

FishTracker

***A GIS tool for
analyzing radio-
tagged fish
migration***

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Alaska Dept of Fish and Game
Sport Fish Division

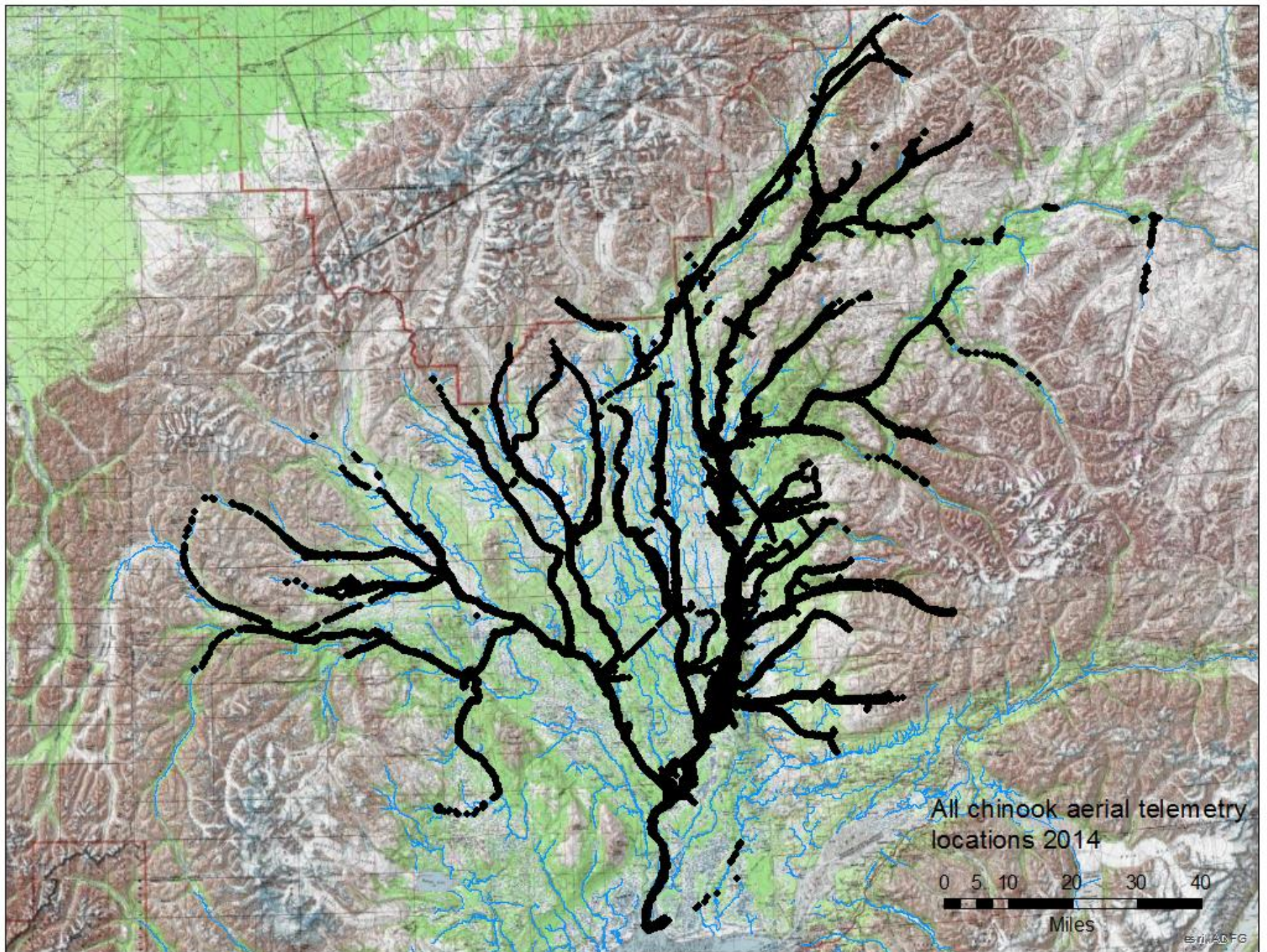


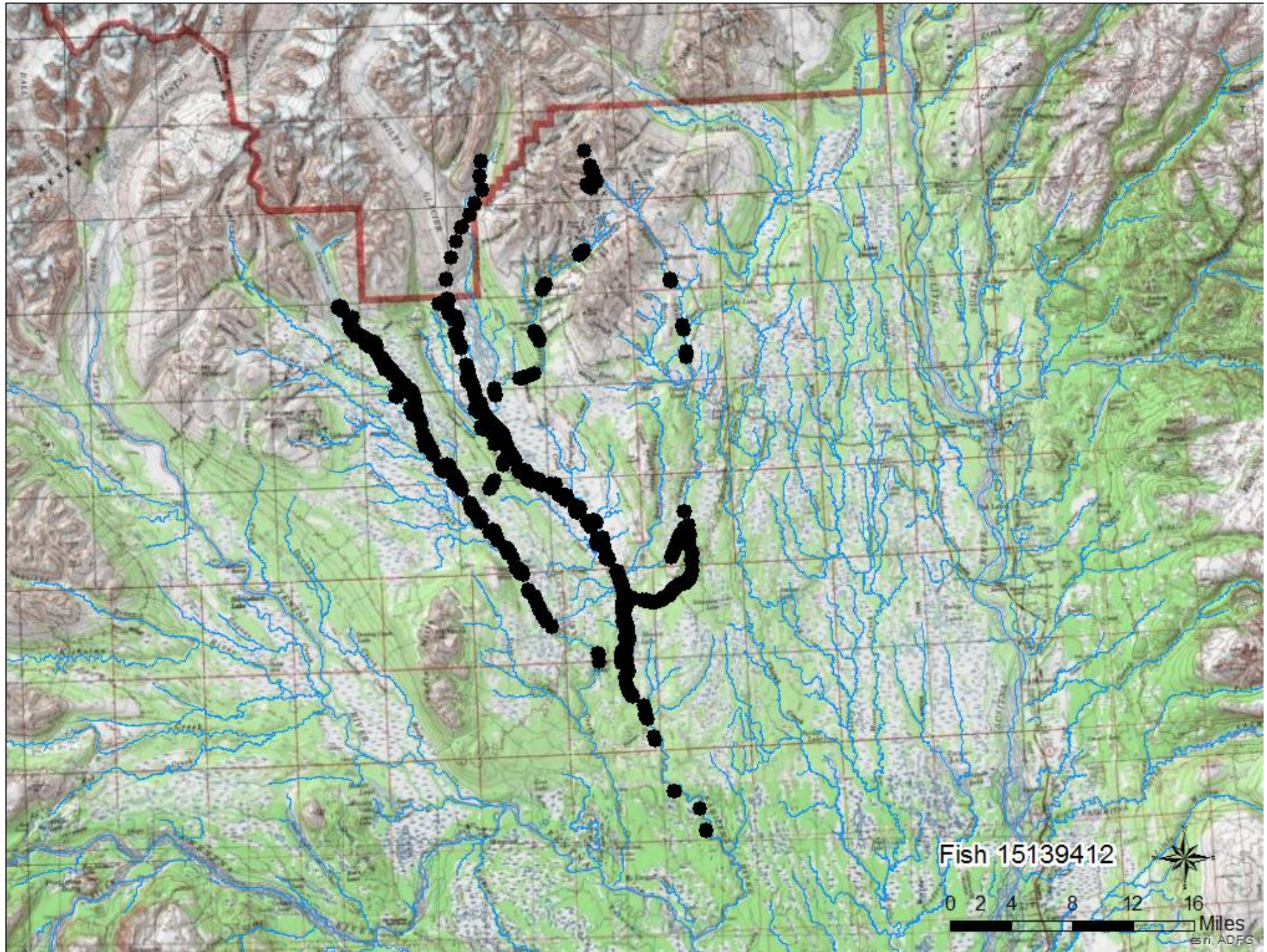
Introduction

- In 2014, a study was undertaken to estimate, in part, the abundance and spawner distribution of Chinook salmon in the Susitna and Yentna River drainages.
- A total of 955 Chinook salmon ≥ 500 mm (MEFL) were tagged with radio tags.
- 10 Station receivers were placed within the study area
- 11 flights were made for aerial telemetry detection

The problem...

