

## **Beaufort Sea Play 7: Rift**

### **Geological Assessment:**

*GRASP UAI: (AAAAABAK)*

*Play Area: 7,940 square miles*

*Play Water Depth Range: 5-300 feet*

*Play Depth Range: 1850 – 23000 feet*

*Play Exploration Chance: 0.405*

<b>Play 7, Rift, Beaufort Sea OCS Planning Area, 2006 Assessment, Undiscovered Technically-Recoverable Oil &amp; Gas</b>			
Assessment Results as of November 2005			
<b>Resource Commodity (Units)</b>	<b>Resources *</b>		
	<b>F95</b>	<b>Mean</b>	<b>F05</b>
BOE (Mmboe)	0	1,157	3,296
Total Gas (Tcfg)	0.000	2.002	4.804
Total Liquids (Mmbo)	0	801	2,441
Free Gas** (Tcfg)	0.000	1.153	2.190
Solution Gas (Tcfg)	0.000	0.850	2.614
Oil (Mmbo)	0	773	2,385
Condensate (Mmbc)	0	27	56

\* Risked, Technically-Recoverable  
 \*\* Free Gas Includes Gas Cap and Non-Associated Gas  
 F95 = 95% chance that resources will equal or exceed the given quantity  
 F05 = 5% chance that resources will equal or exceed the given quantity  
 BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas  
 Mmb = millions of barrels  
 Tcf = trillions of cubic feet

**Table 1**

Play 7, The Rift play is the 4<sup>th</sup> ranked play of the Beaufort Province containing just under 9% of the province’s endowment (1161 Mmbo mean: BOE). The overall assessment results for play 7 are shown in [table 1](#). Oil and condensate liquids form 69% of the hydrocarbon energy endowment of this play. [Table 5](#) reports the detailed

assessment results by commodity for play 7.

[Table 3](#) summarizes the volumetric input data developed for the *GRASP* computer model of Beaufort Sea play 7. [Table 4](#) reports the risk model used for play 7. The location of play 7 is shown in [figure 1](#).

Play 7 sediments are locally derived clastics of the Beaufortian sequence preserved in fault blocks (e.g., Dinkum graben) associated with an Early Jurassic to Early Cretaceous rifting event. It also includes correlative strata deposited beyond the rift zone. The stratigraphic bounds for the play are from the Pebble Shale at the top to the Kingak formation at the base, and includes the Kuparuk formation. The reservoirs are marine and fluvial sandstones. The traps are anticlines, faulted anticlines, fault blocks, unconformity truncations, and stratigraphic terminations of reservoir beds. Potential source rocks may occur in the underlying Shublik or Kingak Formations or the overlying Pebble Shale and HRZ (“Highly Radioactive Zone”) sequences. The play was penetrated by six OCS tests (that targeted deeper formations), including Mars, Beechy Pt., Fireweed, Antares, Mukluk, and Phoenix wells.

There are several fields in the correlative onshore play, including the Kuparuk field with 2.9 billion barrels of recoverable oil, the Milne Point field with 680 million barrels of recoverable oil, the Point McIntyre field with 582 million barrels of recoverable oil, and the Point Thomson field with 300 million barrels of condensate. Eight fields with rift age reservoirs have been discovered in NPRA. Prior to the year 2000 the South Barrow gas field with 26

billion cubic feet of recoverable gas, East Barrow gas field with 13 billion cubic feet of recoverable gas, Walakpa gas field with 38 billion cubic feet of recoverable gas, and the Alpine field with 556 million bbl oil were discovered. Since the year 2000 hydrocarbons were discovered in the Lookout, Spark, Rendezvous, and Moose's Tooth wells in rift age reservoirs. These discoveries all contain high GOR, and high-gravity oil, condensate, and gas.

The primary risk for the Rift play is adequacy of reservoir facies. The presence of source rock and porosity and permeability are also risk factors. This is in part due to the depth of rift age sediments in the Dinkum Graben.

