**-IP Data – General Information**

Enclosed are the “Intrinsic Potential” (IP) data for juvenile salmonid rearing habitat. The IP models were originally developed for coho salmon and steelhead by scientists at the USFS Forest Sciences Laboratory and Oregon State University as part of the CLAMS1 project to examine various natural and anthropogenic processes at a landscape scale. Please see Burnett et al. (2003, 2007)2 for more detail. The enclosed files are the a result of NOAA Fisheries Southwest Fisheries Science Center’s application of the CLAMS method to coastal California streams. Modifications were made to the stream discharge relationship developed for Oregon to reflect differences in rainfall-runoff relationships in the more arid landscapes of California and southern Oregon. Additionally, an IP model for Chinook salmon was also developed by NOAA scientists using the same principles outlined by Burnett et al. (2008). .

IP describes the potential for a stream reach3 to exhibit habitat characteristics suitable for a species as a function of the geomorphologic and hydrologic characteristics of the landscape. IP does not indicate the actual distribution of “good” habitat, only the inferred potential for such habitat to occur, given the basic hydrologic and geomorphic structure of the stream. Nor does the model necessarily predict productivity, abundance, or any other characteristic of populations. Equally important, IP models do not predict current conditions habitat potential, as many anthropogenic activities can diminish habitat quality, and these adverse effects are often greatest in areas with historically high IP. Rather, IP reflects underlying geomorphology and hydrology, and thus is an index for the relative likelihood of suitable habitat occurring under pristine conditions.

Calculating IP for a species proceeds in two phases. First, a GIS stream network is generated using information on (1) topography from a 10-meter Digital Elevation Model (DEM) and (2) mean annual precipitation4. Within this stream network, reaches on the order of 50-200 meters in length are defined dynamically by changes in gradient and form the units for subsequent calculations. Second, for each reach three variables are calculated: mean gradient, mean annual discharge at the base of the reach, and valley constraint5. Reach-specific values for each variable are converted to habitat suitability scores through functions that map the value of each variable to a scale of 0-1. The geometric mean of these scores yields the IP score for that reach.

**January, 2008 Updates. Natural Barriers and Dams - Attributes Added to Coverages.**

**(Description updated February, 2011.)**

To incorporate both natural barriers and anthropogenic barriers (dams), attributes have been

added to the coverages affected by these barriers. For the North Central California Coast

(NCCC) recovery domain watersheds, if natural barrier(s) and/or dam(s) are present in the

watershed, a NAT\_BARR and/or ANTHRO\_BARR attribute exists in the arc attribute table. For

the Southern Oregon Northern California Coasts (SONCC) recovery domain watersheds, only

the natural barriers were included in the analysis, so if both natural and anthropogenic barriers

occur in the watershed, only a NAT\_BARR attribute exists in the arc attribute table and there is

no ANTHRO\_BARR field. For a natural barrier in both recovery domains, all arcs downstream

of the barrier are given a value of zero and all arcs upstream of the barrier are given the value of

the FNODE of the first arc downstream of the barrier (essentially the node where the barrier is

located). For anthropogenic barriers (dams) in the NCCC domain, all arcs downstream of the

barrier are given a value of zero and all arcs upstream of the barrier are given a value of one.

Accompanying the IP coverages is a point shapefile detailing the natural barriers

(nccc\_barr\_ip.shp or sonc\_ip\_barr.shp). The shapefile attribute table contains specific information about each barrier and whether the barrier is considered passable or impassable to different species.

**January, 2012 Updates.**

In July of 2012, NOAA Fisheries made revisions to their intrinsic potential model for steelhead in the Central California Coast and Northern California distinct population segments. These revisions involved modification of curves relating estimated mean annual flow and suitability. Details of these revisions and their influence on population delineation and viability criteria can be found in Spence et al. (2012)6. Versions of the steelhead IP model that pre-date these revisions are incorrect and should be discarded.

**September 2014 Updates.**

In September 2014, NOAA Fisheries Southwest Fisheries Science Center collaborated with NOAA Fisheries West Region to create species-specific data files of intrinsic potential for four ESUs and DPSs within the North-Central California Coast Recovery Domain: California Coastal Chinook salmon, Central California Coast coho salmon, Northern California Steelhead, and Central California Coast steelhead. These data files differ from their predecessors in two important respects. First, stream reaches with IP values of zero that occur upstream of the upper extent of the predicted distribution have been removed to reduce file size and increase portability. Second, areas upstream of long-standing natural barriers to fish passage have been removed from these files as well. This eliminates the need to query based on barrier attributes in order to obtain the extent of intrinsic potential that formed the bases for population delineation and viability criteria developed by the recovery teams (Bjorkstedt et al. 2005; Spence et al. 2008; Spence et al. 2012).