- Telemetry projects generate an overwhelming amount of data:
 - » 955 fish tag records
 - » 448,449 aerial tracking telemetry records
 - » 1,622,709 stationary receiver records
- We had a short reporting deadline
- How do we consistently yet quickly extract the appropriate data from the dataset?

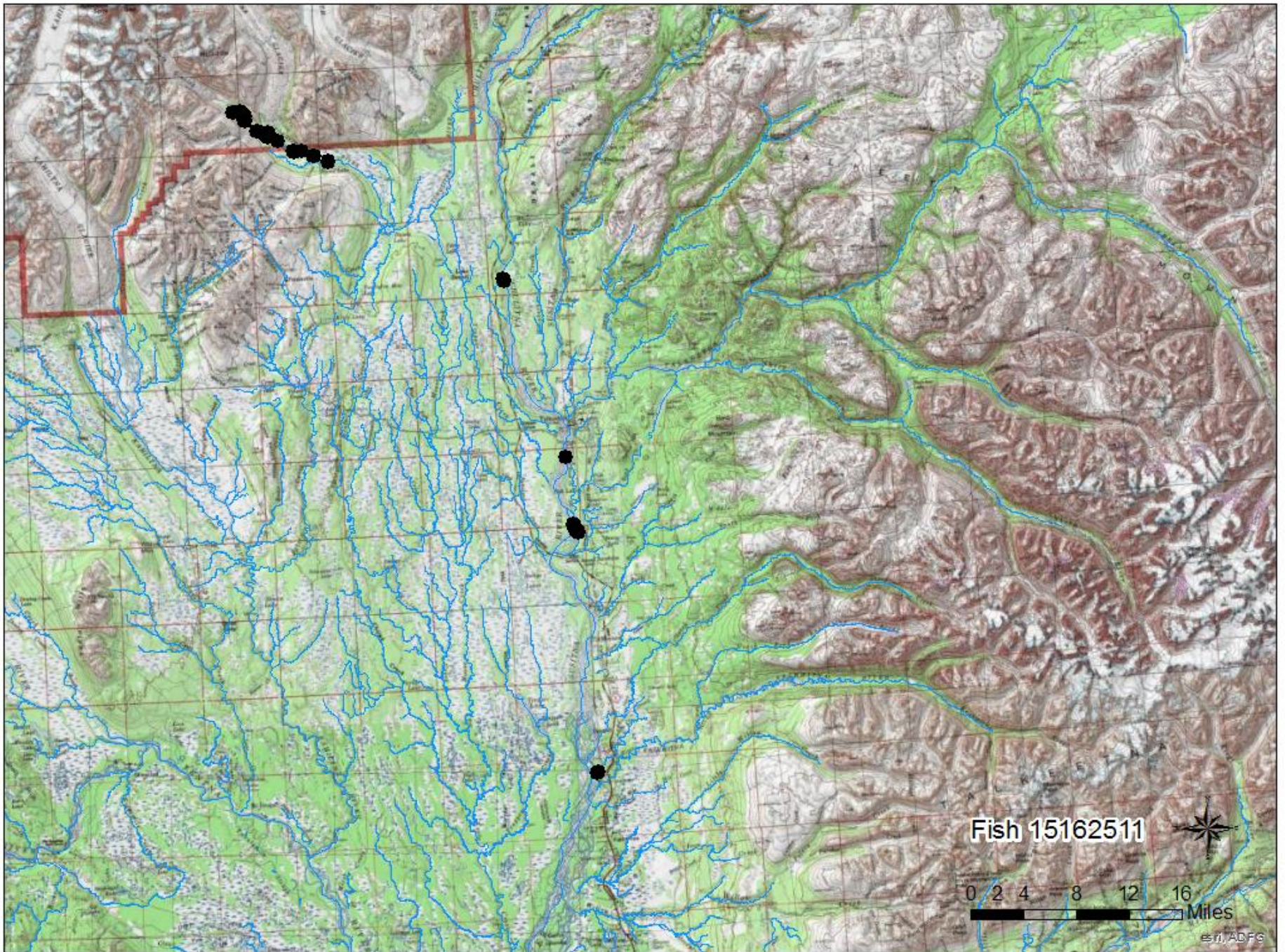




Fish 15139412

0 2 4 8 12 16

Miles
esri, ADFG



Fish 15162511

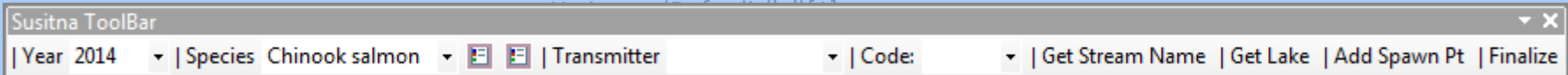
0 2 4 8 12 16 Miles

ADFG

```

class btnNextNonFinal(object):
    """Implementation for Tools_addin.btnNextNonFinal (Button)"""
    def __init__(self):
        self.enabled = True
        self.checked = False
    def onClick(self):
        mxd = arcpy.mapping.MapDocument('current')
        df = arcpy.mapping.ListDataFrames(mxd)[0]
        lyr = arcpy.mapping.ListLayers(mxd, "", df)[0]
        dasXmitter = 0
        IDef = lyr.definitionQuery
        print IDef
        if len(IDef) == 0:
            print "No layerDefn set!"
            curXmitter = 0
        else:

```



```

        intSpeciesID = 40
        elif (cboSpecies.value == "coho salmon"):
            intSpeciesID = 48
        elif cboSpecies.value == "pink salmon":
            intSpeciesID = 49
        elif cboSpecies.value == "sockeye salmon":
            intSpeciesID = 50
        elif cboSpecies.value == "chum salmon":
            intSpeciesID = 47
    conn = pyodbc.connect(connStr)
    dbCursor1 = conn.cursor()
    dbCursor1.execute("{call spGetNextFish( %i, %i, %i, 1 )}" % (
int(cboYear.value), intSpeciesID, int(curXmitter) ) )
    row = dbCursor1.fetchone()
    if row:
        print row
        dasXmitter = row.transmitter
    dasYear = cboYear.value

```

Data source and selection

The screenshot displays two dialog boxes in ArcGIS. The background is a topographic map of a mountainous region with a river network.

Layer Properties Dialog:

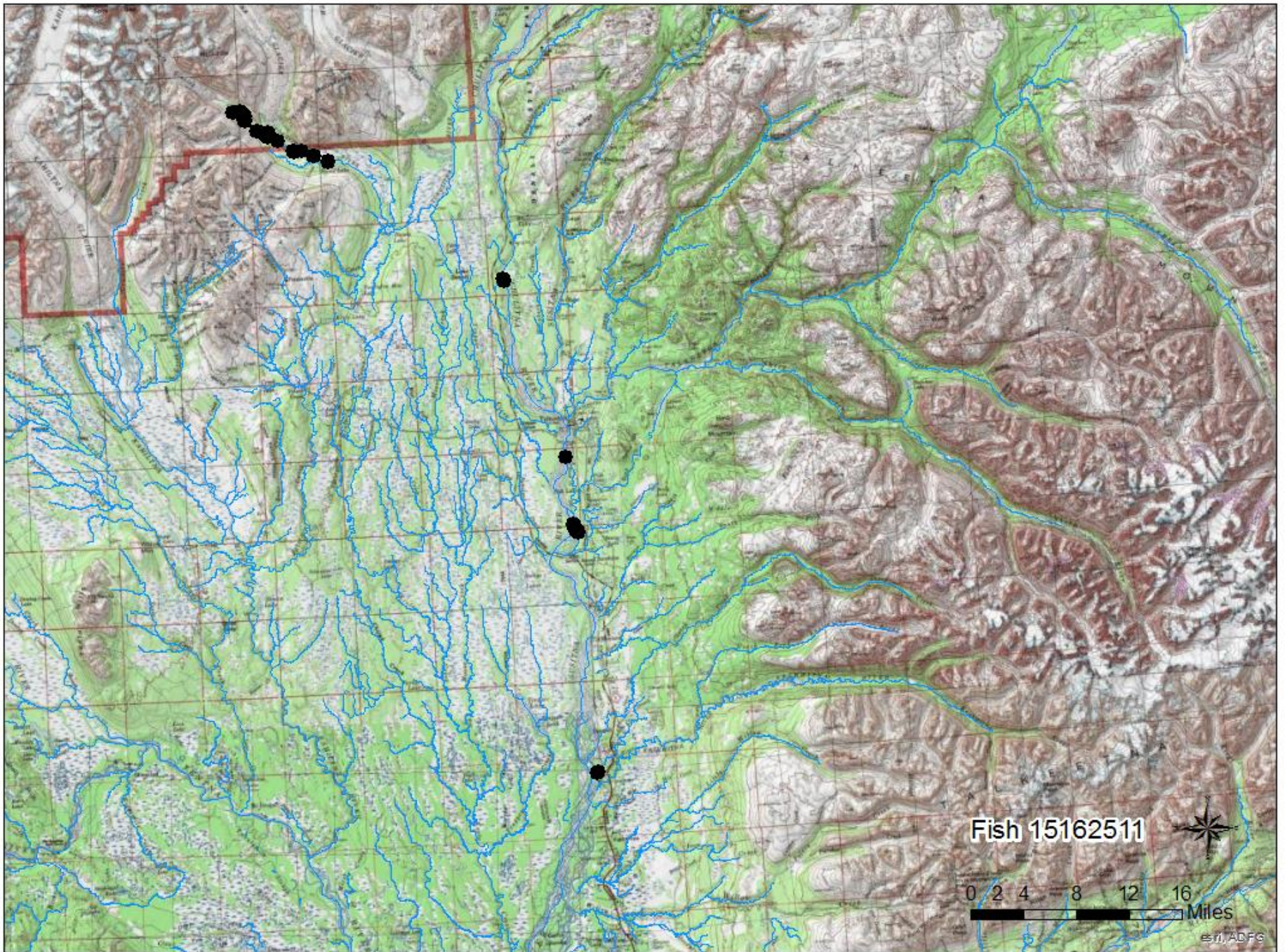
- Extent: Top: 62.830268 dd, Left: -150.447503 dd, Right: -149.056663 dd, Bottom: 61.572883 dd. Includes an "Update Extent" button.
- Data Source: Query Feature Class: DFGANCD83, Server: sqlserver, Client: DFGANCD83, Database: SF_Telemetry, Feature Type: Simple, Geometry Type: Point, Coordinates have Z values: No, Coordinates have measures: No. Includes a "Change Query" button.

Edit Query Layer Dialog:

- Connection: [Dropdown menu]
- List of Tables: A list of tables from the SF_Telemetry database, including lkpAgency, lkpFieldDefinition, lkpFieldTranslator, lkpGear, lkpImportDestinatio, and lkpImportSource.
- Columns: A table with headers Name, Type, and Nullable.
- Query: `select * from dbo.vspTelemetryDFGWorking WHERE telemetryYear = 2014 and speciesID = 46`
- Buttons: "Validate", "Show advanced options", "< Back", "Finish", and "Cancel".

Susitna ToolBar:

Server: DB3 | Year: 2014 | Species: Chinook salmon | Transmitter: [Dropdown] | Code: [Dropdown] | Get Stream Name | Get Lake | Add Spawn Pt | Finalize