<b>Play 7, Rift, Beaufort Sea OCS Planning Area, 2006 Assessment, Conditional BOE Sizes of Ten Largest Pools</b>			
Assessment Results as of November 2005			
Pool Rank	BOE Resources *		
	F95	Mean	F05
1	77	838	3287
2	36	244	679
3	21	125	352
4	12	76	200
5	8	50	133
6	5	34	93
7	3	24	67
8	2	18	50
9	1.1	13	38
10	0.7	10	30

\* Conditional, Technically-Recoverable, Millions of Barrels Energy-Equivalent (Mmboe), from "PSRK.out" file  
 F95 = 95% chance that resources will equal or exceed the given quantity  
 F05 = 5% chance that resources will equal or exceed the given quantity  
 BOE = total hydrocarbon energy, expressed in barrels-of-oil-equivalent, where 1 barrel of oil = 5,620 cubic feet of natural gas

**Table 2**

A maximum of 38 hypothetical pools is forecast by the aggregation of the risk model

and the prospect numbers model for play 7. These pools range in mean conditional (un-risked) recoverable volumes from 0.4 Mmboe (pool rank 38) to 838 Mmboe (pool rank 1). Pool rank 1 ranges in possible conditional recoverable volumes from 77 Mmboe (F95) to 3,287 Mmboe (F05). Table 2 shows the conditional sizes of the 10 largest pools in play 7.

Table 6 reports statistics for the simulation pools developed in the GRASP computer model for play 7. In the computer simulation for the play, a total of 121,607 "simulation pools" were sampled for size. These simulation pools can be grouped according to the USGS size class system in which sizes double with each successive class. Pool size class 10 contains the largest share (17,347 or 14%) of simulation pools (conditional, technically recoverable BOE resources) for play 7. Pool size class 10 ranges from 16 to 32 Mmboe. The largest pool among the 121,607 simulation pools falls within pool size class 19, which ranges in size from 8,192 to 16,384 Mmboe.

**GRASP Play Data Form (Minerals Management Service-Alaska Regional Office)**

Basin: Beaufort  
 Play Number: 07  
 Play UAI Number: AAAAABAK

Assessor: Johnson/ Scherr  
 Play Name: Rift

Date: 10/13/2005

Play Area: mi<sup>2</sup> ( million acres) 7940 (5081.6)  
 Reservoir Thermal Maturity: % Ro

Play Depth Range: feet 1850 7000 23000  
 Expected Oil Gravity: ° API 27  
 Play Water Depth Range: feet 5 60 300

**POOLS Module (Volumes of Pools, Acre-Feet)**

Fractile	F100	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Prospect Area (acres)-Model Input	35	580		2158	5380		13414			49929	86873	90000	95000
Prospect Area (acres)-Model Output													
Fill Fraction (Fraction of Area Filled)	0.1	0.144		0.289	0.499		0.746			0.949		0.99	1
Productive Area of Pool (acres)	5	206	364	926	2638	010.775/14631.66	7752	13767	20503	31654			93322
Pay Thickness (feet)	1.34	8.93	12.44	21.63	40.00	61.079/69.202	73.97	102.87	128.62	179.11	260.00	333.33	668.71

**MPRO Module (Numbers of Pools)**

Play Level Chance	0.9	Prospect Level Chance	0.45	Exploration Chance	0.405
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Risk Model	Play Chance	Petroleum System Factors	Prospect Chance
		presence of reservoir facies	0.5
		presence of closure	0.9
	0.9	Presence of porosity and permeability	

Fractile	F99	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Numbers of Prospects in Play	19.00	21.50	23.00	25.50	29.00	30.03/ 5.60	33.00	35.00	36.50	39.00	42.00	44.00	57.00
Numbers of Pools in Play			0	10	13	12.16/5.37	15	17	18	20	22	23	38

Minimum Number of Pools	0	Mean Number of Pools	12.16	Maximum Number of Pools	38
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**POOLS/PSRK/PSUM Modules (Play Resources)**

