Pacific Salmon:

SFP Fisheries Sustainability Overview 2014

December 2014

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CITATION

PHOTO CREDITS

Cover, bottom left and right: Zaporozhets and Zaporozhets (2011).

KEYWORDS

DISCLAIMER

This report was mainly prepared with information available from **FishSource.com**™, a program by Sustainable Fisheries Partnership (SFP). The findings summarized in the report are based on information that the authors accessed from FishSource in the summer of 2014. SFP updates FishSource regularly, but this report may not capture the most recent data for all the stocks. Given the large number of existing stocks for a given sector, this report evaluates the most strategically important stocks worldwide (based on criteria such as volume of catch or interest for SFP partners). The *scoring* and *ranking categories* provided do not take into account the environmental impacts of the fisheries (i.e., they are based solely on the quality of management/fishers' compliance and the status of the stock). However, SFP sector reports do address main environmental issues at high resolution on the basis of narrative "Environment and Biodiversity" sections of FishSource.com, as well as other sources of information.

EXECUTIVE SUMMARY

This report comprises the second edition of the Sustainable Fisheries Partnership global sustainability overview of Pacific salmon fisheries and describes assessment results produced through the application of an adapted, species-specific version of the FishSource sustainability criteria and presented online (www.fishsource.com). The analysis covers 82 principal Pacific salmon fisheries that target five species (pink, chum, sockeye, coho, and Chinook salmon) across the North Pacific and account for 95% of global wild-capture commercial salmon harvest.

Fishery performance against the five FishSource scores is used to place fisheries into one of three ranked sustainability categories (A, B, and C). The categorization is based on the quality of management (scores 1 to 3) and status of the target stock (scores 4 and 5). While information on environmental impacts of fishing activities is also captured in the narrative sections of the FishSource fishery profiles, it is not currently captured by the scoring system. The definitions of the categories are:

Category A – Very well managed fisheries that score 8 and above across all FishSource scores
Category B – Reasonably managed fisheries that score ≥ 6 across all FishSource scores
Category C – Poorly managed fisheries where at least one FishSource score is below 6

In summary, the report and accompanying dataset conclude that for salmon fisheries:

- **52%** of the total volume of Pacific salmon included in our analysis comes from well or reasonably managed fisheries (Categories A and B). This includes 99% of coho, 87% of sockeye, 60% of pink, 48% of Chinook, and 23% of chum salmon global harvest.

- **48%** of the total volume of Pacific salmon included in our analysis comes from fisheries in need of significant improvements (Category C). **22%** of this volume is accounted for by Russian fisheries with illegal fishing issues; **13%** by Japanese chum fisheries with hatchery issues; and **10%** by Prince William Sound, Alaska, fisheries with hatchery issues.

- **74%** of Alaskan, **95%** of British Columbian, and **47%** of Russian salmon harvest volumes come from well or reasonably managed fisheries.

- All of the Pacific Northwest US and Japanese fisheries included in this report need significant improvements.

- In 2013–2014, the salmon sector exhibited increased engagement in the Marine Stewardship Council (MSC) program. Over half (50.3%) of global supply now comes from fisheries either certified by or under full assessment of MSC.

- Scoring of Category C fisheries indicated four priority areas where improvements are needed: (1) illegal fishing, (2) hatcheries, (3) harvest control practices for depleted stocks, and (4) offshore fisheries.

The report offers the following improvement recommendations for the four priority areas of sustainability concern:

1. Illegal fishing: (1) International buyers of Russian salmon, particularly those in Japan or in western countries purchasing re-exported Russian salmon products processed in China, should request copies of the certificate of catch origin from suppliers and avoid purchase of products that lack an accompanying certificate. (2) International buyers should make written requests of the Russian Federal Fisheries Agency asking that documentation regulations be updated to specify that a single, standardized certificate of catch origin can be obtained and used by any Russian supplier exporting to any international destination. (3) Bilateral agreements between Russia and its export partners Japan and Korea regarding illegal fishing should be amended to include specific reference to salmon, following the example of the bilateral agreement with China. A sample certificate of catch origin should also be added to all three agreements. (4) The EU should follow recommendations described by Clarke and Hosch (2013), improving upon its IUU Regulation in order to close loopholes that presently allow for illegal fish to enter the supply chain for export to Europe. (5) Additional measures to curb illegal fishing, including observer programs, on-site inspection of fishing areas, and control documents, should be implemented in the Russian salmon fishery.

2. Hatcheries: A North Pacific-wide and individual fishery moratorium on hatchery expansion should be established until such time as risks to wild populations from hatchery impacts are, at the highest level, ascertained and integrated into management objectives. This recommendation is made particularly strongly for the Prince William Sound, Alaska, and Iturup, Russia, fisheries, where recent significant increases in hatchery releases threaten to compromise the accuracy of ongoing studies of hatchery impacts upon wild stocks.

3. Harvest control practices for depleted stocks: Managers across the North Pacific should continue to improve upon approaches to defining overfishing and regulatory stock-of-concern status, and, particularly in British Columbia, integrate *Lower Evaluation Benchmarks* for salmon *Conservation Units* into harvest control rules.