Fish 15162511

0 2 4 8 12 16 Miles

© 11, ADFG

Fish 15162511

Day of Year

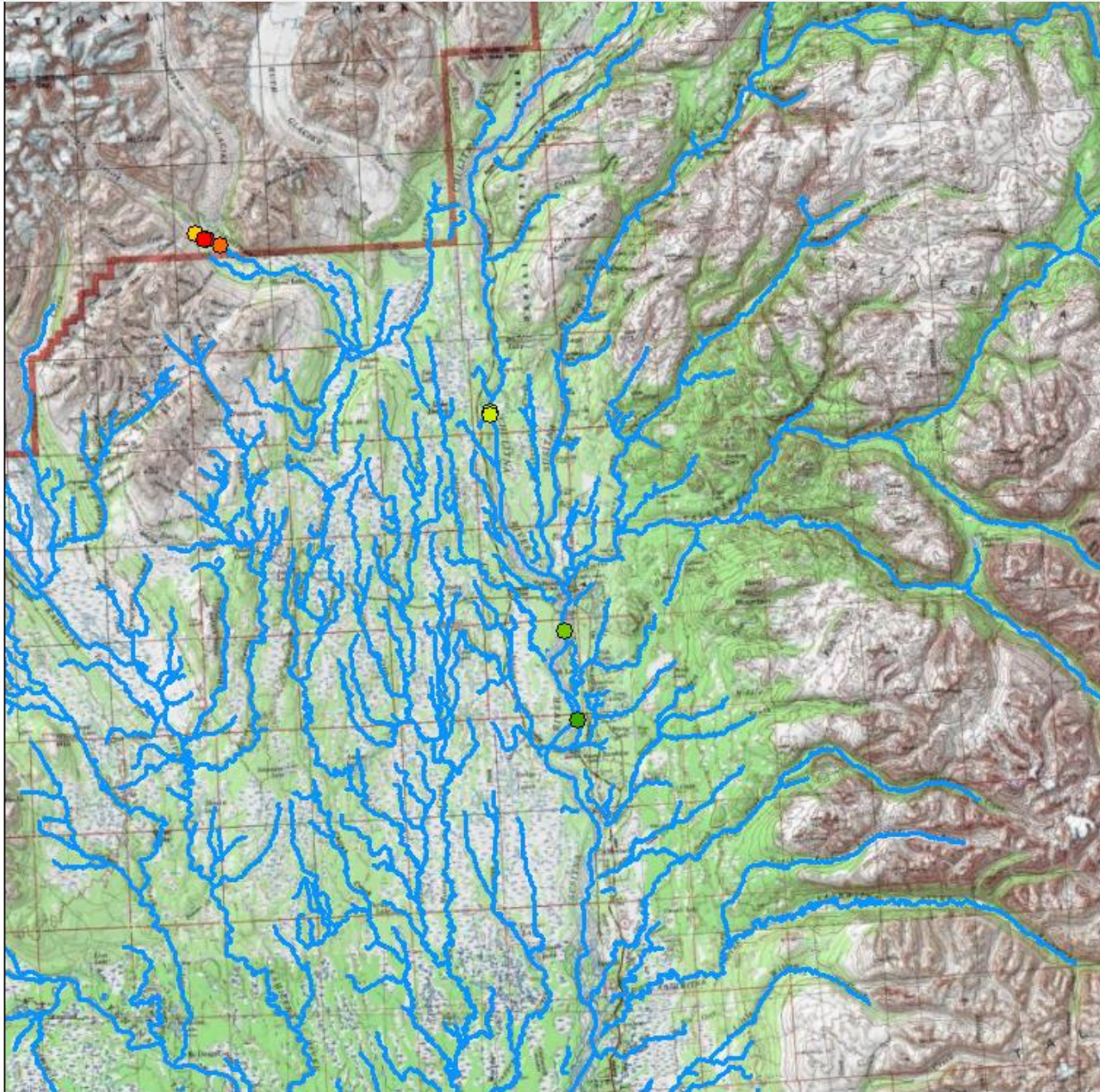
- 168
- 173
- 175
- 219
- 246
- 266

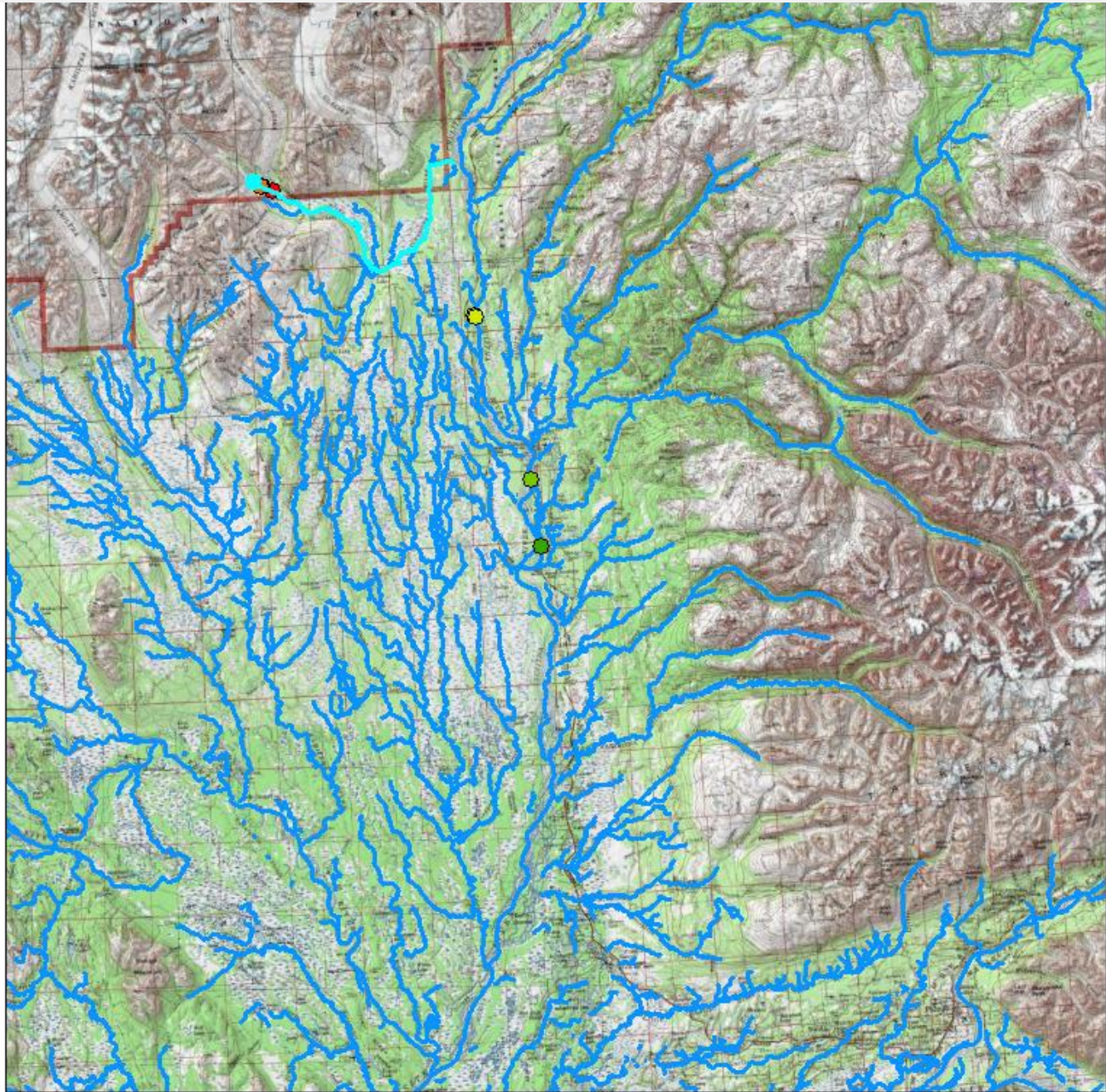


— Streams



Miles





Fish 15162511

Day of Year

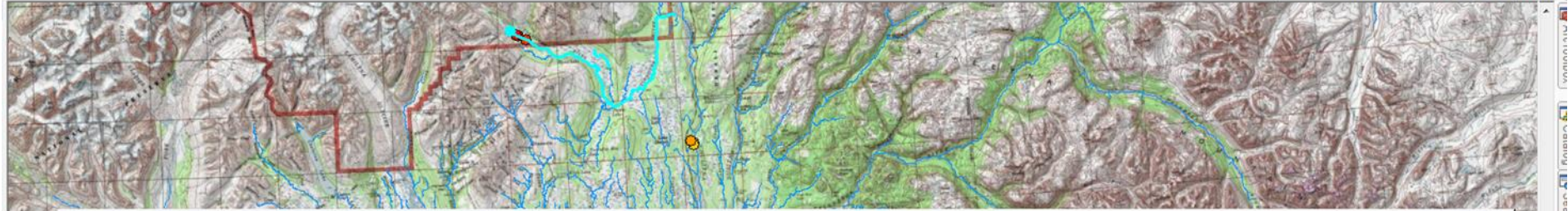
- 163
- 168
- 173
- 175
- 219
- 246
- 266



— Streams



Miles



telemetryID	transmitter	telemetryType	decDegLat	decDegLon	telemetryDateTime	telemetryDay	signalStren	maxStre	mortC	spawning	spawningLocatio	spawningLocationSele	spawningLocationFi	spawningDecDegL	spawningDecDegL
192834	15162511	Tagging	61.5773	-150.4095	5/30/2014 6:30:00 AM	150	<Null>	1	<Null>	<Null>	<Null>	1	0	<Null>	<Null>
183351042	15162511	Station	61.69127	-150.30632	6/4/2014 11:52:00 PM	155	100	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183307042	15162511	Station	61.69127	-150.30632	6/5/2014 12:49:00 AM	156	135	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183310622	15162511	Station	61.69127	-150.30632	6/5/2014 12:49:00 AM	156	134	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183324092	15162511	Station	61.69127	-150.30632	6/5/2014 12:55:00 AM	156	134	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183436782	15162511	Station	61.69127	-150.30632	6/5/2014 2:42:00 PM	156	121	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183438932	15162511	Station	61.69127	-150.30632	6/5/2014 3:13:00 PM	156	113	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183441242	15162511	Station	61.69127	-150.30632	6/5/2014 2:37:00 PM	156	124	1	0	<Null>	<Null>	1	0	<Null>	<Null>
14894971	15162511	Aerial	61.930703	-150.096783	6/12/2014 2:05:29 PM	163	96	1	0	<Null>	<Null>	1	0	<Null>	<Null>
14897941	15162511	Aerial	61.930703	-150.096783	6/12/2014 2:05:29 PM	163	96	1	0	<Null>	<Null>	1	0	<Null>	<Null>
15023401	15162511	Aerial	62.200465	-150.111445	6/17/2014 3:08:06 PM	168	146	1	0	<Null>	<Null>	1	0	<Null>	<Null>
214144932	15162511	Station	62.173	-150.17428	6/17/2014 5:06:00 AM	168	132	1	0	<Null>	<Null>	1	0	<Null>	<Null>
214171272	15162511	Station	62.173	-150.17428	6/17/2014 5:06:00 AM	168	131	1	0	<Null>	<Null>	1	0	<Null>	<Null>
214197872	15162511	Station	62.173	-150.17428	6/17/2014 5:06:00 AM	168	131	1	0	<Null>	<Null>	1	0	<Null>	<Null>
15212551	15162511	Aerial	62.282448	-150.128089	6/22/2014 10:03:22 AM	173	111	1	0	<Null>	<Null>	1	0	<Null>	<Null>
13621651	15162511	Aerial	62.485368	-150.251217	6/24/2014 12:23:30 PM	175	119	1	0	<Null>	<Null>	1	0	<Null>	<Null>
13631911	15162511	Aerial	62.483333	-150.25	6/24/2014 12:23:33 PM	175	119	1	0	<Null>	<Null>	1	0	<Null>	<Null>
211319822	15162511	Station	62.48851	-150.25992	6/25/2014 11:07:00 AM	176	133	1	0	<Null>	<Null>	1	0	<Null>	<Null>
211327062	15162511	Station	62.48851	-150.25992	6/25/2014 11:08:00 AM	176	132	1	1	<Null>	<Null>	1	0	<Null>	<Null>
211333842	15162511	Station	62.48851	-150.25992	6/25/2014 11:17:00 AM	176	130	1	0	<Null>	<Null>	1	0	<Null>	<Null>
14280131	15162511	Aerial	62.662948	-150.019803	8/7/2014 10:12:57 AM	219	133	1	0	2	Tokostna River	1	0	<Null>	<Null>
20276081	15162511	Aerial	62.65048	-150.771287	9/3/2014 10:42:13 AM	246	129	1	1	<Null>	<Null>	1	0	<Null>	<Null>
20420071	15162511	Aerial	62.656932	-150.79688	9/23/2014 11:50:29 AM	266	134	1	1	<Null>	<Null>	1	0	<Null>	<Null>
20427831	15162511	Aerial	62.657537	-150.802273	9/23/2014 11:50:34 AM	266	134	1	1	<Null>	<Null>	1	0	<Null>	<Null>

0 | (1 out of 24 Selected)

