Northwest Fisheries Science Center
FRAMD, NMFS
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Cruise Report for the 2008 West Coast Groundfish Bottom Trawl Survey May 12 – Oct. 27, 2008

Chartered vessels:	F/V *Ms. Julie*	(2008 Pass 1)
	F/V *Noah's Ark*	(2008 Pass 1)
	F/V *Excalibur*	(2008 Pass 2)
	F/V *Raven*	(2008 Pass 2)

Summary

The Northwest Fisheries Science Center's (NWFSC) Fishery Resource Analysis and Monitoring Division (FRAM) conducted the eleventh in a series of groundfish bottom trawl surveys along the west coast upper continental slope and shelf from May 12 to October 27, 2008. The survey targeted the commercial groundfish resources inhabiting depths of 55 to1,280 meter from the area off Cape Flattery, Washington (lat. 48°10'N) to the U.S.-Mexican border (lat. 32°30'N). The West Coast groundfish fishery includes about 80 commercially fished stocks off Washington, Oregon and California. The goal of the 2008 groundfish survey is to provide fishery-independent data used in the assessment of the status and trends of commercially important species. Four chartered West Coast bottom trawlers were selected to participate in the survey through a competitive bid process. Two vessels, the Fishing Vessel (F/V) *Noah's Ark* and the F/V *Ms. Julie*, were used during the first survey period, pass 1. Two additional vessels, the F/V *Excalibur* and the F/V *Raven*, were used during the second survey period, pass 2. All vessels progressed south along the coast, finishing the survey south of San Diego, CA.

In 2008, 773 stations were sampled with 701 successful tows. Catches were sorted to species, aggregate or other appropriate taxonomic level and then weighed using an electronic, motion compensated scale. A count of 619 distinct fish and invertebrate species were identified within the survey area. Biological sampling included determination of sex as well as collection of lengths, weights, otoliths, and stomachs. Summaries indicate that 24,666 individual weights and 85,939 length measurements were taken with 23,081 otolith samples collected. A total of 1,281 stomachs were collected from 18 species: primarily Pacific hake, sablefish, Pacific ocean perch, darkblotched and canary rockfish.

In 2008 we continued an inventory of marine debris and a study of fish distribution and abundance in a hypoxic area off Newport OR initiated in 2007. We also added a study of fish distribution in the low oxygen waters of the Santa Barbara basin. Corals were subsampled (n = 262) for DNA analysis, collected whole (n = 14) or photographed (n = 202). Estimates of seabird abundance were made at the start of each tow, time permitting, with data intended to advance an understanding of the distribution of seabird species and their oceanic habitats.

Itinerary

The survey was conducted on board the chartered commercial trawlers F/V *Ms. Julie* and F/V *Noah's Ark* from May 12 through July 24, 2008 and the F/V *Excalibur* and the F/V *Raven* from August 18 until October 27, 2008. These vessels began the cruise in Newport Or, worked north to Cape Flattery, Washington and then proceeded southward to the U.S.-Mexican border sampling in randomly predetermined areas and depths.

Objectives

The West Coast Groundfish BottomTrawl Survey (WCGBTS) is designed to provide information on distribution and abundance of demersal fish species, and other biological resource information. Although NWFSC assumed responsibility for the slope portion of the groundfish survey starting in 1998, the time series began as a West Coast continental slope survey conducted by the Alaska Fisheries Science Center (AFSC) in 1988. Since 1998, the NWFSC has conducted an annual coast-wide survey to establish an ongoing time series of groundfish catch, fishing effort, and individual fish measurement. Beginning in 2003, the NWFSC expanded the depth coverage of the slope survey (184 – 1,280 m) to incorporate the continental shelf (55 – 183 m). Consequently, in the current sampling configuration the WCGBTS now also encompasses the area historically monitored by the continental shelf survey conducted triennially by the Alaska Fisheries Science Center (from 1977 through 2001). The NWFSC's groundfish survey currently provides not only an annual snapshot of fish stock status, but also provides an extension of two established, long-term time series from which informed management decisions can be made. Prior to 1998, surveys conducted by the AFSC were the principal source for fishery-independent data of groundfish resources along the upper continental slope and shelf of the U.S. West Coast. The AFSC conducted slope surveys, periodically from 1984 – 1987, and annually beginning in 1988 and shelf surveys triennially from 1977 – 2001. The AFSC slope surveys were conducted with the NOAA vessel *Miller Freeman* while the triennial survey used chartered Alaskan fishing vessels. Spatial coverage of the West Coast surveys varied among years due to constraints imposed by annual budget levels and availability of NOAA ship time.

The NWFSC groundfish survey was initially designed to cover the same depths and latitudes established with the AFSC slope survey. Beginning in 2003, the WCGBTS was expanded to include the continental shelf and slope (range of depths 55 m to 1,280 m) along the entire area U.S. West Coast (U.S.-Canadian border to U.S.-Mexican border). Since inception in 1998, the NWFSC survey has utilized chartered fishing vessels from the West Coast commercial fishing industry. This feature capitalizes on the skills of

fishing captains familiar with the challenges of fishing in the waters off the West Coast, and fulfills the cooperative research provisions of the Magnuson-Stevens Sustainable Fisheries Act. The results of the surveys provide measures of the change in relative abundance, distribution, and condition of groundfish stocks over time, which is of interest to fisheries managers, fishers, and concerned citizens.

Chartered Vessels and Gear Specifications

The four vessels used in the 2008 charter ranged in length from 65 to 92 feet (19.8 to 28.0 m), with vessel horsepower ranging from 450-1,200. Each vessel was rigged as a stern trawler; with a rear gantry housing one or two net reels to set and retrieve trawl gear. Vessels were outfitted with split trawl winches and equipped with modern electronics including global positioning systems (GPS), multiple depth sounders, radars, and other navigational aids. Prior to the start of the survey, the NWFSC provided each vessel with two 5/8" steel core trawl cables, each 2,288 m (1,250 fm) in length. Cables were measured side-by-side and marked at 25 fm increments while being spooled onto the vessel's winches. The markings provided real-time verification of the release of equal warp length from both winches while setting a tow. An experienced captain, two crew members, and three scientists staffed each vessel (Table 1).