Fractile	F100	F95	F90	F75	F50	Mean/Std. Dev.	F25	F15	F10	F05	F02	F01	F00
Oil Recovery Factor (bbl/acre-foot)	32	81	96	125	169	187.019/ 89.236	228	268	299	351	422	476	884
Gas Recovery Factor (Mcfg/acre-foot)	47.50	173.20	217.24	317.18	483.00	589.83/417.786	735.50	921.70	1073.90	1346.91	1738.03	2060.02	4900.00
Gas Oil Ratio (Sol'n Gas)(cf/bbl)	90	170	230	390	720	1075.25/ 1034.163	1350	1900	2300	3200	4700		6000
Condensate Yield ((bbl)/Mmcfg)	0.45	3.21	4.51	7.97	15.00	22.833/23.660	28.24	39.66	49.91	70.18	102.99	133.00	141.00

Pool Size Distribution Statistics from POOLS (1,000 BOE):  $\mu$  (mu)= 9.74404262  $\sigma^2$  (sigma squared)= 3.71465174 Random Number Generator Seed= 847796

BOE Conversion Factor (cf/bbl)	5620	Probability Any Pool Contains Both Oil and Free Gas (Gas Cap)	.25
Probability Any Pool is 100% Oil	0.5	Fraction of Pool Volume Gas-Bearing in Oil Pools with Gas Cap	0.25
Probability Any Pool is 100% Gas	0.25		

Table 3. Input data for Beaufort Sea play 7, 2006 assessment.

Risk Analysis Form - 2006 National Assessment				
Assessment Province:	Beaufort	Play Number, Name:	07, Rift	
Assessor(s):	Johnson/Scherr	Play UAI:	AAAAABAK	
Date:	20-Oct-05			
For each component, a <i>quantitative</i> probability of success (i.e., between zero and one, where zero indicates no confidence and one indicates absolute certainty) based on consideration of the <i>qualitative</i> assessment of <b>ALL</b> elements within the component was assigned. This is the assessment of the probability that the minimum geologic parameter assumptions have been met or exceeded.				
			Play Chance Factors	Average Conditional Prospect Chance <sup>1</sup>
<b>1. Hydrocarbon Fill component (1a * 1b * 1c)</b>		<b>1</b>	<b>1.0000</b>	<b>1.0000</b>
<b>a. Presence of a Quality, Effective, Mature Source Rock</b>				
Probability of efficient source rock in terms of the existence of sufficient volume of mature source rock of adequate quality located in the drainage area of the reservoirs.		1a	1.00	1.00
<b>b. Effective Expulsion and Migration</b>				
Probability of effective expulsion and migration of hydrocarbons from the source rock to the reservoirs.		1b	1.00	1.00
<b>c. Preservation</b>				
Probability of effective retention of hydrocarbons in the prospects after accumulation.		1c	1.00	1.00
<b>2. Reservoir component (2a * 2b)</b>		<b>2</b>	<b>0.9000</b>	<b>0.5000</b>
<b>a. Presence of reservoir facies</b>				
Probability of presence of reservoir facies with a minimum net thickness and net/gross ratio (as specified in the resource assessment).		2a		0.50
<b>b. Reservoir quality</b>				
Probability of effectiveness of the reservoir, with respect to minimum effective porosity, and permeability (as specified in the resource assessment).		2b	0.90	
<b>3. Trap component (3a * 3b)</b>		<b>3</b>	<b>1.0000</b>	<b>0.9000</b>
<b>a. Presence of trap</b>				
Probability of presence of the trap with a minimum rock volume (as specified in the resource assessment).		3a	1.00	0.90
<b>b. Effective seal mechanism</b>				
Probability of effective seal mechanism for the trap.		3b	1.00	1.00
<b>Overall Play Chance (Marginal Probability of hydrocarbons, MPhc)</b>			<b>0.9000</b>	
(1 * 2 * 3) Product of All Subjective Play Chance Factors				
<b>Average Conditional Prospect Chance<sup>1</sup></b>				<b>0.4500</b>
(1 * 2 * 3) Product of All Subjective Conditional Prospect Chance Factors				
<sup>1</sup> Assumes that the Play exists (where all play chance factors = 1.0)				
Must be consistent with play chance and prospect distribution -- See discussion on Page 3 of Guide				
<b>Exploration Chance</b>			<b>0.4050</b>	
(Product of Overall Play Chance and Average Conditional Prospect Chance)				
<b>Comments:</b> See guidance document for explanation of the Risk Analysis Form				
Increased play risk from 1.0 to 0.9 to reflect lack of discoveries in the OCS. Assigned risk to 3b (reservoir quality).				