TelemetryDFGWorking



Table

TelemetryDFGWorking

telemetryID	transmitter	telemetryType	decDegLat	decDegLon	telemetryDateTime	telemetryDay	signalStren	maxStre	mortC	spawning	spawningLocatio	spawningLocationSele	spawningLocationFi	spawningDecDegL	spawningDecDx
192834	15162511	Tagging	61.5773	-150.4094	5/30/2014 6:30:00 AM	150	<Null>								
183351042	15162511	Station	61.69127	-150.30632	6/4		00	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183307042	15162511	Station	61.69127	-150.30632	6/5		35	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183310622	15162511	Station	61.69127	-150.30632	6/5		34	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183324092	15162511	Station	61.69127	-150.30632	6/5		34	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183436782	15162511	Station	61.69127	-150.30632	6/5		21	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183438932	15162511	Station	61.69127	-150.30632	6/5		13	1	0	<Null>	<Null>	1	0	<Null>	<Null>
183441242	15162511	Station	61.69127	-150.30632	6/5		24	1	0	<Null>	<Null>	1	0	<Null>	<Null>
14894971	15162511	Aerial	61.930703	-150.096763	6/1		96	1	0	<Null>	<Null>	1	0	<Null>	<Null>
14897941	15162511	Aerial	61.930703	-150.096763	6/1		96	1	0	<Null>	<Null>	1	0	<Null>	<Null>
15023401	15162511	Aerial	62.200485	-150.111445	6/17/2014 3:08:06 PM		168	146	1	0	<Null>	<Null>	1	0	<Null>
214144932	15162511	Station	62.173	-150.17428	6/17/2014 5:06:00 AM		168	132	1	0	<Null>	<Null>	1	0	<Null>
214171272	15162511	Station	62.173	-150.17428	6/17/2014 5:06:00 AM		168	131	1	0	<Null>	<Null>	1	0	<Null>
214197872	15162511	Station	62.173	-150.17428	6/17/2014 5:06:00 AM		168	131	1	0	<Null>	<Null>	1	0	<Null>
15212551	15162511	Aerial	62.282448	-150.128088	6/22/2014 10:03:22 AM		173	111	1	0	<Null>	<Null>	1	0	<Null>
13621651	15162511	Aerial	62.485368	-150.251217	6/24/2014 12:23:30 PM		175	119	1	0	<Null>	<Null>	1	0	<Null>
13631911	15162511	Aerial	62.483333	-150.25	6/24/2014 12:23:33 PM		175	119	1	0	<Null>	<Null>	1	0	<Null>
211319822	15162511	Station	62.48851	-150.25992	6/25/2014 11:07:00 AM		176	133	1	0	<Null>	<Null>	1	0	<Null>
211327062	15162511	Station	62.48851	-150.25992	6/25/2014 11:08:00 AM		176	132	1	1	<Null>	<Null>	1	0	<Null>
211333842	15162511	Station	62.48851	-150.25992	6/25/2014 11:17:00 AM		176	130	1	0	<Null>	<Null>	1	0	<Null>
14280131	15162511	Aerial	62.662948	-150.819603	8/7/2014 10:12:57 AM		219	133	1	0	2 Tokositna River	1	0	<Null>	<Null>
20276081	15162511	Aerial	62.65046	-150.771287	9/3/2014 10:42:13 AM		246	129	1	1	<Null>	<Null>	1	0	<Null>
20420071	15162511	Aerial	62.656632	-150.79686	9/23/2014 11:50:29 AM		266	134	1	1	<Null>	<Null>	1	0	<Null>
20427831	15162511	Aerial	62.657537	-150.802273	9/23/2014 11:50:34 AM		266	134	1	1	<Null>	<Null>	1	0	<Null>

Do you want to Finalize this fish/transmitter

Yes No

TelemetryDFGWorking | (1 out of 24 Selected)

Attribute table is linked to database tables.

Table

TelemetryDFGWorking

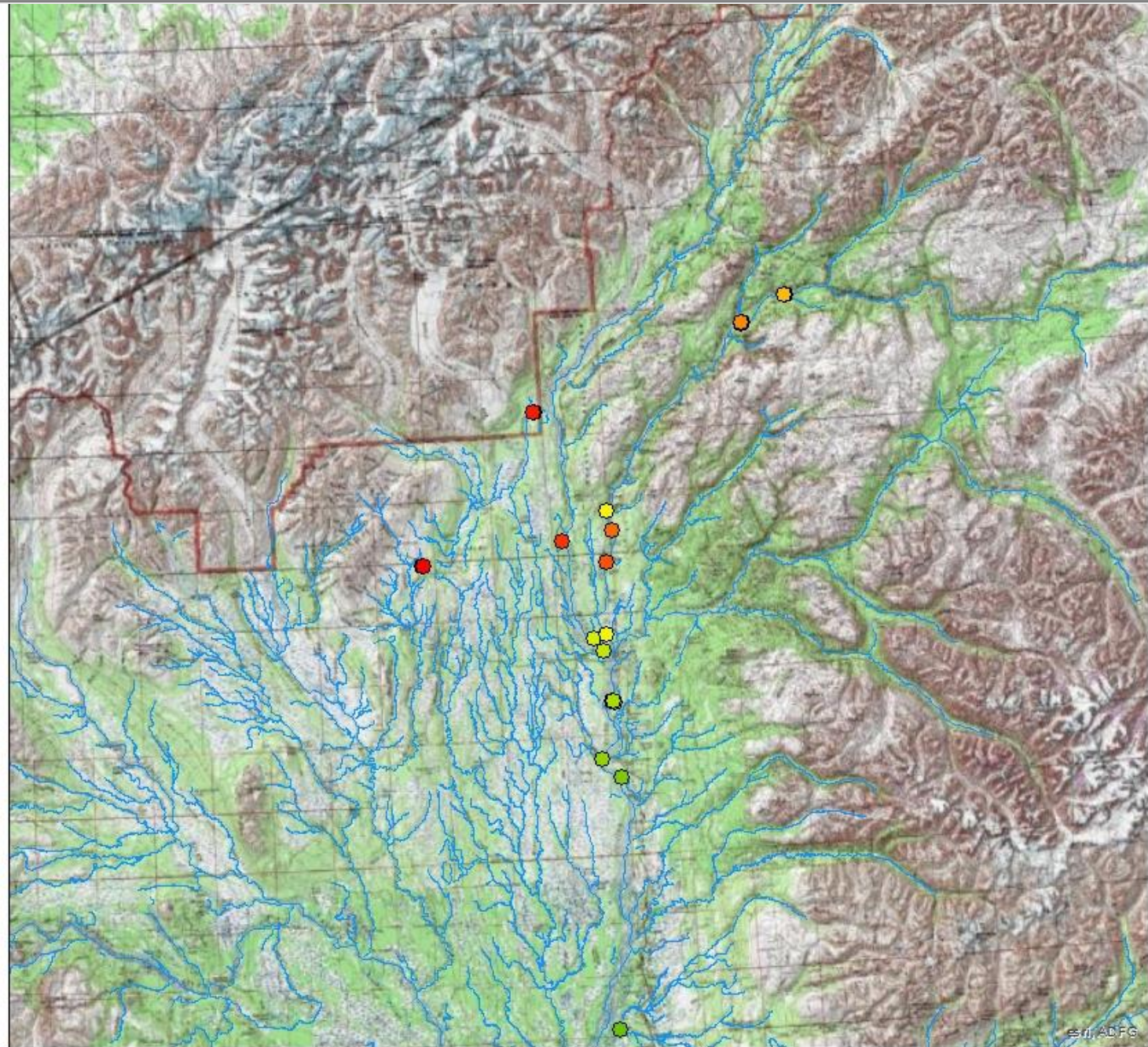
transmitter	decDegLat	decDegLon	telemetryDay	signalStrength	maxStren	mortCo	spawningCod	spawningLocation	spawningLoc	spawningLoc	serialTelemet	stationTelem
15174407	62.871947	49.338273	200	123	1	0	4	Portage Creek	1	1	1690507	0
15111482	61.706011	50.323828	252	100	1	1	5	Deshka River / Kroto Creek	1	1	2135995	0
15119425	62.253111	50.168878	249	116	1	0	2	Susitna River	1	1	2104836	0
15135528	62.231681	50.109758	246	136	1	0	2	Birch Creek	1	1	2092117	0
15192499	61.835831	50.009063	247	115	1	0	7	Little Willow Creek	1	1	2038916	0
15103307	62.1737	50.40375	217	128	1	0	2	Moose Creek	1	1	1419946	0
15119462	61.7053	50.322888	217	138	1	0	2	Deshka River / Kroto Creek	1	1	1417628	0
15041226	61.6704	50.624186	365	0	1	0	10	Kentna River	1	1	0	0