The FRAM division provided standardized fishing gear for the survey. An Aberdeen-style net, built and rigged to operate within strict specifications in compliance with NOAA protocols for bottom trawl surveys was used to sample fish biomass. The Aberdeen trawl is a four panel bottom trawl with a small-mesh (1 1/2" stretched measure or less) liner in the codend to retain small organisms. The Aberdeen trawls were fitted with 8" and 10" rubber disc footropes and spread with 1,200 lb. 5' x 7' steel V-doors. A Simrad ITI trawl instrumentation package was employed on each net to monitor trawl performance and ensure that the gear's haul-to-haul catching performance was kept as constant as possible. Electronic net mensuration data, as well as global positioning system (DGPS) navigation data, bottom contact sensor data, and temperature data were obtained for each tow. Average vessel speed over ground and distance fished were calculated from the position, vessel speed, net-to-vessel range and bearing readings and actual bottom time of the trawl. All features of the trawl event (i.e. from commencement of net deployment to the completion of net retrieval) including net mensuration information, GPS data, trawl location, scope, vessel depth, trawl gear depth, and sea state conditions, were logged using customized software programs. Catches were sorted to species or other appropriate taxonomic levels and then weighed in aggregate using an electronic, motion-compensated scale. Sub samples of important management species were randomly selected for individual measurements (length and weights) and biological sampling (otoliths and sex determinations). Catch and individual species biological information were logged wirelessly into a rugged notebook computer using the Fisheries Scientific Computing System (FSCS) customized data integration system. Data were quality controlled while at sea using FRAM Division custom-built editing applications.

Survey Design and Methods

The survey followed a stratified random sampling scheme with 2 geographic strata (80% N and 20% S of Pt. Conception, CA) and 3 depth strata. The depth strata were: shallow (55-182 m), middle (183-549 m), and deep (550-1,280 m). The sample design consisted of 752 randomly selected sampling locations, within specified depth strata (minimum of 30 tows per strata). Each of the four vessels occupied a different subset of 188 cell sites. Table 2 includes the haul numbers and station locations (latitude, longitude) by vessel. Station location, as initially defined here, is a location central to the sampled survey grid cell that is computed as the mean latitude and mean longitude of the four defined grid cell trapezoid corner positions. Following post-season data processing the station location represent the "best" location as defined by a hierarchy of computational preferences that depend on data availability. These are: (1) the mean of the start (touchdown) and stop (liftoff) locations of the net along a tow track, or in absence of these data, any known single net position along the tow track (preferred and actual for most tows); (2) similar means based on the vessel location at the start and end of the tow, or in absence of these data, any know single vessel position along the vessel track (occasional); or (3) if no other information were available, the cell centroid as previously described for the station locations reported here (rare).

Target duration of each tow was 15 minutes. Captains attempted to maintain a constant speed (2.2±0.5 knots) throughout the tow. Bottom contact sensors (Scott McEntire, AFSC/RACE Division, Seattle WA) were placed on the footrope of the net and used to verify that the trawl was on the bottom. Tow duration was determined from the bottom contact sensors as the time from net touch down to net lift-off. Acoustic instruments attached to the net recorded various aspects of the net's mechanical performance (e.g. net height, net width, distance to bottom, etc.). Other data were collected on the operational conditions (e.g. depth, amount of towing cable deployed, towing speed, tow duration, and weather conditions).

Catches were sorted to species or other appropriate taxon, and then weighed. Samples were taken of the principal species for length-frequency determinations using an electronic measuring board or acquisition of other biological data. The data were logged using a data gathering system called Fisheries Scientific Computing System (FSCS, Dennis Shields, NOAA/OMAO Silver Springs, MD). Following this, marketable fish were placed in the hold of the vessel, iced and delivered to a shoreside processing facility within 5 days. Such fish were part of the vessel's compensation. All prohibited species and other marine organisms with no commercial value were returned to the sea.

Table 1. Scientific survey personnel participating in the 2008 WCGTS.

	Pass 1	**F/V** *Ms. Julie*	**5/12/08 – 7/24/08**
Leg 1	Victor Simon	Chief Scientist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
	Kyle Molton	Fisheries Biologist	Hollings Intern
Leg 2	Keith Bosley	Chief Scientist	NMFS-NWFSC
	John Buchanan	Fisheries Biologist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
Leg 3	John Buchanan	Chief Scientist	NMFS-NWFSC
	Keith Bosley	Fisheries Biologist	NMFS-NWFSC
	Stephen Hillyer	Fisheries Biologist	NMFS-NWFSC
Leg 4	Dan Kamikawa	Chief Scientist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
	Megan Winton	Fisheries Biologist	MLML
Leg 5	John Buchanan	Chief Scientist	NMFS-NWFSC
	Dan Kamikawa	Fisheries Biologist	NMFS-NWFSC
	Stephen Hillyer	Fisheries Biologist	NMFS-NWFSC
	Pass 1	**F/V** ***Noah's Ark***	**5/12/08 – 7/24/08**
Leg 1	Dan Kamikawa	Chief Scientist	NMFS-NWFSC
	John Harms	Fisheries Biologist	NMFS-NWFSC
	Craig Good	Fisheries Biologist	ODFW
Leg 2	Dan Kamikawa	Chief Scientist	NMFS-NWFSC
	John Harms	Fisheries Biologist	NMFS-NWFSC
	Kyle Molton	Fisheries Biologist	Hollings Intern
Leg 3	Victor Simon	Chief Scientist	NMFS-NWFSC
	John Harms	Fisheries Biologist	NMFS-NWFSC
	Erica Fruf	Fisheries Biologist	NMFS-NWFSC
Leg 4	Erica Fruf	Chief Scientist	NMFS-NWFSC
	Stacey Miller	Fisheries Biologist	NMFS-NWFSC
	Kyle Molton	Fisheries Biologist	Hollings Intern
Leg 5	Keith Bosley	Chief Scientist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
	Erin Loury	Fisheries Biologist	MLML

NMFS-NWFSC	National Marine Fisheries Service, Northwest Fisheries Science Center
MLML	Moss Landing Marine Laboratory, Santa Cruz, CA
ODFW	Oregon Department of Fish and Wildlife

Table 1 (continued). Scientific survey personnel participating in the 2008 WCGTS.

