x_{11}	x_{12}	x_{13}		x_{1k}
	2					
	3					
	⋮					
	k	x_{k1}				x_{kk}

where x_{ij} was the number of 12 m segments in the ShoreZone database (the data to be evaluated) classified into geomorphic class *i* and found to be in geomorphic class *j* in the boat survey, and the associated accuracy and error statistics were calculated by:

$$Accuracy_{total} = \frac{\sum_{i=j=1}^{k} x_{ij}}{\sum_{i=1}^{k}\sum_{j=1}^{k} x_{ij}} \tag{1}$$

$$Errors\ of\ Commision_i = \frac{\sum_{\substack{j=1 \\ j \neq i}}^{k} x_{ij}}{\sum_{j=1}^{k} x_{ij}} \tag{2}$$

$$User's\ Accuracy_i = 1 - Errors\ of\ Commission_i$$

$$Errors\ of\ Omission_j = \frac{\sum_{\substack{i=1 \\ i \neq j}}^{k} x_{ij}}{\sum_{i=1}^{k} x_{ij}} \tag{3}$$

$$Producer's\ Accuracy_j = 1 - Errors\ of\ Omission_j$$

The Kappa statistic, which reflects the difference between actual agreement and the agreement expected by chance, was calculated as:

$$\hat{\kappa} = \frac{n\sum_{i=j}^{k}\sum_{j=1}^{k} x_{ij} - \sum_{i=j=1}^{k}\left(x_{i\bullet}x_{\bullet j}\right)}{n^2 - \sum_{i=j=1}^{k}\left(x_{i\bullet}x_{\bullet j}\right)} \tag{4}$$

where $x_{i\bullet}$ and $x_{\bullet j}$ were the marginal totals.

The location of the surveys was not randomly chosen so inferences cannot be expanded beyond the study area.

RESULTS

ASSESSMENT OF THE SHOREZONE DATA SET

In 2007, shoreline classification surveys were conducted on 80 km of shoreline (6,678 12-m segments) in Taku Inlet and Gastineau Channel (Figure 1). We identified the geomorphic substrate class of each of the 12-m shoreline segments comprising the entire 80 km of shoreline within the project area (Table 2). The shoreline within the project area was dominated by nearly equal proportions of Rock and Sediment (38%, 35% respectively) and a lesser amount of Mixed (26%).

When comparing ShoreZone classifications to the geomorphic classifications made by ADF&G, the overall total accuracy of the classification determinations in the ShoreZone data set was 24% (Table 3). The accuracy within each of the four sub-areas (east and west Taku Inlet and north and south Gastineau Channel) ranged from a low of 10% in east Taku Inlet to a high of 51% in south Gastineau Channel (Table 3).

The classifications of Anthro, Channel, and Organic all had 100% Errors of Commission. Sediment had the lowest rate of incidence of Errors of Commission (Table 2). The classification Anthro had 100% and Rock had 99.5% (rounded to 100% in Table 2) Errors of Omission. Mixed had the lowest rate of Errors of Omission (Table 2). The Anthro classification had 100% Errors of Commission and 100% Errors of Omission indicating no incidences of agreement between classifications from the ShoreZone surveys and those from the present study.

The Kappa statistic ($\hat{\kappa}$ = -0.018) indicated that the classifications were not better than if randomly assigned or classified.

DISCUSSION

ASSESSMENT OF THE SHOREZONE DATA SET

Results from the validation surveys show significant discrepancies between the methods used in the present study and ShoreZone classifications. ADF&G conducted classification surveys in spring 2007, which was a few months before ShoreZone published their classification protocol for the Gulf of Alaska in the fall of 2007 (Harney et al. 2007). Both classifications included the same basic geomorphic substrate classes; however, they used different criteria for assigning classes, which accounts for some of the variability in the results.

When interpreted across identical shoreline extents (see Figure 1), ShoreZone identified an Organic classification 1,135 times and the classification in the present study never used it, which accounted for 22% of the overall difference. Comparison of the ShoreZone definition for Organic shoreline to that used in the present study showed that ADF&G used slightly different criteria for classifying a shoreline as Organic. For the present ADF&G study, a shoreline was considered to be Organic if it was primarily composed of organic material (e.g. marshes and estuaries). Although the ShoreZone definition for an Organic classification contains a >50% dominance provision, it also includes an exception to the 50% threshold if a "significant amount of marsh infringes on the intertidal zone" (Table 1; Harney et al. 2007). The exception to the "50% rule" was not included in the ADF&G definition of an Organic shoreline, which might account for some of the error associated with this shoreclass.