TelemetryDFGWorking (0 out of 8 Selected)

Results Messages

fishTagID	stationID	FSTAT	tagDateTime	tagYear	tagDay	sexID	lengthMEF	lengthFRK	lengthTOT	speciesID	transmitter	spawningCode	spawningLocation	spawningLocationFinal	
1	19197	47	20	2014-05-23 07:07:00.000	2014	143	NULL	585	NULL	660	46	15174449	2	Chulitna River	1
2	19198	47	20	2014-05-23 10:51:00.000	2014	143	NULL	695	NULL	735	46	15192480	2	247-41-10200-2053-3150-4131-5012-6101	1
3	19199	47	20	2014-05-23 14:03:00.000	2014	143	NULL	710	NULL	780	46	15171300	2	Deshka River / Kroto Creek	1
4	19200	47	20	2014-05-24 09:42:00.000	2014	144	NULL	620	NULL	720	46	15176400	2	Lake Creek	1
5	19201	47	20	2014-05-24 16:08:00.000	2014	144	NULL	510	NULL	550	46	15192400	2	Moose Creek	1
6	19202	47	20	2014-05-25 02:06:00.000	2014	145	NULL	620	NULL	700	46	15162501	3	Susitna River	1
7	19203	47	20	2014-05-26 07:06:00.000	2014	146	NULL	595	NULL	670	46	15176401	2	Kichatna River	1
8	19204	47	20	2014-05-26 07:09:00.000	2014	146	NULL	790	NULL	860	46	15193501	1	Susitna River	1
9	19205	47	20	2014-05-26 14:13:00.000	2014	146	NULL	610	NULL	680	46	15174402	2	Kahitna River	1
10	19206	47	20	2014-05-27 06:10:00.000	2014	147	NULL	700	NULL	790	46	15192402	2	Deshka River / Kroto Creek	1
11	19207	47	20	2014-05-27 06:12:00.000	2014	147	NULL	680	NULL	760	46	15171303	3	East Fork Chulitna River	1
12	19208	47	20	2014-05-27 14:02:00.000	2014	147	NULL	650	NULL	710	46	15185503	4	Portage Creek	1
13	19209	47	20	2014-05-27 14:06:00.000	2014	147	NULL	630	NULL	690	46	15162504	4	Indian River	1
14	19210	47	20	2014-05-27 15:05:00.000	2014	147	NULL	580	NULL	670	46	15176404	3	Prairie Creek	1
15	19211	47	20	2014-05-28 06:12:00.000	2014	148	NULL	580	NULL	660	46	15193504	2	Chulitna River	1
16	19212	47	20	2014-05-28 06:14:00.000	2014	148	NULL	600	NULL	680	46	15174405	2	Chulitna River	1
17	19213	47	20	2014-05-28 06:20:00.000	2014	148	NULL	660	NULL	770	46	15192405	2	Chulitna River	1
18	19214	47	20	2014-05-28 14:00:00.000	2014	148	NULL	690	NULL	780	46	15171306	3	Chunilna Creek	1
19	19215	47	20	2014-05-28 14:05:00.000	2014	148	NULL	570	NULL	650	46	15185506	3	Chulitna River	1
20	19216	47	20	2014-05-28 14:09:00.000	2014	148	NULL	770	NULL	825	46	15162507	2	Chulitna River	1
21	19217	47	20	2014-05-29 06:22:00.000	2014	149	NULL	710	NULL	830	46	15176407	2	Chulitna River	1
22	19218	47	20	2014-05-29 06:26:00.000	2014	149	NULL	880	NULL	990	46	15193507	2	East Fork Chulitna River	1
23	19219	47	20	2014-05-29 06:28:00.000	2014	149	NULL	790	NULL	890	46	15174408	2	Chulitna River	1
24	19220	47	20	2014-05-29 06:35:00.000	2014	149	NULL	620	NULL	720	46	15192408	3	Peters Creek	1
25	19221	47	20	2014-05-29 14:03:00.000	2014	149	NULL	690	NULL	820	46	15171309	3	Deshka River / Kroto Creek	1
26	19222	47	20	2014-05-29 14:05:00.000	2014	149	NULL	730	NULL	840	46	15185509	2	Chulitna River	1
27	19223	47	20	2014-05-29 14:11:00.000	2014	149	NULL	620	NULL	620	46	15162510	2	Chulitna River	1

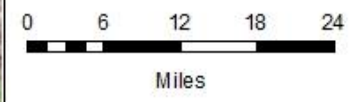
Fish 15192444

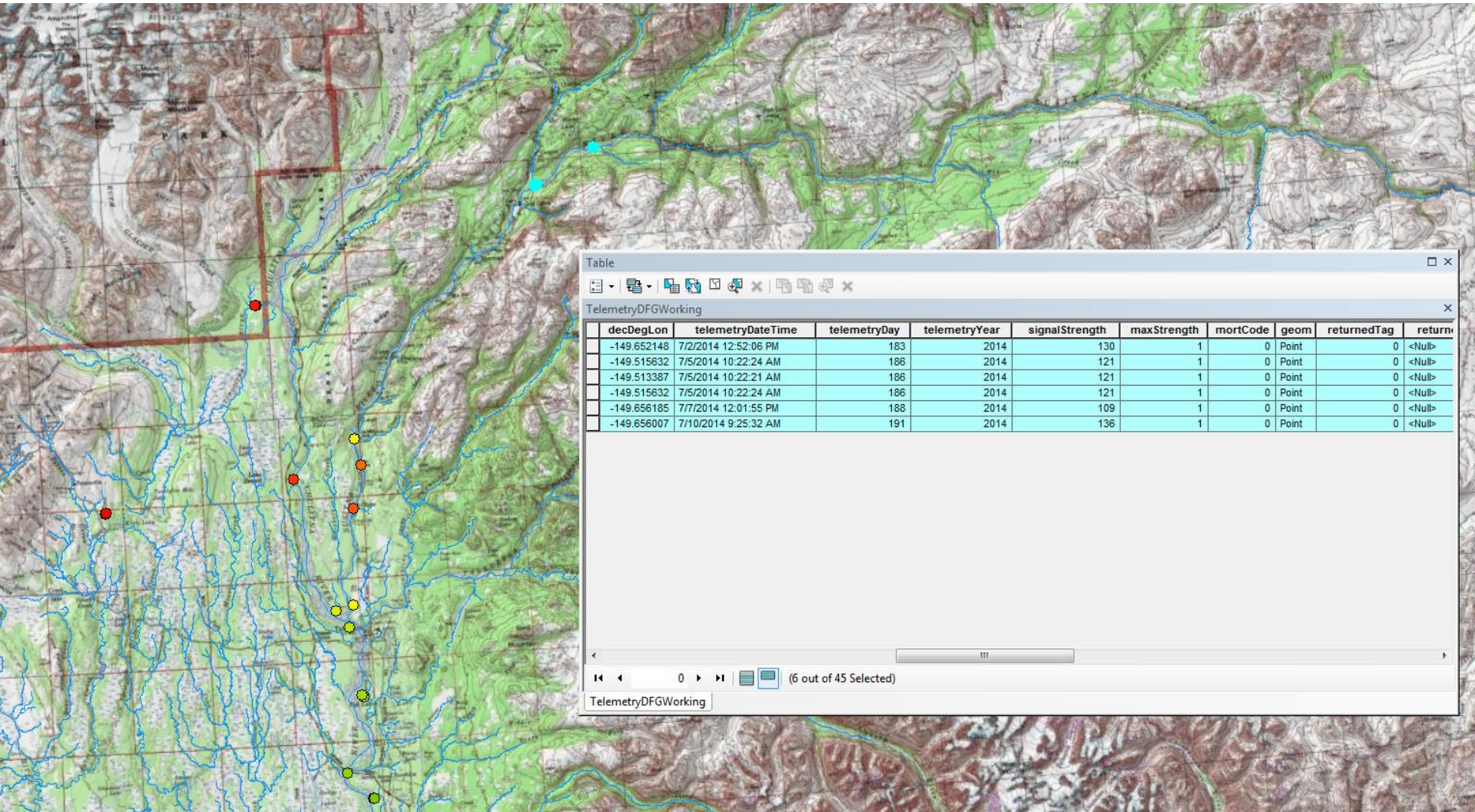


Day of Year

- 156
- 158
- 159
- 163
- 168
- 170
- 173
- 175
- 176
- 179
- 180
- 183
- 186
- 188
- 191
- 194
- 197
- 200
- 202
- 219