	Pass 2	**F/V *Excalibur***	**8/18/08 –10/27/08**
Leg 1	Dan Kamikawa	Chief Scientist	NMFS-NWFSC
	Erica Fruh	Fisheries Biologist	NMFS-NWFSC
	Jim Miller	Fisheries Biologist	NMFS-NWFSC
Leg 2	Victor Simon	Chief Scientist	NMFS-NWFSC
	Dan Kamikawa	Fisheries Biologist	NMFS-NWFSC
	Jim Miller	Fisheries Biologist	NMFS-NWFSC
Leg 3	Erica Fruh	Chief Scientist	NMFS-NWFSC
	Cassandra Donovan	Fisheries Biologist	NMFS-NWFSC
	Nick Wilsman	Fisheries Biologist	ODFW
Leg 4	Keith Bosley	Chief Scientist	NMFS-NWFSC
	John Wallace	Fisheries Biologist	NMFS-NWFSC
	Kelly Corbett	Fisheries Biologist	ODFW
Leg 5	Victor Simon	Chief Scientist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
	Matt Blume	Fisheries Biologist	ODFW
	Pass 2	**F/V *Raven***	**8/18/08 –10/27/08**
Leg 1	John Buchanan	Chief Scientist	NMFS-NWFSC
	Ian Stewart	Fisheries Biologist	NMFS-NWFSC
	Mariah Boyle	Fisheries Biologist	MLML
Leg 2	Erica Fruh	Chief Scientist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
	Mariah Boyle	Fisheries Biologist	MLML
Leg 3	John Buchanan	Chief Scientist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
	Cathleen Vestfals	Fisheries Biologist	OSU
Leg 4	John Buchanan	Chief Scientist	NMFS-NWFSC
	Melanie Johnson	Fisheries Biologist	NMFS-NWFSC
	Isaac Kaplan	Fisheries Biologist	NMFS-NWFSC
Leg 5	Keith Bosley	Chief Scientist	NMFS-NWFSC
	Erica Fruh	Fisheries Biologist	NMFS-NWFSC
	Dawn Dougherty	Fisheries Biologist	UW

NMFS-NWFSC	National Marine Fisheries Service, Northwest Fisheries Science Center
ODFW	Oregon Department of Fish and Wildlife
MLML	Moss Landing Marine Laboratory, Santa Cruz, CA
OSU	Oregon State University; UW University of Washington

Table 2. Vessel, haul number, and station locations for the 2008 WCGTS.

Vessel	Haul	Latitude (N)	Longitude (W)
Excalibur	1	45.32	-124.94
Excalibur	2	45.20	-124.86
Excalibur	3	45.15	-124.74
Excalibur	4	45.13	-124.47
Excalibur	5	45.34	-124.66
Excalibur	6	45.25	-124.32
Excalibur	7	45.22	-124.15
Excalibur	8	45.36	-124.08
Excalibur	9	45.46	-124.60
Excalibur	10	45.57	-124.57
Excalibur	11	46.07	-124.46
Excalibur	12	46.36	-124.47
Excalibur	13	46.55	-124.76
Excalibur	14	46.58	-124.71
Excalibur	15	46.63	-124.44
Excalibur	16	46.73	-124.57
Excalibur	17	46.86	-124.72
Excalibur	18	47.14	-124.78
Excalibur	19	47.32	-124.62
Excalibur	20	47.36	-124.68
Excalibur	21	47.42	-124.71
Excalibur	22	47.89	-125.03
Excalibur	23	47.93	-124.82
Excalibur	24	48.16	-124.92
Excalibur	25	48.36	-125.17
Excalibur	26	48.36	-125.21
Excalibur	27	48.15	-125.91
Excalibur	28	48.06	-125.86
Excalibur	29	47.98	-125.59
Excalibur	30	48.03	-125.38
Excalibur	31	47.69	-125.47
Excalibur	32	47.83	-125.08
Excalibur	33	47.63	-125.00
Excalibur	34	47.59	-125.10
Excalibur	35	47.51	-125.00
Excalibur	36	47.30	-124.84
Excalibur	37	47.26	-124.99
Excalibur	38	46.73	-125.15
Excalibur	39	46.55	-124.95
Excalibur	40	46.18	-124.87
Excalibur	41	46.17	-124.91

Excalibur	42	46.12	-124.99
Excalibur	43	44.97	-124.26
Excalibur	44	44.81	-124.31
Excalibur	45	44.60	-124.27
Excalibur	46	44.54	-124.73
Excalibur	47	44.44	-124.78
Excalibur	48	44.31	-124.84
Excalibur	49	44.23	-124.62
Excalibur	50	44.18	-124.60
Excalibur	51	44.35	-124.35
Excalibur	52	44.53	-124.20
Excalibur	53	44.83	-124.33
Excalibur	54	44.99	-124.68
Excalibur	55	44.90	-124.76
Excalibur	56	44.58	-124.59
Excalibur	57	44.57	-124.58
Excalibur	58	44.03	-124.44
Excalibur	59	43.95	-124.70
Excalibur	60	43.89	-124.86
Excalibur	61	43.84	-125.02
Excalibur	62	43.72	-124.89
Excalibur	63	43.80	-124.33
Excalibur	64	43.75	-124.47
Excalibur	65	43.61	-124.57
Excalibur	66	43.33	-124.79
Excalibur	67	43.26	-124.88
Excalibur	68	43.22	-124.89
Excalibur	69	43.17	-124.98
Excalibur	70	43.18	-124.93
Excalibur	71	43.06	-124.86
Excalibur	72	42.88	-124.93
Excalibur	73	42.87	-124.81
Excalibur	74	42.79	-124.86
Excalibur	75	42.77	-124.68
Excalibur	76	42.77	-124.68
Excalibur	77	42.77	-124.70
Excalibur	78	43.06	-124.50
Excalibur	79	42.64	-124.97
Excalibur	80	42.64	-124.79
Excalibur	81	42.38	-124.51
Excalibur	82	42.33	-124.48
Excalibur	83	42.22	-124.67
Excalibur	84	42.12	-124.82
Excalibur	85	41.86	-124.55
Excalibur	86	41.73	-124.54
Excalibur	87	41.73	-124.50