4. Offshore fisheries: (1) The offshore driftnet fishery in the Russian EEZ should either close or integrate a genetic- or tag-based stock identification program into the management of the fishery. (2) Mark-selective fisheries in the Pacific Northwest US should not be expanded to new areas or sectors until further evidence of their relative costs and benefits is available and associated stock assessment data gaps in offshore troll fisheries are addressed.

Additionally, the report addresses the issue of mining and associated habitat impacts, and offers the following recommendation:

Overlap between mining projects and wild salmon habitat should be, when possible, avoided (for example, the fishing industry should continue to actively oppose construction of the Pebble Mine in Bristol Bay). In those cases where mining projects are going ahead in the midst of salmon habitat, best practices should be employed to minimize impacts.

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1   INTRODUCTION

A sector-based approach underlies Sustainable Fisheries Partnership's (SFP's) mission of putting actionable information into the hands of retailers and the supply chain in order to leverage market forces to motivate fishery sustainability improvements. We have grouped fisheries into seafood sectors characterized by shared biological and market characteristics of harvested species. Within each sector, we track fishery performance against the FishSource sustainability criteria for management quality and stock status, environmental impacts, and improvement needs of individual fisheries. Results of these analyses are compiled and presented in periodic sector reports like this one for Pacific salmon, the second annual edition of the report. The sector reports allow for both comparison among individual fisheries and aggregation of data in order to reflect the status of the overall sector.

SFP's Pacific salmon sector currently comprises 82 fisheries in Russia, Alaska, Japan, British Columbia, and the Pacific Northwest US targeting the five principal commercial species of Pacific salmon (pink, chum, sockeye, coho, and Chinook). These fisheries are defined by geography, species, and gear(s), and accounted for approximately 95% of the 1.09 million metric tons of wild Pacific salmon harvested commercially in these geographies in 2013 (NPAFC 2014). Fisheries were chosen for inclusion in the report on the basis of catch volume and the strategic interests of SFP partners in the seafood supply chain.

While not a significant sector in terms of contribution to global seafood production volume, salmon are valued highly on the market and are an iconic species for many global markets. Furthermore, sustainability issues within salmon fisheries have prominently drawn attention from and been relevant to other sectors. Fishery and aquaculture production of salmon[1] in 2011 accounted for 4.1% of global seafood production, but also 13.6% of global fishery trade and production value, illustrating the high value of salmon products. Wild harvest comprised only 29% of total salmon production in that year, with aquaculture accounting for the remaining 71% (FAO 2014). However, wild Pacific salmon fisheries play an important role in the sustainable seafood movement at large, highlighting contentious issues such as artificial enhancement, mixed-stock fishing, and habitat degradation that are common to other seafood sectors. In light of salmon fisheries' high economic value and importance in the effort to define sustainability best practices for all fisheries, SFP is committed to providing guidance to those in the fishing and seafood industries with an interest in this sector and for whom sustainability is an important component of their business strategy.

Overall, 2013 was a strong year for the Pacific salmon sector, with North Pacific-wide harvest achieving a peak second only to the historic high harvest of 2009 (Figure 1). The strongest harvest of Alaskan pink salmon on record was a main factor in the overall high harvest, and has resulted in the US Department of Agriculture twice purchasing surplus pink salmon from Alaska in 2014 for over $30 million to help slow price declines. The high global harvest was also spurred by continued recovery of the Japanese chum fishery following the 2010 tsunami. Pink and chum salmon accounted for 53% and 31% of sector-wide harvest, respectively, with sockeye (12%), coho (3%), and Chinook salmon (1%) comprising the remainder (NPAFC 2014, preliminary data). Some regional fisheries experienced

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[1] "Salmon" here refers to all species classified as salmons, trouts, and smelts in the ISSCAAP classification system.

weak runs in 2013, particularly the Alaska and British Columbia sockeye and Chinook salmon fisheries. Notably, the British Columbian and Washington State Fraser River sockeye salmon commercial fishery was closed for the second year in a row, triggering a US federal "fishery disaster" declaration in early 2014 (NOAA 2014). In Russia, the East Kamchatka pink salmon fishery experienced its lowest returns in over two decades. According to official statistics, other Russian regions' harvests made up for the East Kamchatkan shortfall, resulting in an average national harvest. However, according to an industry source, high prices for Russian salmon and ample availability of refrigerated transport ships during the fishing season pointed to a much lower 2013 Russian harvest than that reflected by statistics.
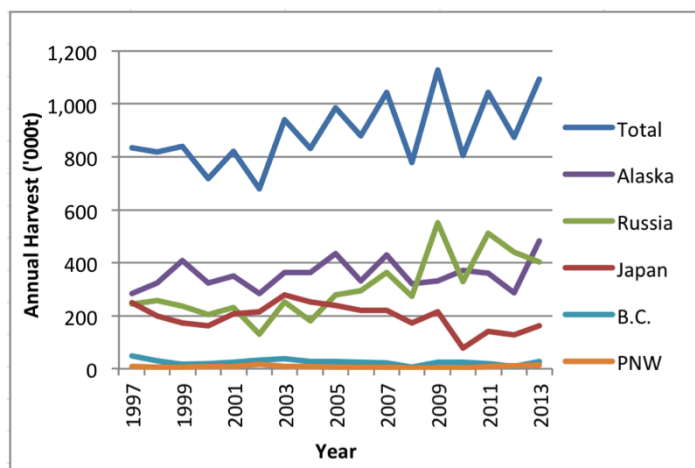
Figure 1: Annual harvest of the five main commercial species of Pacific salmon by region, 1997–2013. The 2013 harvest marked a historic high second only to the all-time high of 2009.