— Streams





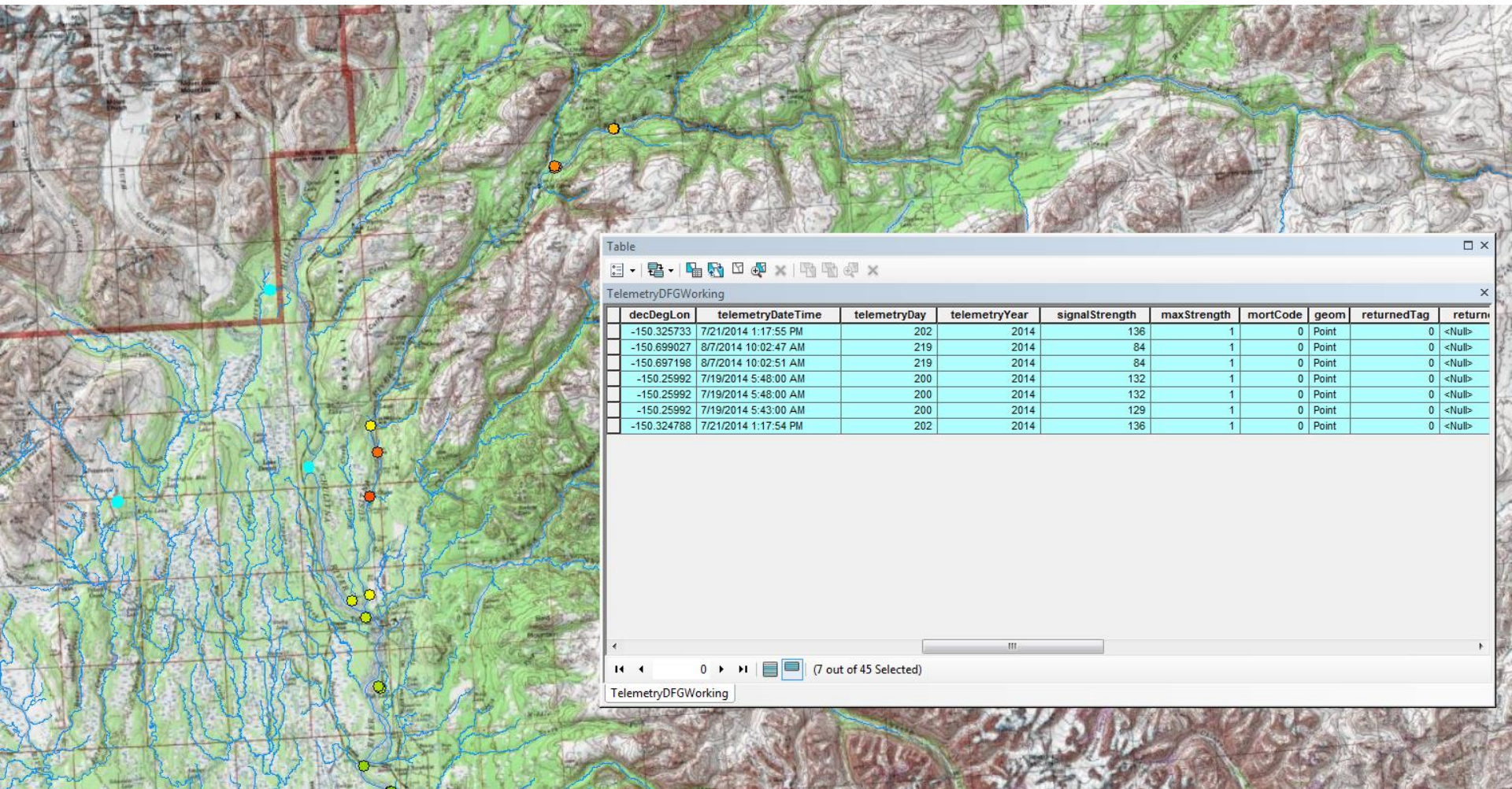
Table

TelemetryDFGWorking

decDegLon	telemetryDateTime	telemetryDay	telemetryYear	signalStrength	maxStrength	mortCode	geom	returnedTag	return
-149.652148	7/2/2014 12:52:06 PM	183	2014	130	1	0	Point	0	<Null>
-149.515632	7/5/2014 10:22:24 AM	186	2014	121	1	0	Point	0	<Null>
-149.513387	7/5/2014 10:22:21 AM	186	2014	121	1	0	Point	0	<Null>
-149.515632	7/5/2014 10:22:24 AM	186	2014	121	1	0	Point	0	<Null>
-149.656185	7/7/2014 12:01:55 PM	188	2014	109	1	0	Point	0	<Null>
-149.656007	7/10/2014 9:25:32 AM	191	2014	136	1	0	Point	0	<Null>

(6 out of 45 Selected)