There were also differences between the present study and ShoreZone definitions for a Sediment beach. Areas identified by ShoreZone as a Sediment beach were often classified by ADF&G as Rock or Mixed instead. This discrepancy accounted for 35% of the overall error. Again, ShoreZone had more defined criteria than ADF&G for what is considered to be a Sediment beach versus a Mixed beach. ShoreZone does not consider a beach to be Mixed unless the rock outcrops/platforms consist of >25% of the shoreline. ADF&G used the following criteria for classifying a shoreline as Mixed: "shoreline composed of bedrock and sediment, which includes bedrock/sand, bedrock/gravel, bedrock/sand/gravel, etc." The ADF&G definition of a Mixed shoreline did not include any specific percentages associated with substrate type, so different criteria were used for the two classifications.

There was also measurement error in the determination of the "break" points in the present study. While recording waypoints on the GPS, the lowest accuracy observed was 12 m and was independent of classification. For the average classification segment (1,068 m in length) the GPS measurement error could account for up to 2% of the error in the accuracy assessment.

Some other possible reasons for the discrepancy between the classifications might be related to the difference in perspective between conducting surveys on the water in a boat, and flying along the shoreline in a helicopter at or below an altitude of 100 m, cruising at a speed of approximately 100 km/h (Harney et al. 2007); this difference might have caused observers to interpret the substrate differently. Another difference between the classifications is that ShoreZone does not have a minimum shoreline length (i.e., minimum mapping unit), whereas this study had a minimum 100-m shoreline length for classification calls. For example, if ADF&G observed a 200-m segment of shoreline that was predominantly Rock that also had a 50-m stretch of Mixed shoreline, the entire 200 m segment would be classified as Rock because the 50-m stretch of Mixed shoreline did not exceed the 100-m minimum mapping length. In ShoreZone, on the other hand, for that same 200-m stretch of shoreline the 50 m of Mixed shoreline would be separated out from the Rock shoreline, resulting in 150 m of Rock and 50 m of Mixed. Because only 3% of the study area involved ShoreZone classifications that were less than 100 m in length, the difference in minimum mapping units did not contribute appreciably to the discrepancy between the classifications. Ideally, a comparison of shoreline mapping with 2 different methodologies would be consistent in regard to minimum mapping-unit size; this would provide a consistent 'scale' at which shoreline features are mapped and the ability to evaluate why discrepancies or differences occur.

ADF&G and ShoreZone used different methods and protocols for their shoreline classification surveys, making direct comparisons difficult to quantify. This should not imply that one method is better or more accurate than the other, but rather, that direct comparisons are not always possible.

The ShoreZone inventory is a valuable tool for coastal management because it characterizes many biotic and physical aspects of the shoreline over a large geographic area. To use the inventory appropriately, users need to be aware of its limitations. The inventory is a snapshot in time, collected rapidly. In this way, it is a conservative inventory of the actual extent of the resources. Its strength is at a regional scale, not site-specific (Berry et al. 2001). ShoreZone could be used as a tool for science, education, management, and environmental hazard mitigation; it is currently used for oil spill contingency planning, conservation planning, habitat research, development evaluation, mariculture site review, and recreation opportunities (Harney et al. 2007). As long as users keep in mind the limitations associated with the data, and do not make inferences beyond these constraints, ShoreZone can have many useful applications and can serve as a starting point to guide further research and investigation depending on the identified need.

The shoreline classification used for the present study is a useful approach for site-specific needs because investigators have control over the speed at which surveys are conducted and can easily access the shore if closer investigation is desired. However, users who need site-specific information would benefit from a more detailed classification than ADF&G used for surveys documented in this report. The classification used in the present study could be improved by incorporating components of the ShoreZone classification, including biotic aspects of the shoreline and the more defined geomorphic classes used in the ShoreZone methodology.

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APPENDIX A

Appendix A1.–Computer files used in this report.

File Name	Description
ShoreclassComparison_112508_pat.xls	Excel spreadsheet containing all shoreline classification calls made throughout the study area by ADF&G, ShoreZone, and the Merged Geographic dataset. Also contains tables created by the project biometrician.
ShorelineClass_comparisons_FY08.xls	Excel spreadsheet containing all shoreline classification calls made throughout the study area by ADF&G, ShoreZone, and the Merged Geographic dataset.
Taku_ShoreClass2007_FDS.mxd	ArcMap project that includes shapefiles containing shoreline classification calls in the study area for ADF&G, ShoreZone, and the Merged Geographic dataset.
ADFG_2007StudyArea_Diss.shp	Shapefile containing the ADF&G shoreline classification calls for the study area.
ShoreZone_2007StudyArea.shp	Shapefile containing the ShoreZone shoreline classification calls for the study area.
MergedGeographic_2007StudyArea.shp	Shapefile containing the Merged Geographic dataset shoreline classification calls for the study area.

Note: These files are available at Alaska Department of Fish and Game, Division of Sport Fish, Research and Technical Services, 333 Raspberry Road, Anchorage, AK 99518-1565.