As for artificial production, approximately 4.9 billion juveniles were released from Pacific-wide hatcheries in 2013 (Figure 2). This amounts to a 77 million reduction compared with 2012, and 300 million fewer releases than the historic, pre-tsunami high of 2010 (5.2 billion) (NPAFC 2014). Modest 2012 returns of Alaskan pink and Japanese chum salmon accounted for the slight dip in 2013 releases, as hatchery production is partly dependent upon the number of returning adults that can be used for hatchery broodstock.

Forecasts for 2014 indicated that a smaller North Pacific harvest was expected due to modest returns of pink salmon in Alaska, Kamchatka, and Sakhalin (Kaev 2012; Shevlyakov 2013a; Munro and Tide 2014). Preliminary harvest statistics generally line up with expectations. As of September 19, Alaska's 2014 salmon harvest of 156 million fish was 58% of its 2013 harvest, but 8% above the 2014 forecast (ADFG 2014a; Undercurrent News 2014a). The 2014 Kamchatka pink salmon harvest volume is low, similar to that of 2013, due to limited West
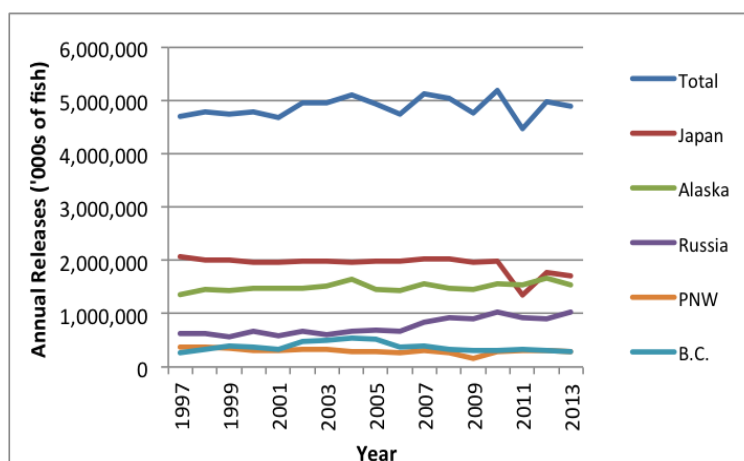
Figure 2: Hatchery releases of the five main commercial species of Pacific salmon by region, 1997–2013. 2013 releases dipped slightly in comparison with 2012.

Kamchatka returns. Meanwhile, Sakhalin's pink salmon harvest of 76.6 thousand metric tons is 58% of the 2013 harvest (Fishnews 2014b). While official Russian statistics for 2014 have not yet been published, an industry source indicated that harvest volumes were low.

Despite modest harvest expectations elsewhere, large returns of Fraser River sockeye salmon were awaited, as offspring of the record 2010 season returned to spawn (DFO 2014). As of mid-

September, the Fraser River return appeared to be historically sizeable (possibly among the top five in the last half-century), but lower than that of 2010 (Undercurrent News 2014b). This result aligns with cyclic population dynamics of Fraser sockeye salmon over the last decade, with strong returns following 3 years of extremely weak returns. This instability in British Columbia's most iconic salmon fishery relevant to Monterey Bay Aquarium's controversial 2014 "avoid" rating of British Columbia net pen farmed Atlantic salmon. The location of Atlantic salmon farms along Fraser wild salmon migration routes and potential for transfer of diseases and parasites in farm effluent to wild fish, which may be occurring and playing a role in Fraser sockeye salmon declines, was an important factor in determination of the rating (Bridson 2014).

Meanwhile, 2014 hatchery releases may have approached historic highs due to the large 2013 returns. Alaskan hatcheries also successfully applied for permits in the spring of 2014 that could increase pink salmon production capacity statewide by approximately 16%, indicating potential for hatchery release increases down the road (ADFG 2014b). Meanwhile, NGO and industry sources on Kamchatka report that private industry is lobbying actively to build hatcheries in that region of mostly wild salmon production. Companies are reportedly interested in building hatcheries because they provide a means of claiming rights to adjacent fishing areas.

Global salmon markets are presently in a particular state of flux due to Russia's early August ban of seafood imports from a number of Western countries, including Norway, the United States, and Canada. Russian suppliers have worked since the imposition of the ban to replace sizeable imports from Norway with salmon from Iceland, the Faroe Islands, and Chile, countries that were not included in the sanctions. Meanwhile, Alaskan fishery representatives and legislators have asked the US federal government to enact a retaliatory ban on imports of Russian seafood (Undercurrent News 2014c).