Excalibur	88	41.23	-124.82
Excalibur	89	41.23	-124.83
Excalibur	90	41.24	-124.71
Excalibur	91	41.15	-124.50
Excalibur	92	41.12	-124.42
Excalibur	93	40.77	-124.44
Excalibur	94	40.72	-124.53
Excalibur	95	40.53	-124.59
Excalibur	96	40.15	-124.39
Excalibur	97	40.05	-124.58
Excalibur	98	39.57	-123.94
Excalibur	99	39.54	-123.86
Excalibur	100	39.43	-123.91
Excalibur	101	39.12	-123.98
Excalibur	102	39.11	-123.95
Excalibur	103	39.12	-123.93
Excalibur	104	39.01	-123.80
Excalibur	105	38.97	-123.80
Excalibur	106	38.99	-124.07
Excalibur	107	38.78	-123.78
Excalibur	108	38.52	-123.67
Excalibur	109	38.45	-123.53
Excalibur	110	38.49	-123.40
Excalibur	111	38.37	-123.34
Excalibur	112	38.33	-123.18
Excalibur	113	38.17	-123.05
Excalibur	114	38.14	-123.06
Excalibur	115	38.18	-123.55
Excalibur	116	38.26	-123.46
Excalibur	117	38.04	-123.22
Excalibur	118	37.93	-123.10
Excalibur	119	37.35	-123.18
Excalibur	120	37.33	-122.87
Excalibur	121	37.23	-122.78
Excalibur	122	37.11	-122.83
Excalibur	123	37.18	-122.56
Excalibur	124	37.06	-122.47
Excalibur	125	36.77	-121.87
Excalibur	126	36.58	-122.02
Excalibur	127	36.58	-122.01
Excalibur	128	36.50	-122.15
Excalibur	129	36.35	-122.32
Excalibur	130	36.34	-122.06
Excalibur	131	36.44	-121.97
Excalibur	132	36.32	-121.98
Excalibur	133	36.29	-122.02

Excalibur	134	36.19	-121.91
Excalibur	135	36.15	-121.80
Excalibur	136	35.92	-121.87
Excalibur	137	35.90	-121.54
Excalibur	138	35.83	-121.53
Excalibur	139	35.67	-121.42
Excalibur	140	35.49	-121.31
Excalibur	141	35.18	-121.39
Excalibur	142	35.07	-121.52
Excalibur	143	35.03	-121.35
Excalibur	144	34.82	-121.18
Excalibur	145	34.62	-121.36
Excalibur	146	34.62	-121.37
Excalibur	147	35.09	-121.07
Excalibur	148	35.37	-120.99
Excalibur	149	34.26	-120.48
Excalibur	150	34.25	-120.44
Excalibur	151	34.30	-120.32
Excalibur	152	34.36	-120.29
Excalibur	153	34.41	-120.06
Excalibur	154	34.25	-120.10
Excalibur	155	34.16	-120.11
Excalibur	156	34.19	-119.86
Excalibur	157	34.23	-119.80
Excalibur	158	34.34	-119.75
Excalibur	159	34.04	-119.46
Excalibur	160	33.96	-119.20
Excalibur	161	33.90	-118.87
Excalibur	162	33.84	-118.80
Excalibur	163	33.87	-118.63
Excalibur	164	33.84	-118.44
Excalibur	165	33.64	-118.51
Excalibur	166	33.50	-118.51
Excalibur	167	33.53	-118.81
Excalibur	168	33.31	-118.48
Excalibur	169	32.30	-119.66
Excalibur	170	32.34	-119.67
Excalibur	171	32.36	-119.66
Excalibur	172	32.35	-119.66
Excalibur	173	33.16	-120.08
Excalibur	174	33.25	-120.41
Excalibur	175	33.43	-120.31
Excalibur	176	33.41	-120.31
Excalibur	177	33.59	-119.81
Excalibur	178	33.88	-119.92
Excalibur	179	33.87	-120.01

Excalibur	180	33.89	-120.30
Excalibur	181	33.92	-120.36
Excalibur	182	34.00	-120.45
Excalibur	183	33.96	-120.50
Excalibur	184	34.16	-120.62
Excalibur	185	34.29	-120.54
Excalibur	186	34.59	-120.70
Excalibur	187	34.72	-120.78
Ms. Julie	1	45.58	-124.79
Ms. Julie	2	45.55	-124.78
Ms. Julie	3	45.70	-124.31
Ms. Julie	4	45.77	-124.34
Ms. Julie	5	45.90	-124.66
Ms. Julie	6	46.19	-124.73
Ms. Julie	7	46.27	-124.85
Ms. Julie	8	46.75	-125.22
Ms. Julie	9	46.76	-125.22
Ms. Julie	10	47.17	-124.90
Ms. Julie	11	47.23	-124.80
Ms. Julie	12	47.50	-125.08
Ms. Julie	13	47.53	-125.18
Ms. Julie	14	48.16	-125.48
Ms. Julie	15	48.16	-125.48
Ms. Julie	16	48.24	-125.49
Ms. Julie	17	48.30	-125.22
Ms. Julie	18	48.40	-125.10
Ms. Julie	19	48.31	-125.03
Ms. Julie	20	48.01	-125.07
Ms. Julie	21	47.93	-125.03
Ms. Julie	22	47.87	-124.86
Ms. Julie	23	47.77	-124.78
Ms. Julie	24	47.70	-124.77
Ms. Julie	25	47.02	-124.68
Ms. Julie	26	47.03	-124.79
Ms. Julie	27	46.84	-124.82
Ms. Julie	28	46.84	-124.73
Ms. Julie	29	46.75	-124.56
Ms. Julie	30	46.67	-124.72
Ms. Julie	31	46.47	-124.51
Ms. Julie	32	46.44	-124.62
Ms. Julie	33	46.04	-124.38
Ms. Julie	34	45.90	-124.57
Ms. Julie	35	45.94	-124.51
Ms. Julie	36	45.93	-124.39
Ms. Julie	37	45.87	-124.31
Ms. Julie	38	45.67	-124.11

