| **Key Discussion Points from PIT Tag Scenario Analysis** | | | |
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| **MANAGEMENT AREA** | **INDICATOR: PIT-TAG** | **PRIMARY/SECONDARY** | **OTHER** |
| **Hatchery** | **1b adult harvet retursn escapement** | Adipose – strong secondary; |  |
| **Hatchery** | **3a adult abundance** | PIT - WS |  |
| **Hydro** | **1A (Hydrosystem survival for juvenile)** | PIT- primary; Acoustic – specialized, Radio - specialized  Genetics-future | COE will be conducting acoustic study for avian predation. Acoustic and radio tags are too expensive to implement systemwide (i.e. specialized use). |
| **Hydro** | **1C (Project survival)** | PIT- primary; Acoustic – Primary, Radio – primary |  |
| **Hydro** | **1B (Hydrosystem survival adults)** | PIT – primary,  Acoustic – specialized  Radio – specialized  Genetics – future  CWT – strong secondary | CWT used to track harvest so need that info to inform hydrosystem survival. But could use PIT to inform the harvest component as well.  Not having CWT and relying on PIT only for the harvest component of this estimate would affect your ***confidence*** ***levels*** in the estimate. |
| **Hydro** | **1D (Fish Guidance Efficiency)** | PIT- primary; Acoustic – Primary, Radio – primary |  |
| **Hydro** | **1E (Forebay Delay)** | PIT- weak secondary;  Acoustic – Primary, Radio – primary | We’ll use PIT data if we have it, but don’t rely on it. |
| **Hydro** | **2A (Dam passage delay)** | PIT- weak secondary;  Acoustic – Primary, Radio – primary | PIT used to look at adult delay |
| **Hydro** | **2B (Dam passage fall back and reascension)** | PIT- primary;  Acoustic – specialized use,  Radio – specialized use |  |
| **Hydro** | **2C (Travel Time)** | PIT – primary;  Acoustic – specialized use,  Radio – specialized use |  |
| **Hydro** | **2D (Migration timing/between dam migration** | PIT – primary;  Genetics – future;  Radio – specialized;  Genetics – future;  Acoustic - specialized | Acoustic tags are becoming more attractive as the infrastructure builds up, so could be used in the future. |
| **Hydro** | **2E (smolt to adult return rates)** | PIT – primary  CWT;  Genetics- future;  Otolith – future;  To be completed later |  |
| **Hydro** | **3A Fish Condition** | PIT – primary;  Genetics – future; | Acoustic and radio are biased towards healthy fish (tag healthy fish only) so wouldn’t use them for this. |
| **Hydro** | **3B (Bonneville through estuary (LCR) survival behavior, travel time)** | PIT – primary;  Acoustic - primary | PIT tags detected via NOAA pair trawl in estuary. |
| **Hydro** | **3C (route specific survival – through individual dam passage route)** | PIT future ;  Acoustic – primary;  Radio - primary | PIT – in-river transport; sort by code; bypass; but not for passage through other project routes. Could be used in future if have more detectors at the dam, e.g., spillways and turbines. |
| **Hydro** | **3D reach survival** | PIT – primary  Acoustic – primary;  Radio- primary |  |
| **Hydro** | **3E Travel time** | PIT – primary  Acoustic – primary;  Radio- primary |  |
| **Hydro** | **3F juvenile dam passage delay** | PIT – primary  Acoustic – primary;  Radio- primary |  |
| **Hydro** | **3G migration timing (overwintering, residence time, in season)** | PIT – primary;  Acoustic – future;  Radio- future;  Scales –Specialized;  Otolith – specialized;  Genetics – future; | Acoustic/radio – future application is contingent on developing longer battery life. |
| **Hydro** | **4A – juvenile survival** | PIT = primary;  Acoustic- specialized;  CWT specialized; |  |
| **Hydro** | **4Di tributary survival straying rates** | CWT primary;  Genetics – primary;  Otolith - future;  PIT- primary;  Radio – specialized;  Acoustic - future; | Acoustic could be used now if desired, but not currently used. |
| **Hydro** | **~~4D ii – spawning success ( detect difference between fish transported versus inriver migration)~~** |  | Group decided to remove this indicator from hydro; the essence of it is captured under a habitat indicator. |