2   SOURCES OF INFORMATION AND ASSESSMENT CRITERIA

Our overview is based on information from [FishSource.com](http://fishsource.com), SFP's online information resource about the status of fish stocks and fisheries. FishSource includes five scores (Cannon 2007) that facilitate rapid assessment of management quality and stock status of fisheries and fish stocks. An explanation of the five FishSource scores can be found at: http://www.fishsource.com/faqs.

By grouping fisheries into sectors, SFP was able to develop standardized approaches to data gathering and scoring. Notably, we have devised an approach to salmon fishery assessment that includes examination of attributes specific to salmon fishery management (escapement, hatcheries) in scoring fisheries for 14 sub-criteria[2] on a scale of 0–10. The sub-criteria are nested within five overlying scores that generally align with the five FishSource criteria in the original assessment method (Table 1). The salmon-specific FishSource assessment method can be downloaded [here](#).

Approximately half (40) of the fisheries included in this sector report have undergone full analysis of all 14 sub-criteria. Numeric scores indicate those fisheries that have undergone this analysis (application of the FishSource salmon method in its entirety) by SFP staff with help from consultants

Table 1: Salmon-specific adaptation of the five standard FishSource criteria.

Criterion/Score (Standard)	Criterion/Score (Salmon)	Nested Sub-Criteria
1. Is the management strategy precautionary?	1. Is management responsive?	1.1a In-season responsiveness 1.1b Harvest vs. TAC (offshore fisheries only) 1.2 Multi-season responsiveness 1.3 Responsiveness to habitat issues
2. Do managers follow scientific advice on output controls?	2. Are the management guidelines appropriate?	2.1 Appropriate escapement objectives
3. Does the fishery comply?	3. Are the management guidelines and responses based on adequate data?	3.1 Illegal harvest and deviation between reported and actual catch 3.2 Harvest monitoring 3.3 Escapement monitoring 3.4 Stock identification (offshore fisheries only)
4. Is the fish stock healthy?	4. Has stock productivity been maintained?	4.1 Escapement trends over 15 years 4.2 Harvest trends over 15 years
5. Will the fish stock be healthy in	5. Are hatcheries or other	5.1 Hatchery contribution to fishery

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[2] In 2013, SFP made adaptations to its salmon scoring method for use when assessing fisheries that are managed using preseason regulations, occur in open waters, and target mixed-stock aggregates. Three additional sub-criteria that are applied only to these "offshore" fisheries are noted in Table 1.

the future?	enhancement activities negatively affecting wild stocks?	5.2 Wild stock management
		5.3a Straying magnitude and measurement
		5.3b Hatchery influence on TAC (offshore fisheries only)
		5.4 Hatchery: wild stock mixing
		5.5 Hatchery policies

with regional expertise. Scores for the other 42 fisheries were derived from a quick assessment format, through which scores for each of the five FishSource criteria were assigned in range rather than numeric format (≥8, ≥6, <6). If a fishery has undergone Marine Stewardship Council (MSC) assessment, quick assessment entails derivation of scores and rationales from relevant MSC performance indicators, possibly updated with research published since the most recent certification. For fisheries without MSC assessment, quick assessment involves analysis of only one nested sub-criterion (the sub-criterion where lower scores are deemed most likely on the basis of preliminary information) for each of the five criteria.

Generally, fishery data and scores in FishSource are updated annually. However, because the salmon scoring method examines stock status trends over the past 15 years, rather than assigning scores only on the basis of the most recent year of data available, annual profile updates are less of an imperative for this sector. Datasets for fully-scored fisheries have all been updated within the last 2 years, using mostly 2011 and 2012 data with some 2013 data. Some of the information for quick-scored fisheries has not been updated as recently, although scores of MSC-certified fisheries were aligned with MSC audits as of June 2014.

Fishery performance against the five FishSource criteria is used to place fisheries into one of three ranked sustainability categories (A, B, and C). The categorization is based on the quality of management (criteria 1 to 3) and status of the target stock (criteria 4 and 5). While information on environmental impacts of fishing activities is also captured in the narrative sections of the FishSource fishery profiles, it is not currently captured by the scoring system. The definitions of the categories are:

Category A – Very well managed fisheries that score 8 and above across all FishSource scores

Category B – Reasonably managed fisheries that score ≥ 6 across all FishSource scores

Category C – Poorly managed fisheries where at least one FishSource score is below 6

Finally, the analysis described in this paper also includes data regarding recent catches, escapements, and hatchery releases; MSC certification (certification status, outstanding MSC conditions if the fishery is certified); fishery improvement projects (FIPs); and recommendations on how fisheries can improve their scores.

3   RESULTS

The results are presented in Excel workbook format in the Data Annex with the following included spreadsheets:

"Fully-Scored Profiles" – Provides numeric scores for 40 district fishery profiles and 13 regional umbrella profiles that summarize results for nested district fishery profiles. Scores for nested sub-criteria are in hidden columns. For each fishery, average catch volume in the two most recent years for which data is available (using an average balances for stocks with 2-year abundance cycles), gear type, FIP status, and recommended improvements are indicated, as are the MSC status of the fishery and the number of outstanding conditions that need to be fulfilled.