1 http://www.fsl.orst.edu/clams/prj\_wtr\_str\_indx.html

2 Burnett, K., G. Reeves, D. Miller, S. Clarke, K. Christiansen, and K. Vance-Borland. 2003. A first step toward broad-scale identification of freshwater protected areas for Pacific salmon and trout in Oregon, USA.J. P. Beumer, A. Grant, and D. C. Smith, editors. Aquatic protected areas: what works best and how do we know? Proceedings of the World Congress on Aquatic Protected Areas, Cairns, Australia, August 2002; Burnett, K.M., G.H Reeves, D.J. Miller, S. Clarke, K. Vance-Borland, and K. Christiansen 2007. Distribution of salmon-habitat potential relative to landscape characteristics and implications fro conservation. Ecological Applications 17(1): 66-80.

3 A stream reach is a section of stream or river approximately 50-200 m in length, and is generally defined with respect to geomorphological features.

4 Mean annual precipitation was obtained from the output of the PRISM model. The PRISM model predicts climate variables by interpolating observations over the period 1961-1990 and accounting for topographical effects such as elevation and aspect.

5 Valley constraint is defined as the ratio of the valley floor (floodplain), which is derived from the topography of the DEM, and the active channel width, which is derived from an empirical relation between discharge and active channel width based on observations in Oregon.

6 Spence, B.C., E.P. Bjorkstedt, S. Paddock, and L. Nanus. 2012. Updates to biological viability criteria for threatened steelhead populations in the North-Central California Coast Recovery Domain. (Revised 2 July 2012). NMFS Southwest Fisheries Sciece Center, Fisheries Ecology Division, Santa Cruz, CA.

**Additional Summary Notes on the Intrinsic Potential Data distributed by NOAA’s Southwest Fisheries Science Center, Santa Cruz Office.**

By Holly Davis, Updated Sept. 2, 2010.

The definitive documents regarding IP are the technical memos published by the Southwest Fisheries Science Center:

1) General IP - NOAA-TM-NMFS-SWFSC-379.pdf

2) SONCC IP - Coho - NOAA-TM-NMFS-SWFSC-390.pdf (Southern Oregon/Northern California Coasts)

3) NCCC IP - Coho, Chinook, Steelhead -TM 382.pdf (North Central California Coast)

4) Lindley's 2006 paper, "CV - Hist Pop Structure - Steelhead - 00425.pdf (Central Valley)

5) SCSCC - NOAA-TM-NMFS-SWFSC-391.pdf (Southern California – SC and Southern Central Coast - SCC)

6) NCCC IP revisions – steelhead only. (White paper produced by NMFS SWFSC Fisheries Ecology Division)

These technical memos and peer-reviewed papers are the primary resource for understanding “Intrinsic Potential” data.

The information in this document serves as a 30,000 ft overview and quick summary of the differing datasets.

**Modeled Historical Data**

Different models were used for the different domains. The intrinsic potential (IP) model was used to generate the distribution data for the North Central California Coast (NCCC) and the Southern Oregon/Northern California Coasts (SONCC) domains. To understand how the GIS data were generated, see the "General IP - NOAA-TM\_NMFS-SWFSC-379.pdf" file. To see how the IP results were applied in the North Central California Coast see the "NCCC IP - Coho, Chinook, Steelhead -TM 382.pdf" document. To see how the IP results were applied for coho salmon in the Southern Oregon/Northern California Coasts domain see the " SONCC IP - Coho - NOAA-TM-NMFS-SWFSC-390.pdf " document.

Metadata is included for each of the data sets including descriptions of each of the many fields in the data sets. To give you a quick leg up, the fields in the GIS data that are specifically for Chinook have CHK somewhere within the field name, coho have CO, and steelhead have ST.

The fields that most people are interested in symbolizing on are:

**IP\_Curve**: use for mapping - shows the quality of the IP (from 0.0 to 1.0).

**IP\_INT** = Integrated IP: use if comparing to other watersheds. The area over which IP was calculated is taken into account (values are > 1).

To get **total IP miles for a watershed**, sum all the IP\_INT records in that watershed.