

Selecting fish for upstream survival analyses

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This memo explains the methods and rationale used in selecting fish for upstream survival analyses in the 2008 BiOp, and updates that analysis through upstream migration year 2012, using data current as of 9/30/2013. It also displays the 2008 results and compares them to the current (2013) results as well. The focus is on “raw” survival rates, with no adjustments for harvest and straying. The code used to generate the results is in the appendix.

Methods

While similar information on upstream migration is available on DART and elsewhere, I use a somewhat different method to start the database work. Because I often do queries that return millions of fish (e.g., all steelhead smolts tagged between 1990 and 2010), I use the PTAGIS system-generated dimension and fact files which, when merged, allow one to recreate the entire PTAGIS database for tagging, detection, recapture, and mortality events. The resulting database (about 35.2 million records as of 9/30/2013) has one record (or observation in SAS-speak) for each tagged fish. Each observation has most of the tagging and detection information for each fish that is relevant to fish released above Bonneville Dam. Note that in selecting records for this step, I only use fish with known species, tagging location, and tagger-assigned migration year; the selection process eliminates perhaps 0.1% of the PTAGIS data.

The steps in the 2008 upstream survival analysis and the present update are straightforward:

1. Select fish detected at Bonneville, McNary, Lower Granite, and Wells ladders from 2002 to present (step 1 in the attached SAS code). Of those, select fish that spent one to seven years at sea, based on tagger-assigned migration year and the year of detection in the ladders.
2. In step 2, select Chinook, steelhead, or sockeye from spring, summer, fall, and unknown (“5”) run types, that were detected at Bonneville ladders in 2013 or earlier. Assign ESU’s based on tagging location (tagging kilometer), and drop fish at sea for more than six years.
3. In step 3 for the Snake, assign run types (spring or fall for Chinook, summer for steelhead and sockeye), and assign transport based on detection in a raceway at transport sites (no transport schedule used). This step also drops fish detected in the ladders at Lower Granite but not detected at McNary. Jack-adult status is based on years at sea, calculated as noted above. Note that in both 2008 and this update, Chinook tagged at Lower Granite were excluded because their run (spring or summer) is unknown at the time of tagging. We may wish to revisit this decision.
4. For Upper Columbia the logic is similar, but no fish were assumed to be transported. In addition, since most steelhead returns were one-ocean fish, we lumped all steelhead into the “adult” class. Also, since very few wild fish had returned as adults, we dropped the few wild returnees the BiOp; I included them in the update.

Results

Results for Chinook and steelhead are displayed in the tables that follow for inriver migrants; transported fish showed similar patterns. By and large, those that Blane Bellerud compiled for 2009-2012 are very close to the updated results using 2008 methods. A cursory examination suggests that in no case would the differences be considered statistically significant; further work to test this could easily be carried out.

Discussion

Obviously, the results reported here are only one of many ways to slice and dice the data. That said, the fact that the methods developed in roughly 2003-2005, as adult detections at McNary and other upstream dams came online, produce about the same results when querying the current version of PTAGIS suggests that they are robust if nothing else.

It is also clear that the methods could be improved. The 2008 methods assign upstream passage year based on the last detection at the ladders of any dam; assignment based on detection at Bonneville only would be more accurate. Similarly, this version uses tagger-assigned migration year to calculate adult ocean age; using the year of downstream detections would again be more accurate where it's available. Upstream survival into the UC would be easy to estimate, but I have not yet done so. Finally, as noted above, it would be easy to include Chinook tagged at Lower Granite and other dams in the Snake, with some judgment calls given the partial overlap of spring/summer and fall run emigration timing. Doing so would increase sample size and hence precision of the survival estimates.

Snake Steelhead, Inriver	Upstream Year	N at BON, 2008 Methods	BON to LGR, B.B.	2008 methods, 2013 data	Difference
	2009	500	67.0%	72.8%	-5.8%
	2010	1,688	69.3%	72.8%	-3.5%
	2011	1,434	68.7%	74.1%	-5.3%
	2012	1,600	71.9%	74.8%	-2.9%
Snake River Fall Chinook, Inriver	Upstream Year	N at BON, 2008 Methods	BON to LGR, B.B.	2008 methods, 2013 data	Difference
	2009	569	59.4%	60.1%	-0.7%
	2010	2,988	70.0%	64.6%	5.4%
	2011	1,832	62.5%	60.1%	2.4%
	2012	2,632	77.2%	73.3%	3.9%
Spring/Summer Chinook, Inriver	Upstream Year	N at BON, 2008 Methods	BON to LGR, B.B.	2008 methods, 2013 data	Difference
	2009	1,268	71.9%	75.2%	-3.3%
	2010	2,241	69.9%	73.6%	-3.7%
	2011	1,740	67.2%	66.8%	0.4%
	2012	1,709	75.6%	74.4%	1.3%

UC Spring Chinook, Inriver	Upstream Year	N at BON, 2008 Methods	BON to MCN, B.B.	2008 methods, 2013 data	Difference
	2009	148	80.4%	80.4%	0.0%
	2010	461	82.6%	82.7%	0.0%
	2011	342	75.6%	76.6%	-1.0%
	2012	490	83.0%	83.1%	-0.1%
UC Steelhead, Inriver	Upstream Year	N at BON, 2008 Methods	BON to MCN, B.B.	2008 methods, 2013 data	Difference
	2009	1379	73.3%	75.3%	-1.9%
	2010	940	78.5%	78.5%	0.0%
	2011	1142	78.4%	79.6%	-1.2%
	2012	1037	78.6%	78.8%	-0.2%