"Quick-Scored Profiles" – Provides qualitative scores for 42 district fishery profiles, as well as all fields in the "Fully-Scored Profiles" spreadsheet with the exception of recommended improvements.

"Volume and category analysis <u>by region</u>" – A single pie chart (Figure 3 in this document) that indicates proportions and volumes of A, B, and C scores in Alaska, British Columbia, Japan, Pacific Northwest US, and Russia (species are aggregated).

"Volume and category analysis <u>by species & region</u>" – Five bar graphs, one per species, indicate regions' contributions to harvest volume of particular species that were scored as Category A, B, and C (Figure 4).

"Harvest trends" – Linear graphs indicate recent harvest trends for each species, encompassing both the 82 salmon fisheries currently included in FishSource and those that are not. The upper trendline indicates total, Pacific-wide harvest, while the other trendlines indicate contributing harvest in a particular region (Alaska, British Columbia, Japan, Pacific Northwest US, and Russia) during 1997–2013 (Figure 1).

"Hatchery trends" – Five linear graphs (one per species) represent 1997–2013 hatchery releases from both the 82 salmon fisheries currently included in FishSource and those that are not. The upper trendline indicates total, Pacific-wide harvest, while the other trendlines indicate contributing releases from a particular region (Alaska, British Columbia, Japan, Pacific Northwest US, and Russia) (Figure 2).

"MSC information" (2 sheets) – Two bar graphs summarize MSC engagement of both the 82 salmon fisheries currently included in FishSource and those that are not. The first bar graph indicates the proportion of total global harvest of each species that is MSC certified, in MSC full assessment, and neither certified nor in full assessment (Figure 14). The second bar graph indicates the proportions of open and resolved conditions for each MSC-certified salmon fishery (Figure 15). Two additional tables compare fishery MSC engagement and performance between 2013 and 2014 (Tables 5 and 6).

"Stock trends" – Harvest and escapement trends for 421 stocks that were used in generating Figures 5–12, as well as a key to stock abbreviations.

3.1 Overview of fishery management quality and stock status

Overall, the main results from the current assessment of the 82 salmon fisheries, in terms of management quality and stock status, are as follows:

52% of the total volume of Pacific salmon included in our analysis comes from 56 fisheries that are in very good (Category A—22 fisheries) or reasonable (Category B—34 fisheries) condition. This includes 99% of coho, 87% of sockeye, 60% of pink, 48% of Chinook, and 23% of chum salmon global harvest.

48% of the total volume of Pacific salmon included in our analysis comes from 26 fisheries that are poorly managed (Category C). **22%** of this volume is accounted for by Russian fisheries with illegal fishing issues; **13%** by Japanese chum fisheries with hatchery issues; and **10%** by Prince William Sound, Alaska, fisheries with hatchery issues.

74% of Alaskan salmon harvest volume comes from 33 fisheries that are in very good (48%) or reasonable (26%) condition. Prince William Sound fisheries for pink, chum, and sockeye salmon account for the other 26%, which is rated as Category C due to hatchery impacts.

95% of British Columbia salmon harvest volume comes from 13 fisheries that are in very good (6%) or reasonable (89%) condition. One fishery accounting for 5% of regional catch volume, the West Coast Vancouver Island Chinook troll fishery, was rated Category C due to repeatedly exceeding the catch limit.

47% of Russian salmon harvest volume comes from 10 fisheries that are in very good (<0.1%) or reasonable (47%) condition. 16 Category C fisheries account for the other 53% of Russian harvest volume. Eight of these fisheries have problems (scores of <6) with illegal, unregulated, and unreported (IUU) fishing; five were classified as Category C fisheries due to stock status issues; four due to absence of adequate stock identification programs in offshore fisheries; and two due to hatchery impacts (likely high straying of hatchery fish into wild spawning habitat or absence of adequate monitoring).

All of Japanese chum salmon harvest is classified as Category C due to hatchery impacts on wild stocks.

Of the **Pacific Northwest US** fisheries, only the troll component targeting coho and Chinook salmon, which accounts for 20% of regional salmon harvest, has been rated. These two fisheries are rated **Category C** due to stock status issues in both fisheries, as well as undue influence of hatchery fish in determining catch limits in the Chinook fishery.

Since the summer of 2013, some North American fisheries have shifted between Categories A and B, but no fisheries moved into or out of Category C during the last calendar year (Table 2).

Table 2: Changes in percentage volumes of harvest (average of the latest 2 years for which data are available) and number of fisheries among the three ranking categories, A – C, between the 2013 and 2014 reporting periods.