TelemetryDFGWorking



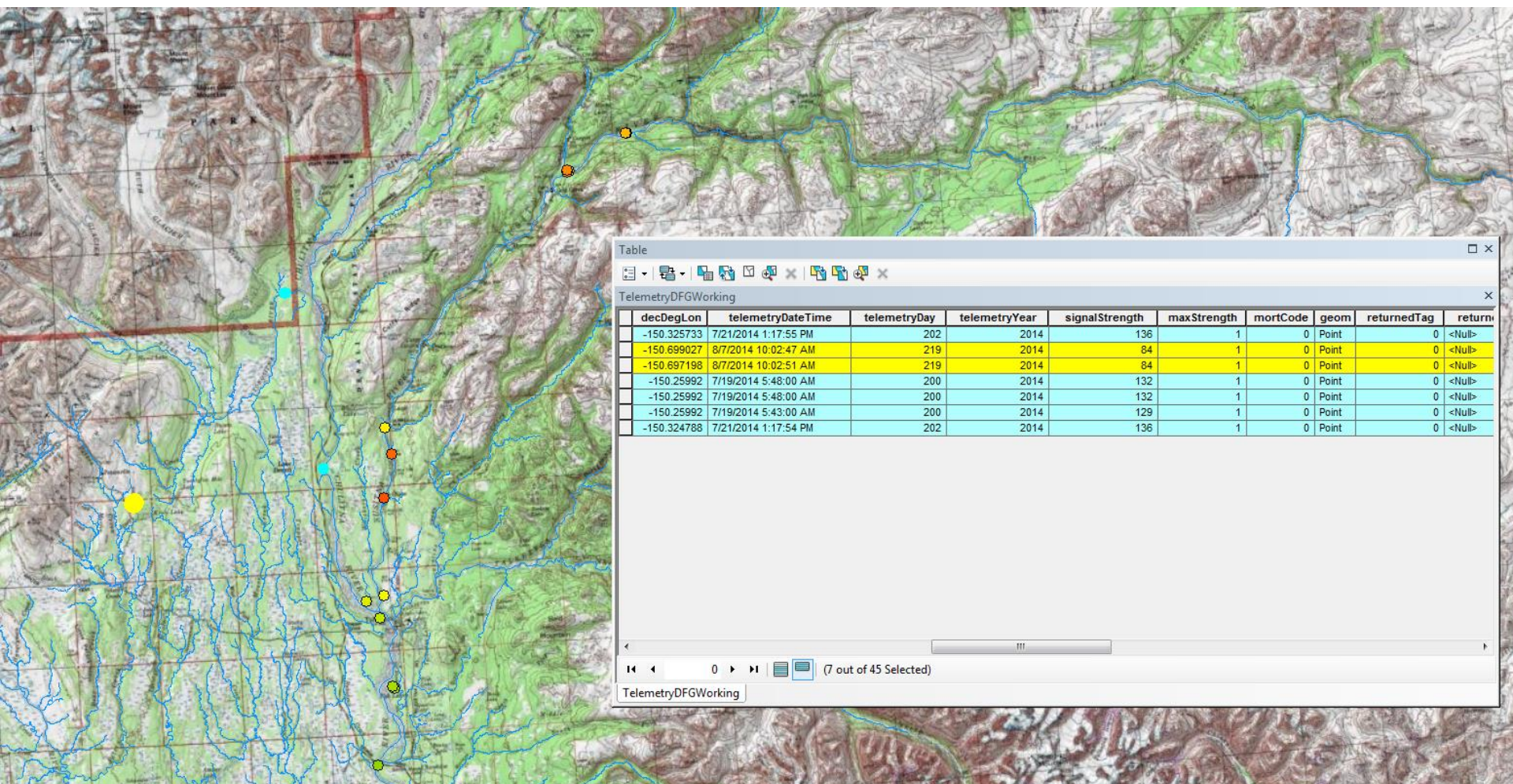
Table

TelemetryDFGWorking

decDegLon	telemetryDateTime	telemetryDay	telemetryYear	signalStrength	maxStrength	mortCode	geom	returnedTag	return
-150.325733	7/21/2014 1:17:55 PM	202	2014	136	1	0	Point	0	<Null>
-150.699027	8/7/2014 10:02:47 AM	219	2014	84	1	0	Point	0	<Null>
-150.697198	8/7/2014 10:02:51 AM	219	2014	84	1	0	Point	0	<Null>
-150.25992	7/19/2014 5:48:00 AM	200	2014	132	1	0	Point	0	<Null>
-150.25992	7/19/2014 5:48:00 AM	200	2014	132	1	0	Point	0	<Null>
-150.25992	7/19/2014 5:43:00 AM	200	2014	129	1	0	Point	0	<Null>
-150.324788	7/21/2014 1:17:54 PM	202	2014	136	1	0	Point	0	<Null>

7 out of 45 Selected

TelemetryDFGWorking



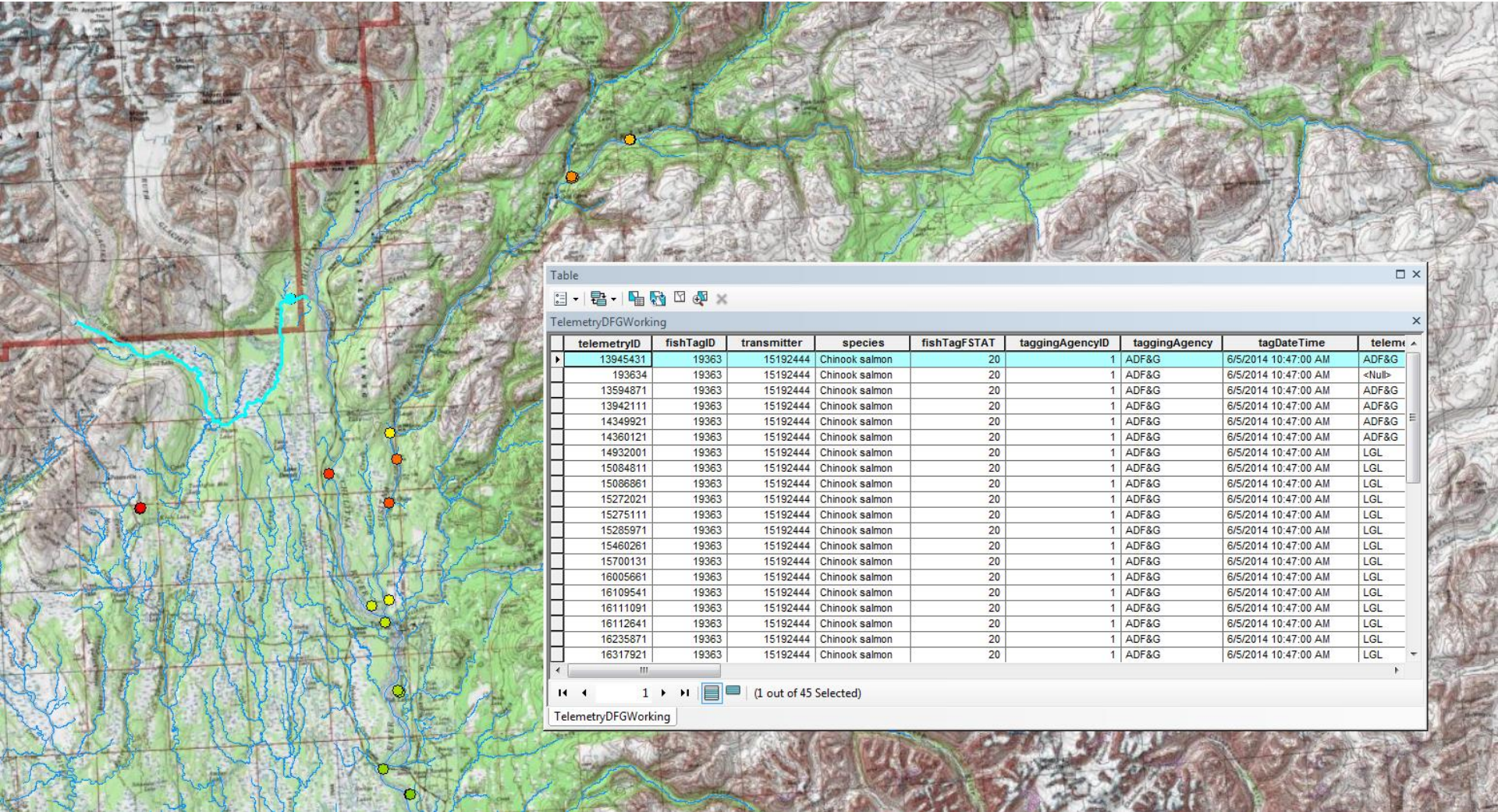
Table

TelemetryDFGWorking

decDegLon	telemetryDateTime	telemetryDay	telemetryYear	signalStrength	maxStrength	mortCode	geom	returnedTag	return
-150.325733	7/21/2014 1:17:55 PM	202	2014	136	1	0	Point	0	<Null>
-150.699027	8/7/2014 10:02:47 AM	219	2014	84	1	0	Point	0	<Null>
-150.697198	8/7/2014 10:02:51 AM	219	2014	84	1	0	Point	0	<Null>
-150.25992	7/19/2014 5:48:00 AM	200	2014	132	1	0	Point	0	<Null>
-150.25992	7/19/2014 5:48:00 AM	200	2014	132	1	0	Point	0	<Null>
-150.25992	7/19/2014 5:43:00 AM	200	2014	129	1	0	Point	0	<Null>
-150.324788	7/21/2014 1:17:54 PM	202	2014	136	1	0	Point	0	<Null>

0 (7 out of 45 Selected)

TelemetryDFGWorking



Table

TelemetryDFGWorking

telemetryID	fishTagID	transmitter	species	fishTagFSTAT	taggingAgencyID	taggingAgency	tagDateTime	telemetry
13945431	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	ADF&G
193634	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	<Null>
13594871	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	ADF&G
13942111	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	ADF&G
14349921	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	ADF&G
14360121	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	ADF&G
14932001	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
15084811	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
15086861	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
15272021	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
15275111	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
15285971	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
15460261	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
15700131	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
16005661	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
16109541	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
16111091	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
16112641	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
16235871	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL
16317921	19363	15192444	Chinook salmon	20	1	ADF&G	6/5/2014 10:47:00 AM	LGL

TelemetryDFGWorking (1 out of 45 Selected)

How accurate were we?

Final selected point

19 miles separate
one day's points



How accurate were we?

- Accuracy of final location was tested on a total of fifty tagged fish
- ALL of the aerial telemetry detections for the day of year of selected final location were used.
- Median Center tool was used to determine the location that minimizes the overall Euclidean distance to the other detections on that specific day.
- Tool was run twice for each fish: once with all detections considered equally, once with detections weighted by signal strength.

How accurate were we?

Distance between calculated median center of all detections and selected final location with all detections.

	Median Center		Median Center Weighted	
	Feet	Miles	Feet	Miles
Mean	3893	0.74	3640	0.69
Std Dev	4732	0.90	4690	0.89
Median	1420	0.27	1196	0.23

95% relative precision = 0.2

Thanks to:

- ***Ryan Snow, ADF&G,
database programmer***
- ***Skip Repetto, ADF&G,
GIS developer***
- ***Alaska Energy Authority***