| **Hydro** | **4C – physiological stressors** | Radio primary;  Genetics - future |  |
| **Hydro** | **4E – post hydrosystem juvenile behavior survival and travel time** | PIT – strong secondary;  Acoustic – specialized;  Scales – weak secondary; | Acoustic primary in the recent past, funding has stopped, so as funding becomes available would like to use in the future –choice to use it as needed.  NOAA is fishing in ocean for juveniles and using CWT. |
| **Hydro** | **5A – age one recruitment for sturgeon** | PIT – specialized;  Genetics - specialized | States don’t use tag (use catch index) but PUD uses PIT for population index work within reservoirs. |
| **Hydro** | **5B - passage numbers and directions for sturgeon and lamprey** | Radio- specialized use for lamprey;  PIT –strong secondary used for sturgeon;  Acoustic – future used for sturgeon;  Genetics – future used for sturgeonOtolith – future used for sturgeon | PIT is currently the only option for ***sturgeon.*** |
| **Hydro** | **5C – entrainment rates for sturgeon and lamprey** | PIT – primary for sturgeon ;  Genetics for future secondary for sturgeon ;  Acoustic future secondary for sturgeon ;  Radio future secondary for sturgeon ;  Otolith future secondary for sturgeon ; | Not sure what is done for ***lamprey*** using tags. |
| **Hydro** | **5D adult lamprey passage** | Radio – specialized;  PIT – primary;  Acoustic - future | Half duplex PIT been used for about 10 years for ***lamprey*** (Detectors at ladders, Willamette Falls).  Acoustics currently don’t work well in the noisy ladder environments. |
| **Harvest** | **1E (ESA listed population impact rate)** | CWT primary;  PIT strong; secondary  Genetic strong secondary;  Adipose – strong secondary;  Radio – specialized use |  |
| **Harvest** | **1F (non esa listed population harvest rate)** | CWT – primary;  Genetic – strong secondary;  PIT strong secondary |  |
| **Harvest** | **2B (ESA listed population impact rate)** | CWT – primary;  Genetic – strong secondary;  PIT strong secondary;  Adipose – for certain species primary | PIT are put in ***wild*** ***fish***, CWT are not in wild fish. So PIT allows sampling wild fish for these rates.  PIT is beginning to grow in use.  Adipose clip is primary tool for ESA listed fish in selective harvest fishery, and contribute to impact rate.  ***Spring*** ***Chinook*** rely on adipose clip to inform the impact rate;  Reach survival estimates currently rely strongly on PIT; |
| **Harvest** | **3H (Other state management objectives)** | CWT – primary (ocean)  Genetic – primary (especially for IDFG)  PIT – primary (especially for WDFW) | Best applicable tag is often ***species*** and ***region***-***specific***. It’s hard to generalize tag priority across this indicator. |
| **Habitat** | **1A juvenile production** | PIT – primary;  Genetics – weak secondary;  CWT – specialized;  Adipose weak secondary | CWT used in the past.  Often only have external tagging needed (clip, dye) used. |
| **Habitat** | **1B relationship of trib habitat actions and productivity (out migrant)** | PIT – primary;  Genetics – weak secondary;  CWT – specialized;  Adipose weak secondary; | We use PIT now to estimate migrants. |
| **Habitat** | **1 F post hydro-system adult survival** | PIT primary;  Radio primary; |  |
| **Habitat** | **1 G rearing distribution** | PIT primary;  Radio specialized |  |
| **Habitat** | **1 H juvenile growth rate** | PIT – primary;  Genetics future;  Otolith weak secondary;  Scales weak secondary | We can get information from otolith and scales, but these are not the ideal method |
| **Habitat** | **1 I patterns of movement** | PIT – primary;  Acoustic – specialized;  Radio primary;  Genetics weak secondary |  |
| **Habitat** | **1J patterns of timing** | PIT primary; radio specialized; genetics future; acoustics future |  |
| **Habitat** | **1D fish in** | PIT primary; radio primary  CWT - SP |  |