Evaluation category	Evaluation category scores	Percentage of catch / no. of fisheries in 2014 report	Percentage of catch / no. of fisheries in 2013 report	Change, 2013–2014	Notable Movers (fisheries)
A	All scores ≥ 8	19% / 22	21% / 20	- 2% / + 2 fisheries	**1. Westward Alaska sockeye** (B to A): completed WASSIP stock identification study. **2. Annette Island Chinook** (B to A): conducted tagging studies to determine hatchery contribution to harvest & escapement. **3. Barkley Sound B.C. sockeye salmon** (B to A): Improvements were made to escapement monitoring and stock identification methods.
B	All scores ≥ 6	32% / 34	30% / 36	+2% / - 2 fisheries	
C	One or more scores < 6	49% / 26	49% / 25	no change in vol. / + 1 fishery (newly scored)	----------------- **1. Westward Alaska pink** (A to B): MSC condition assigned—need to assess hatchery impacts on wild fish.

Ranking results aggregated by region and by species into pie charts (Figures 3 and 4) provide a visual illustration of the statistics above and indicate the geography and species-specific nature of existing sustainability issues in the sector. Chum and Chinook salmon fisheries face the greatest challenges, with over half of global harvest volume of each species accounted for by Category C fisheries. On the other end of the spectrum, over 85% of global sockeye salmon harvest comes from good or reasonably managed fisheries.