Table 4. Risk model for Beaufort Sea play 7, 2006 assessment.

**GRASP - Geologic and Economic Resource Assessment Model - PSUM Module Results**

Minerals Management Service - Alaska OCS Region  
 GRASP Model Version: 8.29.2005)  
 Computes the Geologic Resource Potential of the Play

**Play UAI: AAAABAK**                      **Play No. 7**

World Level - World Level Resources  
 Country Level - UNITED STATES OF AMERICA  
 Region Level - MMS ALASKA REGION  
 Basin Level - **BEAUFORT SHELF**  
**Play Level - 7 Rift Play**

Geologist Peter Johnson  
 Remarks Play 7 2005 Assessment  
 Run Date & Time: Date 19-Sep-05 Time 13:48:36

**Summary of Play Potential**

Product	MEAN	Standard Deviation
BOE (Mboe)	1,157,200	1,318,700
Oil (Mbo)	773,420	942,940
Condensate (Mbc)	27,437	103,800
Free (Gas Cap & Nonassociated) Gas (Mmcf)	1,152,900	2,656,200
Solution Gas (Mmcf)	849,550	1,419,500

10000 (Number of Trials in Sample)  
 0.8999 (MPhc [Probability] of First Occurrence of Non-Zero Resource)  
 Windowing Feature: used

**Empirical Probability Distributions of the Products**

Greater Than Percentage	BOE (Mboe)	Oil (Mbo)	Condensate (Mbc)	Free (Gas Cap & Nonassociated) Gas (Mmcf)	Solution Gas (Mmcf)
100	0	0	0	0	0
99.99	0	0	0	0	0
99	0	0	0	0	0
95	0	0	0	0	0
90	31,137	19,453	935	44,005	16,409
85	234,150	157,420	5,799	258,540	140,100
80	323,390	197,230	9,040	442,940	215,280
75	403,990	257,080	12,077	506,000	251,710
70	484,930	316,600	11,619	574,230	306,510
65	565,180	362,010	13,144	681,550	386,400
60	645,320	432,420	13,481	665,360	455,370
55	730,490	468,550	18,887	843,510	522,460
50	820,540	507,380	25,863	1,050,700	563,930
45	922,470	607,840	23,720	996,550	638,340
40	1,025,500	695,970	25,720	1,020,500	686,950
35	1,152,400	792,820	25,870	1,120,100	755,560
30	1,303,000	894,990	27,810	1,243,800	892,660
25	1,475,300	942,760	37,906	1,684,300	1,095,700
20	1,701,200	1,220,100	26,118	1,315,300	1,241,800
15	2,011,600	1,329,200	51,490	2,108,100	1,437,200
10	2,471,400	1,594,300	60,240	2,715,000	1,875,400
8	2,725,300	1,806,900	64,851	2,799,800	1,997,300
6	3,083,000	2,178,000	54,246	2,491,000	2,290,100
5	3,296,100	2,385,300	56,009	2,190,300	2,613,700
4	3,575,000	2,631,300	51,160	2,312,100	2,704,000
2	4,781,300	3,181,400	113,960	4,447,900	3,902,900
1	6,382,300	4,195,100	162,340	5,092,200	6,287,500
0.1	13,551,000	831,720	1,182,200	64,214,000	622,110
0.01	16,815,000	14,144,000	28,045	8,648,800	6,207,000
0.001	16,832,000	2,034,700	110,680	81,354,000	1,187,400