| **Habitat** | **1k Residency** | PIT primary; radio future; acoustic future; genetics future; otolith specialized; scales specialized | Using otolith microchemistry analysis to see how long fish are in certain waters.  Most development is occurring in acoustics so it is a future potential. |
| **Habitat** | **2A life history diversity index** | PIT primary; Genetics primary; |  |
| **Habitat** | **2B salmon and steelhead smolt survival from BON to estuary** | Acoustic specialized;  PIT strong secondary;  Scales weak secondary; |  |
| **Habitat** | **2C juvenile growth rate** | Otolith specialized  PIT primary  Scales - SP |  |
| **Habitat** | **2D Migration timing** | PIT – primary  Acoustic specialized;  Radio specialized | Consider combining 2d, 2e, and 2f, 2g. |
| **Habitat** | **2E patterns of movement** | Acoustic specialized;  PIT specialized  Genetics WS; | Consider combining 2d, 2e, and 2f, 2g. |
| **Habitat** | **2F patterns of timing** | PIT – primary  Acoustic specialized;  Radio specialized;  Genetics future; | Consider combining 2d, 2e, and 2f, 2g. |
| **Habitat** | **2G residency** | PIT primary; genetics future  (see K) |  |
| **Habitat** | **2H estuary distribution and habitat associations by stock** | Genetics –primary  PIT primary |  |
| **Habitat** | **2I fish density** | PIT primary |  |
| **Habitat** | **2k estuarine life histories among returning adults** | PIT primary;  Otolith specialized;  Scales weak secondary | Scales are WS because they are not as informative as otoliths. |
| **Habitat** | **3A (length of time)** | Acoustic primary;  Genetics future;  Otolith Weak secondary; |  |
| **Habitat** | **3B growth rate** | PIT weak secondary  Genetics future  Otolith primary; scales weak secondary; CWT future | PIT information is used if it is available. |
| **Habitat** | **3C predation** | Acoustic - future |  |
| **Habitat** | **3Di ocean/~~plume~~ life histories** | Otolith specialized;  Scales primary;  CWT primary;  PIT primary;  Genetics future; | Split 3D into ocean and plume. |
| **Habitat** | **3Dii ~~ocean/~~plume life histories** | Acoustic specialized; | Split 3d into ocean and plume. |
| **Habitat** | **3E productivity** | CWT – SP |  |
| **Predation** | **1a (Caspian tern predation rates on juvenile fish)** | Primary – PIT  Acoustic – Weak secondary | Acoustic used more for migration than for predation rate.    CWT were used in the past, pre-PIT tag (pre- 1990s). |
| **Predation** | **1B (Double-crested cormorant predation rates on juvenile fish populations)** | Primary – PIT  Acoustic – Weak secondary |  |
| **Predation** | **1C (other combined avian predation rates on juvenile fish populations)** | Primary – PIT  Acoustic – Weak secondary |  |
| **Predation** | **1D (California and Steller sea lion predation rate on fish in the lower Columbia River)** | PIT is weak secondary  Acoustic is Specialized use  Radio is specialized use | Primary source of data is direct observation. |
| **Predation** | **1E (Northern Pikeminnow annual predation rate on fish)** | PIT – weak secondary | Use diet analysis to assess predation rates. |
| **Predation** | **1F (Other aquatic predator species)** | PIT – Specialized application | Use mark-recapture techniques.  For ***smallmouth*** ***bass*** & ***walleye*** use PIT (used by Grant County PUD at Priest Rapids for this purpose; used by others in the basin more as weak secondary) and Floy tags are also used. |
| **Predation** | **2A (Distribution and population size of Northern Pikeminnow in Columbia and Snake basins)** | PIT – strong secondary | Floy tags are primary tags for this work. |
| **Predation** | **2B (Distribution and population size of other major fish predators in Columbia and Snake basins)** | PIT – weak secondary | PIT tags are used to corroborate Floy tag information. |
| **Predation** | **2C (Annual exploitation rate of No. Pikeminnow removed in sport-reward program)** | PIT – weak secondary | Floy tags are primary tags for this work. |