As part of the process of ranking fisheries, escapement and harvest trends over the last 15 years for individual stocks were assessed and factored into analysis of Score 4. Aggregation of these results by region and species illustrates how stock status varies considerably with respect to these two variables (Figures 5–12).
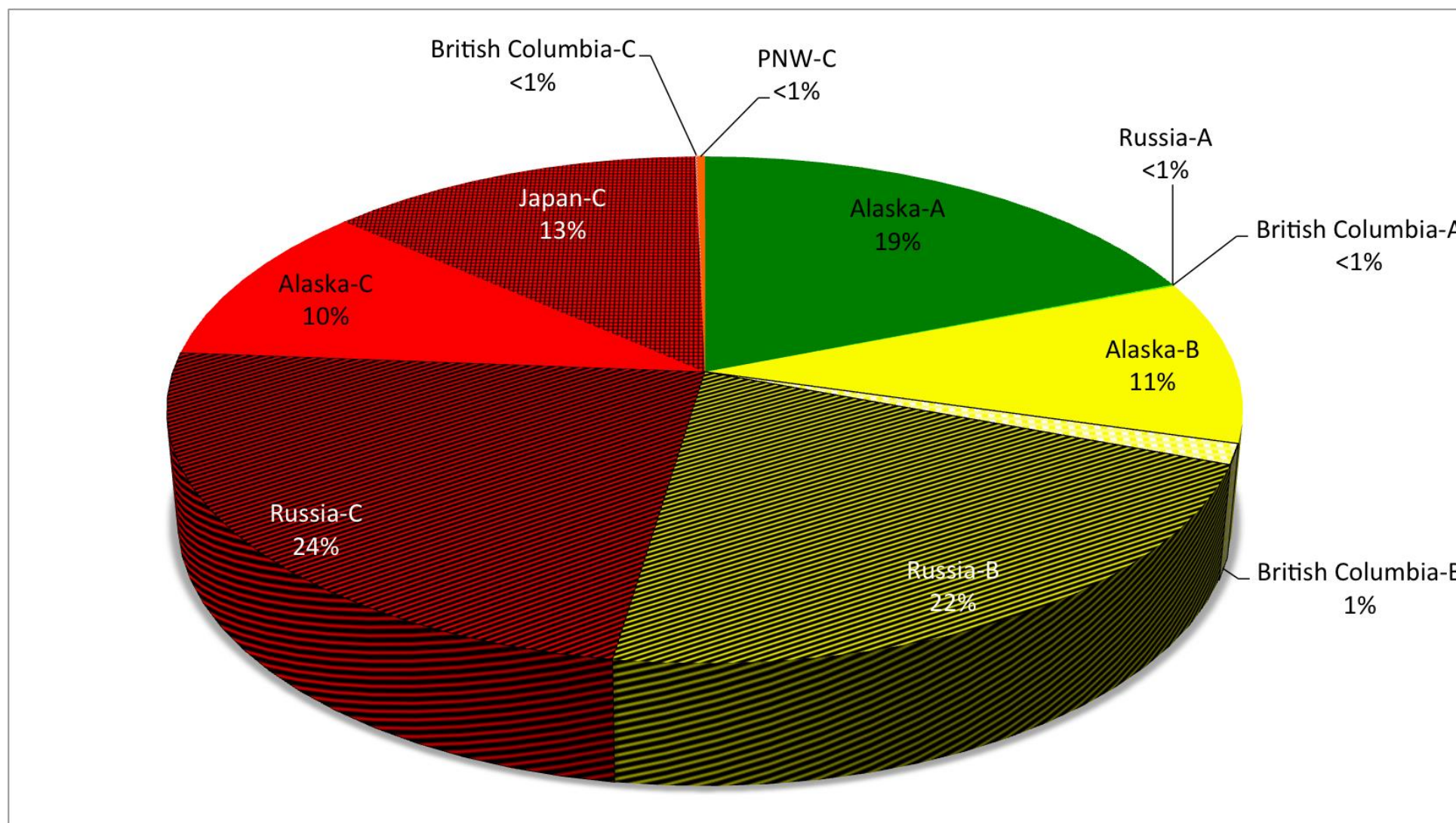
Figure 3: Ranking results aggregated by category and region. A little over half of global wild salmon supply in 2012 and 2013 (average of the two seasons) comes from fisheries that are well or reasonably managed, as indicated by the predominance of green- and yellow-shaded sections of this pie chart.
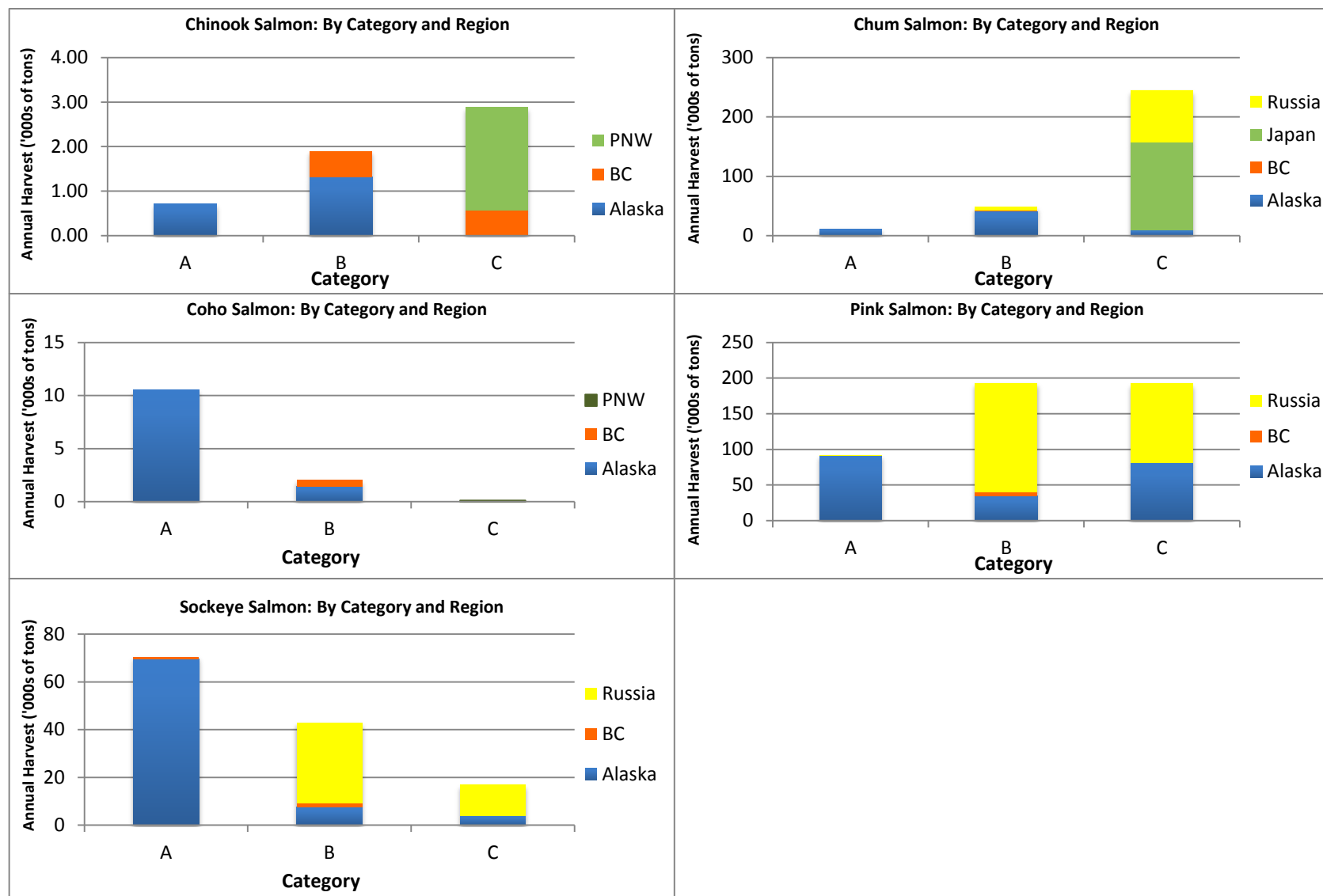
Figure 4: Ranking results aggregated by category and region. Chinook and chum salmon fisheries face greater sustainability challenges (a greater proportion of their volumes is accounted for by Category C fisheries) compared particularly with sockeye salmon (greater proportion of Category A volume).
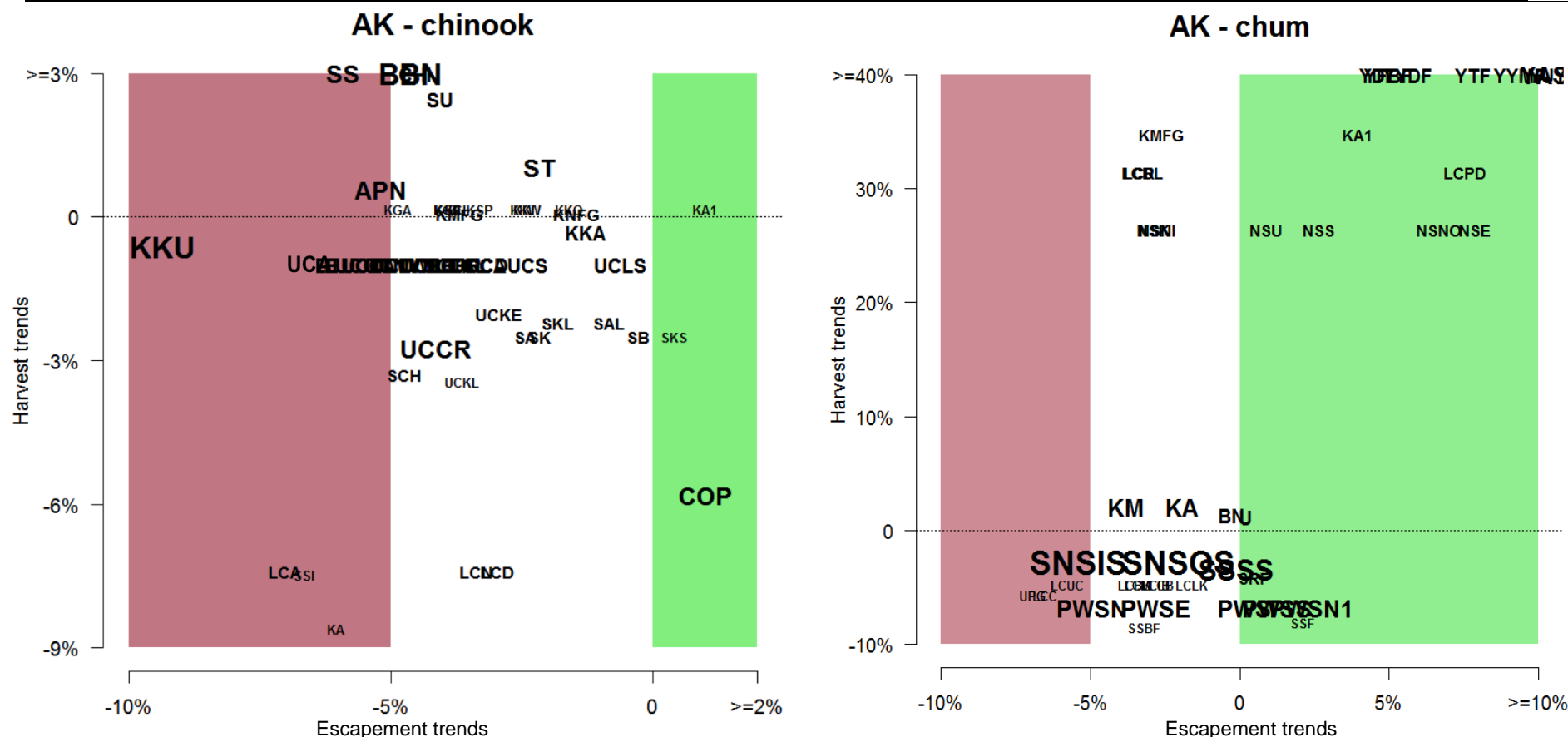
Figures 5 and 6: Adapted Kobe plots indicate annual escapement (x-axis) and harvest (y-axis) trends for Alaska Chinook (left) and Alaska chum (right) salmon stocks over the last 15 years, expressed as a percent-of-year-zero using a robust regression method described by Geiger and Zhang (2002). Geiger and Zhang recommended a threshold of 5% annual declines for triggering stock-of-concern status, indicated in red. Stocks are represented by 3–4 letter abbreviations listed in the Data Annex, with font size