Ms. Julie	39	45.69	-124.48
Ms. Julie	40	45.63	-124.71
Ms. Julie	41	45.47	-124.57
Ms. Julie	42	45.04	-124.52
Ms. Julie	43	44.94	-124.58
Ms. Julie	44	44.97	-124.49
Ms. Julie	45	44.97	-124.41
Ms. Julie	46	44.93	-124.31
Ms. Julie	47	45.17	-124.16
Ms. Julie	48	45.20	-124.27
Ms. Julie	49	45.24	-124.29
Ms. Julie	50	45.20	-124.43
Ms. Julie	51	45.37	-124.49
Ms. Julie	52	45.40	-124.48
Ms. Julie	53	45.30	-124.69
Ms. Julie	54	45.01	-124.74
Ms. Julie	55	44.90	-125.07
Ms. Julie	56	44.77	-124.94
Ms. Julie	57	44.58	-125.18
Ms. Julie	58	44.52	-125.17
Ms. Julie	59	44.58	-124.89
Ms. Julie	60	44.71	-124.88
Ms. Julie	62	44.77	-124.53
Ms. Julie	63	44.87	-124.37
Ms. Julie	64	44.73	-124.18
Ms. Julie	65	44.34	-124.26
Ms. Julie	66	44.30	-124.32
Ms. Julie	67	44.37	-124.38
Ms. Julie	68	44.22	-124.60
Ms. Julie	69	44.15	-124.77
Ms. Julie	70	44.15	-124.92
Ms. Julie	71	44.32	-124.89
Ms. Julie	72	44.13	-124.99
Ms. Julie	73	43.74	-124.69
Ms. Julie	74	43.78	-124.71
Ms. Julie	75	43.82	-124.95
Ms. Julie	76	43.77	-124.39
Ms. Julie	77	43.06	-124.66
Ms. Julie	78	42.98	-124.77
Ms. Julie	79	42.96	-125.00
Ms. Julie	80	42.84	-124.85
Ms. Julie	81	42.89	-124.74
Ms. Julie	82	42.85	-124.73
Ms. Julie	83	42.74	-124.63
Ms. Julie	84	42.75	-124.62
Ms. Julie	85	42.73	-124.60

Ms. Julie	86	42.56	-124.80
Ms. Julie	87	42.53	-124.82
Ms. Julie	88	42.46	-124.84
Ms. Julie	89	42.22	-124.46
Ms. Julie	90	42.16	-124.54
Ms. Julie	91	41.40	-124.29
Ms. Julie	92	40.84	-124.47
Ms. Julie	93	41.11	-124.57
Ms. Julie	94	41.03	-124.64
Ms. Julie	95	41.00	-124.63
Ms. Julie	96	40.34	-124.50
Ms. Julie	97	40.07	-124.82
Ms. Julie	98	40.05	-124.77
Ms. Julie	99	40.04	-124.71
Ms. Julie	100	40.03	-124.54
Ms. Julie	101	39.99	-124.30
Ms. Julie	102	39.75	-124.10
Ms. Julie	103	39.67	-124.03
Ms. Julie	104	39.61	-123.84
Ms. Julie	105	39.52	-124.07
Ms. Julie	106	39.48	-124.07
Ms. Julie	107	39.45	-123.86
Ms. Julie	108	39.31	-123.92
Ms. Julie	109	39.34	-124.01
Ms. Julie	110	39.28	-123.95
Ms. Julie	111	38.73	-123.88
Ms. Julie	112	38.48	-123.63
Ms. Julie	113	38.28	-123.19
Ms. Julie	114	38.18	-123.34
Ms. Julie	115	37.85	-123.28
Ms. Julie	116	37.79	-123.26
Ms. Julie	117	37.78	-122.89
Ms. Julie	118	37.52	-122.65
Ms. Julie	119	37.36	-122.84
Ms. Julie	120	37.24	-122.81
Ms. Julie	121	37.27	-122.75
Ms. Julie	122	37.25	-122.50
Ms. Julie	123	37.11	-122.71
Ms. Julie	124	37.01	-122.55
Ms. Julie	125	36.86	-122.28
Ms. Julie	126	36.76	-122.20
Ms. Julie	127	36.67	-121.97
Ms. Julie	128	36.51	-122.09
Ms. Julie	129	36.22	-121.95
Ms. Julie	130	36.02	-121.96
Ms. Julie	131	35.92	-121.85