Appendix: SAS code to select fish for analysis

Note that in SAS all commands end with a semicolon, and that lines/commands beginning with an asterisk are comments.

```
***adults at any ladder 1 2013-10-30.sas;
```

```
libname sasdata "D:\userfile\ptagis\sasdata\Upstream 2013 Fall";  
libname mergdata "d:\userfile\ptagis\sasdata\PTAGIS SAS\Merged" ;
```

```
data sasdata.upstream_at_BON_v1(label = "BON, MCN, etc adult detects 2013-10 V1");  
    set mergdata.all_to_2013_10(where = (bonacnt = 1 or mcnacnt = 1 or lgracnt = 1 or  
WELLSACNT = 1));  
    by tag_id;  
    if first.tag_id;  
        adult_year = year (datepart( (max (obsdat8, obsdat9, obsdat10,  
obsdat27) ) ) );  
  
        if adult_year < 2000 then delete;  
        age_at_return = adult_year - migr_yr;  
        if age_at_return >= 1 and age_at_return <= 7 ;  
run;
```

```
*** adults V2.sas;
```

```
libname sasdata "D:\userfile\ptagis\sasdata\Upstream 2013 Fall";  
  
data sasdata.upstream_at_BON_v2(label = "BON MCN WELLS LGR ETC");  
    set sasdata.upstream_at_BON_v1;  
    length region $20. life_stage $10. ;  
    if species = "1" or species = "3" or species = "4" ;  
    if run = "1" or run = "2" or run = "3" or run = "5" ;  
    if adult_year > 1999 ;  
    if adult_year <= 2013;  
    if bonacnt > 0 ;  
    tag_km_1 = substr(tag_km, 1, 3);  
    if tag_km_1 = "522" then region = "Snake";  
    if tag_km_1 = "539" and region = " " then region = "Yakima";  
    if tag_km_1 > "539" and region = " " then region = "Upper Col";  
    if region = " " then delete;  
    drop tag_km_1 ;  
    if age_at_return < 1 then delete;  
    if age_at_return > 6 then delete;
```

```

        if age_at_return = 1 then life_stage = "Jack" ;
        else life_stage = "Adult";
run;

```

****SNAKE V3-BON-MCN-LGR 2013-10-31.sas;**

```

libname sasdata "D:\userfile\ptagis\sasdata\Upstream 2013 Fall";
data upstream_at_BON_v3(label = "BON MCN WELLS LGR ETC V3 - SNAKE");
    length spp $20. spp_run $20. transported $16. ;
    set sasdata.upstream_at_BON_v2;
        if adult_year >= 2002 ;
        if adult_year <= 2012 ;
        if region = "Snake" ;
    if species = "1" then spp = "Chinook";
    if species = "3" then spp = "Steelhead";
    if species = "4" then spp = "Sockeye";
    if species = "3" then spp_run = "Summer" ;
    if species = "4" then spp_run = "Sockeye - Summer" ;
    if species = "1" and run = "3" then spp_run = "Fall";
    if spp_run = "Fall" and rear_type = "W" then rear_type = "U" ;
    if species = "1" and (run = "1") then spp_run = "Spring";
    if species = "1" and (run = "2") then spp_run = "Spring";
    if spp_run = " " then spp_run = "Unknown";
    if spp_run = "Unknown" then delete;
    transported = "0 - Inriver" ;
    if rel_site = "LGRBR" or gsbypasd = 1 or lgbypasd = 1 or lmbypasd = 1
        then transported = "1 - Transported" ;
    if lgracnt = 1 and mcnaent = 0 then delete;
    ** No fish missed at MCN for MCN-LGR ;
run;

```

****UCR V3 2013-10-31.sas;**

```

libname sasdata "D:\userfile\ptagis\sasdata\Upstream 2013 Fall";

data upstream_at_BON_v3(label = "BON MCN V3 - UC");
    length spp $20. spp_run $20. transported $16. life_stage $16. ;
    set sasdata.upstream_at_BON_v2;
        if adult_year >= 2002 ;
        if adult_year <= 2012 ;
        if region = "Upper Col" ;
    if species = "1" then spp = "Chinook";
    if species = "3" then spp = "Steelhead";
    if species = "4" then spp = "Sockeye";
    if species = "3" then spp_run = "Summer" ;
    if species = "4" then spp_run = "Summer" ;
    if species = "1" and run = "3" then spp_run = "Fall";

```

```

        if spp_run = "Fall" and rear_type = "W" then rear_type = "U" ;
        if species = "1" and (run = "1") then spp_run = "Spring";
*****below UC Only 01-24-08;
        if species = "1" and (run ne "1") then delete;
**10-31**;    if species = "3" then life_stage = "Jack + Adult" ;
***10/31***   if rear_type ne "H" then delete ; **UC ONLY **;
        if spp_run = " " then spp_run = "Unknown";
        if spp_run = "Unknown" then delete;
        *** 10-31 ***** transported = "0 - Inriver" ;
        if rel_site = "LGRRBR" or gsby pasd = 1 or lgby pasd = 1 or lmbypasd = 1
            then transported = "1 - Transported" ;
***NOT FOR UC*** if lgracnt = 1 and mcna cnt = 0 then delete;
run;

```