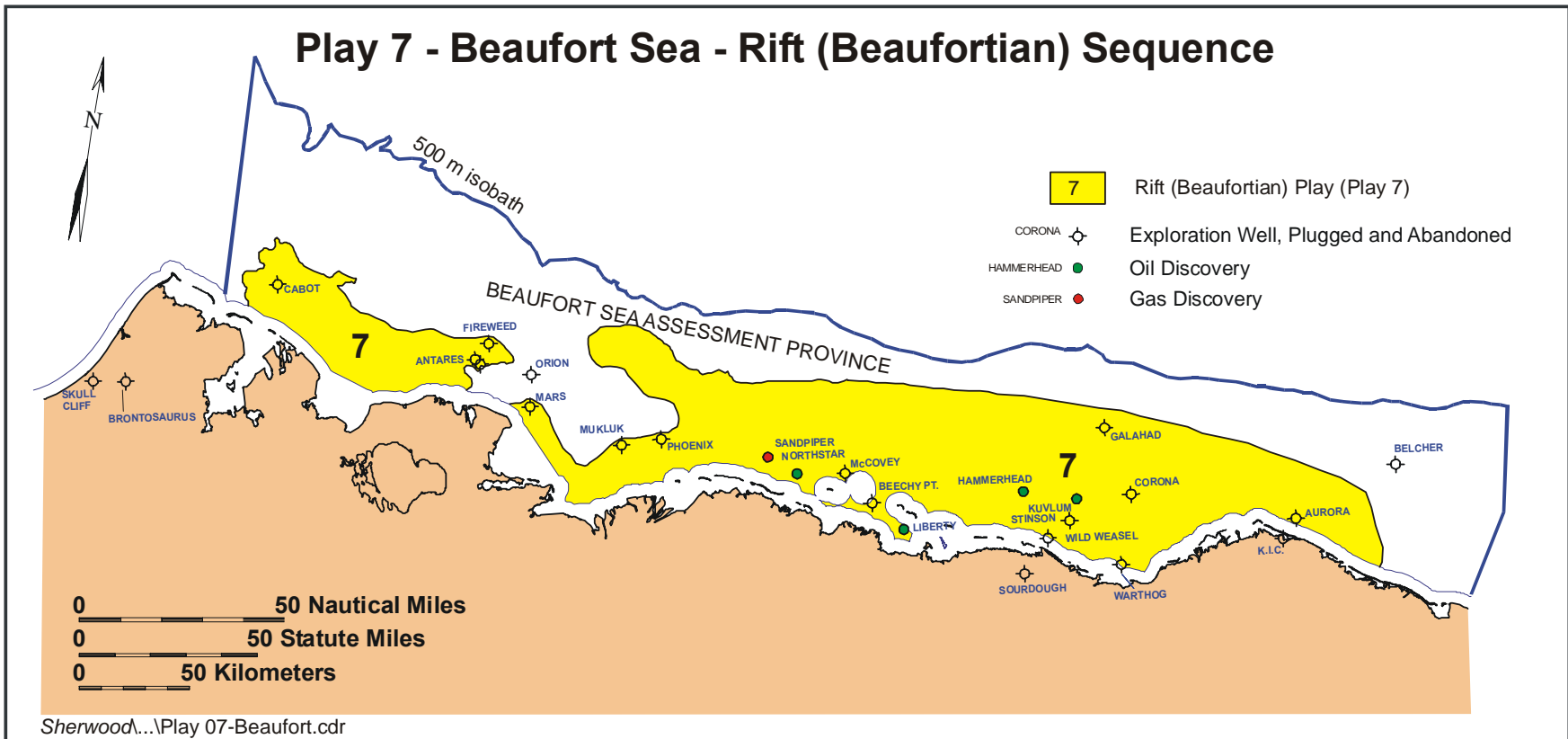
**Table 5.** Assessment results by commodity for Beaufort Sea play 7, 2006 assessment.