Ms. Julie	132	35.75	-121.74
Ms. Julie	133	35.61	-121.77
Ms. Julie	134	35.69	-121.58
Ms. Julie	135	35.70	-121.40
Ms. Julie	136	35.57	-121.31
Ms. Julie	137	35.47	-121.09
Ms. Julie	138	35.32	-121.23
Ms. Julie	139	35.31	-121.64
Ms. Julie	140	35.14	-121.49
Ms. Julie	141	34.96	-121.22
Ms. Julie	142	34.88	-120.96
Ms. Julie	143	35.12	-120.94
Ms. Julie	144	35.09	-121.16
Ms. Julie	145	35.05	-121.01
Ms. Julie	146	35.08	-120.92
Ms. Julie	147	35.31	-121.08
Ms. Julie	148	35.19	-121.06
Ms. Julie	149	34.69	-121.40
Ms. Julie	150	34.59	-121.08
Ms. Julie	151	34.74	-120.95
Ms. Julie	152	34.67	-120.74
Ms. Julie	153	34.57	-120.79
Ms. Julie	154	34.02	-120.55
Ms. Julie	155	34.11	-120.28
Ms. Julie	156	34.31	-120.11
Ms. Julie	157	34.31	-120.11
Ms. Julie	158	34.36	-120.00
Ms. Julie	159	34.23	-119.92
Ms. Julie	160	34.10	-119.71
Ms. Julie	161	34.04	-119.11
Ms. Julie	162	34.07	-119.11
Ms. Julie	163	34.04	-119.02
Ms. Julie	164	33.92	-118.73
Ms. Julie	165	33.97	-119.53
Ms. Julie	166	33.95	-119.67
Ms. Julie	167	33.79	-119.82
Ms. Julie	168	33.82	-119.97
Ms. Julie	169	33.82	-119.98
Ms. Julie	170	33.80	-119.98
Ms. Julie	171	33.69	-119.84
Ms. Julie	172	33.69	-119.85
Ms. Julie	173	33.68	-119.84
Ms. Julie	174	33.48	-120.07
Ms. Julie	175	33.17	-120.12
Ms. Julie	176	33.11	-120.16
Ms. Julie	177	33.06	-120.18

Ms. Julie	178	32.77	-120.11
Ms. Julie	179	32.68	-120.12
Ms. Julie	180	32.59	-119.65
Ms. Julie	181	32.45	-118.59
Ms. Julie	182	32.64	-118.34
Ms. Julie	183	32.78	-118.12
Ms. Julie	184	33.03	-118.13
Ms. Julie	185	33.06	-118.24
Ms. Julie	186	33.20	-118.32
Ms. Julie	187	33.33	-118.52
Ms. Julie	188	33.44	-118.59
Ms. Julie	189	33.52	-117.86
Ms. Julie	190	33.41	-117.68
Ms. Julie	191	33.34	-117.64
Ms. Julie	192	33.21	-117.54
Ms. Julie	193	32.80	-117.40
Ms. Julie	194	32.69	-117.78
Noah’s Ark	1	44.67	-124.98
Noah’s Ark	2	44.90	-124.81
Noah’s Ark	3	45.06	-124.51
Noah’s Ark	4	45.13	-124.54
Noah’s Ark	5	46.36	-124.95
Noah’s Ark	6	46.73	-124.94
Noah’s Ark	7	46.76	-124.97
Noah’s Ark	8	46.85	-124.98
Noah’s Ark	9	46.96	-124.79
Noah’s Ark	10	47.70	-125.70
Noah’s Ark	11	47.72	-125.55
Noah’s Ark	12	47.70	-125.49
Noah’s Ark	13	47.79	-125.36
Noah’s Ark	14	47.96	-125.48
Noah’s Ark	15	47.99	-125.52
Noah’s Ark	16	47.99	-125.41
Noah’s Ark	17	48.10	-125.36
Noah’s Ark	18	48.10	-125.37
Noah’s Ark	19	48.10	-125.36
Noah’s Ark	20	48.29	-125.37
Noah’s Ark	21	48.10	-125.02
Noah’s Ark	22	48.13	-125.12
Noah’s Ark	23	48.07	-125.14
Noah’s Ark	24	47.17	-124.65
Noah’s Ark	25	47.21	-124.90
Noah’s Ark	26	47.17	-124.93
Noah’s Ark	27	47.45	-124.82
Noah’s Ark	28	47.49	-124.93
Noah’s Ark	29	46.67	-124.37

Noah’s Ark	30	46.53	-124.49
Noah’s Ark	31	46.46	-124.30
Noah’s Ark	32	46.45	-124.27
Noah’s Ark	33	46.27	-124.45
Noah’s Ark	34	45.74	-124.13
Noah’s Ark	35	45.73	-124.46
Noah’s Ark	36	45.64	-124.61
Noah’s Ark	37	45.63	-124.60
Noah’s Ark	38	45.54	-124.36
Noah’s Ark	39	45.48	-124.69
Noah’s Ark	40	45.41	-124.62
Noah’s Ark	41	45.12	-124.18
Noah’s Ark	42	45.00	-124.27
Noah’s Ark	43	44.84	-124.41
Noah’s Ark	44	44.72	-124.27
Noah’s Ark	45	44.76	-124.27
Noah’s Ark	46	44.79	-124.17
Noah’s Ark	47	44.73	-124.65
Noah’s Ark	48	44.64	-124.71
Noah’s Ark	49	44.53	-124.29
Noah’s Ark	50	44.50	-124.21
Noah’s Ark	51	44.45	-124.46
Noah’s Ark	52	44.38	-124.42
Noah’s Ark	53	44.18	-124.54
Noah’s Ark	54	44.15	-124.54
Noah’s Ark	55	44.34	-124.99
Noah’s Ark	56	44.17	-125.06
Noah’s Ark	57	44.10	-124.89
Noah’s Ark	58	43.32	-124.59
Noah’s Ark	59	43.06	-124.67
Noah’s Ark	60	42.28	-124.78
Noah’s Ark	61	42.28	-124.83
Noah’s Ark	62	42.10	-124.90
Noah’s Ark	63	42.02	-124.70
Noah’s Ark	64	42.09	-124.61
Noah’s Ark	65	41.92	-124.54
Noah’s Ark	66	41.89	-124.58
Noah’s Ark	67	40.89	-124.41
Noah’s Ark	68	40.96	-124.54
Noah’s Ark	69	41.20	-124.39
Noah’s Ark	70	41.34	-124.38
Noah’s Ark	71	41.31	-124.30
Noah’s Ark	72	40.74	-124.61
Noah’s Ark	73	40.78	-124.69
Noah’s Ark	74	41.57	-124.61
Noah’s Ark	75	41.69	-124.52

Noah’s Ark	76	41.83	-124.57
Noah’s Ark	77	41.86	-124.82
Noah’s Ark	78	41.60	-124.93
Noah’s Ark	79	40.68	-124.45
Noah’s Ark	80	40.58	-124.72
Noah’s Ark	81	40.61	-124.67
Noah’s Ark	82	40.69	-124.72
Noah’s Ark	83	40.46	-124.63
Noah’s Ark	84	40.18	-124.53
Noah’s Ark	85	40.17	-124.45
Noah’s Ark	86	39.98	-124.47
Noah’s Ark	87	39.92	-124.12
Noah’s Ark	88	39.83	-124.07
Noah’s Ark	89	39.83	-124.08
Noah’s Ark	90	39.81	-123.98
Noah’s Ark	91	39.37	-124.15
Noah’s Ark	92	39.32	-123.96
Noah’s Ark	93	39.18	-124.02
Noah’s Ark	94	39.08	-124.15
Noah’s Ark	95	38.99	-124.02
Noah’s Ark	96	38.84	-123.75
Noah’s Ark	97	38.40	-123.31
Noah’s Ark	98	38.43	-123.37
Noah’s Ark	99	38.39	-123.50
Noah’s Ark	100	37.99	-123.23
Noah’s Ark	101	37.93	-123.29
Noah’s Ark	102	37.96	-123.32
Noah’s Ark	103	37.97	-123.38
Noah’s Ark	104	37.95	-123.38
Noah’s Ark	105	37.88	-123.41
Noah’s Ark	106	37.40	-122.66
Noah’s Ark	107	37.40	-122.80
Noah’s Ark	108	37.14	-122.83
Noah’s Ark	109	37.08	-122.83
Noah’s Ark	110	37.10	-122.61
Noah’s Ark	111	37.13	-122.42
Noah’s Ark	112	36.85	-122.11
Noah’s Ark	113	36.83	-122.18
Noah’s Ark	114	36.85	-121.93
Noah’s Ark	115	36.70	-121.90
Noah’s Ark	116	36.73	-121.93
Noah’s Ark	117	36.65	-122.01
Noah’s Ark	118	36.50	-122.06
Noah’s Ark	119	36.27	-122.05
Noah’s Ark	120	36.18	-121.96
Noah’s Ark	121	36.05	-121.96

Noah’s Ark	122	36.07	-121.90
Noah’s Ark	123	35.83	-121.62
Noah’s Ark	124	35.53	-121.32
Noah’s Ark	125	35.80	-121.59
Noah’s Ark	126	35.83	-121.51
Noah’s Ark	127	35.57	-121.64
Noah’s Ark	128	35.62	-121.40
Noah’s Ark	129	35.43	-121.35
Noah’s Ark	130	35.27	-121.57
Noah’s Ark	131	35.30	-121.54
Noah’s Ark	132	35.29	-121.42
Noah’s Ark	133	35.17	-121.09
Noah’s Ark	134	35.15	-121.13
Noah’s Ark	135	35.17	-121.03
Noah’s Ark	136	35.05	-120.85
Noah’s Ark	137	34.94	-120.75
Noah’s Ark	138	34.72	-121.06
Noah’s Ark	139	34.72	-121.22
Noah’s Ark	140	34.75	-121.25
Noah’s Ark	141	34.59	-121.12
Noah’s Ark	142	34.65	-120.97
Noah’s Ark	143	34.53	-120.82
Noah’s Ark	144	34.39	-120.25
Noah’s Ark	145	34.28	-120.30
Noah’s Ark	146	34.16	-120.43
Noah’s Ark	147	34.19	-120.47
Noah’s Ark	148	34.03	-120.50
Noah’s Ark	149	34.01	-120.48
Noah’s Ark	150	33.98	-120.39
Noah’s Ark	151	34.13	-120.10
Noah’s Ark	152	34.13	-120.06
Noah’s Ark	153	34.11	-120.02
Noah’s Ark	154	33.94	-119.69
Noah’s Ark	155	33.97	-119.57
Noah’s Ark	156	33.88	-119.47
Noah’s Ark	157	33.68	-119.80
Noah’s Ark	158	33.65	-119.90
Noah’s Ark	159	33.55	-119.85
Noah’s Ark	160	33.23	-120.18
Noah’s Ark	161	33.03	-120.25
Noah’s Ark	162	32.86	-119.90
Noah’s Ark	163	32.45	-118.34
Noah’s Ark	164	32.85	-118.20
Noah’s Ark	165	32.98	-118.09
Noah’s Ark	166	33.19	-117.98
Noah’s Ark	167	33.37	-117.99

Noah’s Ark	168	33.49	-117.99
Noah’s Ark	169	33.38	-117.71
Noah’s Ark	170	33.54	-118.07
Noah’s Ark	171	33.51	-118.13
Noah’s Ark	172	33.50	-118.56
Noah’s Ark	173	33.60	-118.54
Noah’s Ark	174	33.48	-118.68
Noah’s Ark	175	33.49	-118.67
Noah’s Ark	176	33.41	-118.52
Noah’s Ark	177	33.40	-118.51
Noah’s Ark	178	33.15	-117.40
Noah’s Ark	179	32.86	-117.52
Raven	1	45.38	-124.84
Raven	2	45.43	-124.75
Raven	3	45.44	-124.67
Raven	4	45.53	-124.85
Raven	5	45.93	-124.74
Raven	6	46.09	-124.74
Raven	7	46.19	-124.48
Raven	8	46.50	-124.73
Raven	9	47.80	-125.66
Raven	10	47.91	-125.52
Raven	11	47.93	-125.47
Raven	12	47.97	-125.38
Raven	13	47.92	-125.26
Raven	14	48.14	-125.81
Raven	15	48.12	-125.40
Raven	16	48.23	-125.37
Raven	17	48.29	-125.00
Raven	18	48.20	-125.02
Raven	19	48.15	-125.01
Raven	20	47.93	-125.10
Raven	21	47.87	-125.27
Raven	22	47.33	-124.57
Raven	23	47.10	-124.60
Raven	24	47.05	-124.79
Raven	25	46.92	-124.58
Raven	26	46.83	-124.52
Raven	27	46.80	-124.54
Raven	28	46.46	-124.32
Raven	29	46.50	-124.33
Raven	30	46.53	-124.51
Raven	31	46.10	-124.16
Raven	32	45.90	-124.07
Raven	33	45.73	-124.11
Raven	34	45.63	-124.07