Classification and Size				Pool Count Statistics			Pool Types Count	Mixed Pool Range		Oil Pool Range		Gas Pool Range		Total Pool Range		Pool Resource Statistics (MMBOE)								
Class	Min (MMBOE)	Max (MMBOE)	Pool Count	Percentage	Trial Average	Trials w/Pool Avg	Mixed Pool	Oil Pool	Gas Pool	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Total Resource	Average Resource			
1	0.0312	0.0625	255	0.209692	0.0255	0.028333	40	75	140	1	1	1	1	1	1	1	1	1	1	0.031353	0.062073	11.901963	46.674367	
2	0.0625	0.125	572	0.470368	0.0572	0.063556	143	201	228	1	2	1	2	1	2	1	2	1	2	0.062659	0.124886	53.836217	94.119258	
3	0.125	0.25	1112	0.914421	0.1112	0.123556	237	391	484	1	2	1	2	1	3	1	3	1	3	0.125099	0.249799	211.451898	190.154582	
4	0.25	0.5	2246	1.846933	0.2246	0.249556	486	825	935	1	2	1	3	1	3	1	3	1	3	0.250121	0.499995	835.341583	371.924132	
5	0.5	1	4325	3.556539	0.4325	0.480556	957	1768	1800	1	3	1	3	1	3	1	3	1	3	0.500262	0.999992	3248.263000	751.043439	
6	1	2	7289	5.993898	0.7289	0.809889	1577	3109	2603	1	3	1	4	1	5	1	5	1	5	1.000048	1.998733	10814.696000	1.483701	
7	2	4	10921	8.980569	1.0921	1.213444	2658	4953	3310	1	4	1	5	1	4	1	8	1	8	2.000074	3.999885	32324.462000	2.959845	
8	4	8	14800	12.170352	1.48	1.644444	3657	6811	4332	1	6	1	6	1	5	1	8	1	8	4.000007	7.999912	86324.004000	5.832703	
9	8	16	16997	13.976992	1.6997	1.888556	4285	8381	4331	1	5	1	7	1	5	1	10	1	10	8.000703	15.999175	197615.561000	11.626496	
10	16	32	17347	14.264804	1.7347	1.927444	4445	8776	4126	1	4	1	8	1	5	1	11	1	11	16.000123	31.999939	399952.450000	23.056002	
11	32	64	15244	12.535462	1.5244	1.693778	3938	8135	3171	1	5	1	6	1	4	1	9	1	9	32.000302	63.999819	697634.518000	45.764530	
12	64	128	12241	10.066032	1.2241	1.360111	3199	6714	2328	1	4	1	6	1	4	1	7	1	7	64.003102	127.994584	1109576.000000	90.644241	
13	128	256	8259	6.79155	0.8259	0.917667	2202	4615	1442	1	4	1	4	1	4	1	7	1	7	128.015264	255.999081	1486619.000000	179.999863	
14	256	512	5266	4.330343	0.5266	0.585111	1376	3035	855	1	4	1	4	1	3	1	6	1	6	256.015921	511.873781	1872293.000000	355.543640	
15	512	1024	2888	2.374863	0.2888	0.320889	762	1703	423	1	2	1	4	1	2	1	5	1	5	512.025136	1023.464000	2053868.000000	711.173096	
16	1024	2048	1139	0.936624	0.1139	0.126556	317	695	127	1	2	1	2	1	2	1	3	1	3	1025.150000	2047.334000	1611415.000000	1.414763	
17	2048	4096	401	0.329751	0.0401	0.044556	111	247	43	1	2	1	2	1	1	1	2	1	2	2058.727000	4095.821000	1086788.000000	2.710195	
18	4096	8192	94	0.077298	0.0094	0.010444	25	57	12	1	1	1	1	1	1	1	1	1	1	4122.313000	8108.378000	515160.072000	5.480426	
19	8192	16384	35	0.028781	0.0035	0.003889	10	16	9	1	1	1	1	1	1	1	1	1	1	8560.688000	15758.811000	406906.896000	11.625911	
20	16384	32768	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	0.000000	0.000000	
21	32768	65536	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	0.000000	0.000000	
22	65536	131072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	0.000000	0.000000	
23	131072	262144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	0.000000	0.000000	
24	262144	524288	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	0.000000	0.000000	
25	524288	1048576	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.000000	0.000000	0.000000	0.000000	
Not Classified			176	0.144729	0.0176	0.019556	Below Class	29	56	91										Below Class	0.004211	0.031213	3.287063	18.676493
Totals			121607	100.000008	12.1607	13.511889	Above Class	0	0	0										Above Class	0.000000	0.000000	0.000000	0.000000

**Table 6.** Statistics for simulation pools created in computer sampling run for Beaufort Sea play 7, 2006 assessment.

Min and Max refer to numbers of pools of the relevant size class that occur within any single trial in the simulation.

Min and Max refer to aggregate resources of the relevant size class that occur within any single trial in the simulation.



**Figure 1.** Map location of Beaufort Sea play 7, 2006 assessment.