Raven	35	45.62	-124.32
Raven	36	45.64	-124.38
Raven	37	45.49	-124.15
Raven	38	45.37	-124.24
Raven	39	45.19	-124.30
Raven	40	45.31	-124.66
Raven	41	45.28	-124.58
Raven	42	45.11	-124.48
Raven	43	45.08	-124.45
Raven	44	45.04	-124.44
Raven	45	44.94	-124.13
Raven	46	44.66	-124.27
Raven	47	44.64	-124.36
Raven	48	44.63	-124.54
Raven	49	44.42	-124.40
Raven	50	44.35	-124.41
Raven	51	44.55	-124.87
Raven	52	44.57	-124.87
Raven	53	44.48	-124.79
Raven	54	44.32	-125.04
Raven	55	44.24	-125.10
Raven	56	44.35	-125.12
Raven	57	44.38	-125.12
Raven	58	44.20	-124.55
Raven	59	44.05	-124.41
Raven	60	44.07	-124.70
Raven	61	43.92	-124.71
Raven	62	43.90	-124.44
Raven	63	43.69	-124.60
Raven	64	43.67	-124.37
Raven	65	43.48	-124.91
Raven	66	43.34	-124.87
Raven	67	43.39	-124.59
Raven	68	43.29	-124.50
Raven	69	43.26	-124.78
Raven	70	43.29	-124.93
Raven	71	43.22	-124.87
Raven	72	43.08	-124.96
Raven	73	42.97	-124.93
Raven	74	42.93	-124.91
Raven	75	42.90	-124.83
Raven	76	42.84	-124.69
Raven	77	42.85	-124.71
Raven	78	42.78	-124.85
Raven	79	42.76	-124.72
Raven	80	42.71	-124.66

Raven	81	42.69	-124.52
Raven	82	42.52	-124.61
Raven	83	42.38	-124.71
Raven	84	42.33	-124.74
Raven	85	42.12	-124.42
Raven	86	41.81	-124.39
Raven	87	42.00	-124.60
Raven	88	41.98	-124.73
Raven	89	41.95	-124.84
Raven	90	41.77	-124.78
Raven	91	41.71	-124.87
Raven	92	41.40	-124.91
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Raven	96	41.49	-124.38
Raven	97	41.41	-124.30
Raven	98	41.17	-124.31
Raven	99	41.21	-124.65
Raven	100	41.14	-124.76
Raven	101	40.72	-124.59
Raven	102	40.60	-124.58
Raven	103	40.51	-124.74
Raven	104	40.26	-124.77
Raven	105	40.18	-124.97
Raven	106	40.17	-124.86
Raven	107	40.01	-124.65
Raven	108	40.00	-124.58
Raven	109	40.03	-124.53
Raven	110	40.11	-124.35
Raven	111	39.48	-123.97
Raven	112	39.36	-123.84
Raven	113	39.31	-124.01
Raven	114	39.27	-123.98
Raven	115	39.03	-123.98
Raven	116	38.89	-123.94
Raven	117	38.88	-123.79
Raven	118	38.72	-123.71
Raven	119	38.75	-123.68
Raven	120	38.51	-123.55
Raven	121	38.50	-123.38
Raven	122	38.12	-123.36
Raven	123	38.14	-123.18
Raven	124	38.06	-123.14
Raven	125	37.87	-123.07
Raven	126	37.47	-122.66
Raven	127	37.37	-122.63

Raven	128	37.39	-122.62
Raven	129	37.11	-122.54
Raven	130	37.05	-122.74
Raven	131	36.97	-122.60
Raven	132	37.03	-122.57
Raven	133	37.01	-122.43
Raven	134	36.76	-122.19
Raven	135	36.76	-121.95
Raven	136	35.77	-121.93
Raven	137	35.65	-122.01
Raven	138	35.56	-121.97
Raven	139	35.54	-121.86
Raven	140	35.37	-121.45
Raven	141	35.45	-121.29
Raven	142	35.37	-121.25
Raven	143	35.26	-121.17
Raven	144	35.14	-121.54
Raven	145	35.20	-121.52
Raven	146	35.19	-121.17
Raven	147	35.03	-120.93
Raven	148	35.00	-121.06
Raven	149	34.78	-120.92
Raven	150	34.81	-120.92
Raven	151	34.97	-120.78
Raven	152	35.08	-120.83
Raven	153	34.26	-120.46
Raven	154	34.41	-120.31
Raven	155	34.37	-119.77
Raven	156	34.23	-119.73
Raven	157	34.21	-119.66
Raven	158	34.21	-119.58
Raven	159	33.97	-119.60
Raven	160	33.94	-119.78
Raven	161	33.86	-119.89
Raven	162	33.79	-119.93
Raven	163	33.67	-119.98
Raven	164	33.61	-119.80
Raven	165	33.29	-119.94
Raven	166	32.80	-119.98
Raven	167	32.65	-119.93
Raven	168	32.24	-118.96
Raven	169	32.05	-118.56
Raven	170	32.45	-118.46
Raven	171	33.04	-118.20
Raven	172	32.88	-118.17
Raven	173	32.78	-117.87

Raven	174	32.75	-117.72
Raven	175	32.86	-117.70
Raven	176	32.65	-117.34
Raven	177	32.64	-117.33
Raven	178	32.88	-117.39
Raven	179	33.13	-117.38
Raven	180	33.33	-117.61
Raven	181	33.42	-117.95
Raven	182	33.49	-118.09
Raven	183	33.47	-118.10
Raven	184	33.38	-118.26
Raven	185	33.37	-118.25
Raven	188	33.29	-118.29
Raven	189	33.43	-118.29
Raven	190	33.60	-118.52
Raven	191	33.53	-118.76
Raven	192	34.53	-120.66