illustrating relative harvest (note: blurred text indicates multiple stocks superimposed upon one another). As illustrated by the Chinook plot, most Alaskan Chinook stocks are currently exhibiting declining escapement trends but not exceeding the 5% threshold, as well as ≤3% annual declines in harvest. Notable among the larger stocks, escapements of Kuskokwim Chinook salmon (KKU) have declined by over 9% annually since 1998, while the Nushagak, Bristol Bay stock (BBN) is close to the 5% escapement decline threshold, although harvest has increased simultaneously. Meanwhile, among Alaskan chum salmon, many of the larger, southern stocks, which are targeted by largely hatchery-supported fisheries in Southeast Alaska and Prince William Sound, have exhibited ≤5% annual declines in escapement and comparable declines in harvest. Meanwhile, a second grouping of smaller stocks located in central and northern regions of the state has exhibited increases in harvest and escapement. In the case of Norton Sound, this is indicative of a possible recovery trend following sharp declines in the early 1990s.

AK - coho

AK - pink

Figures 7 and 8: Adapted Kobe plots for Alaska coho (left) and Alaska pink (right) salmon stocks over the last 15 years. In the case of pink salmon stocks with separate goals for even- and odd-year broodlines, escapement and harvest trends were calculated for 12 returns of a particular broodline, or a 24-year series. Coho salmon currently exhibit a mix of trends, with few stocks exceeding the 5% escapement decline threshold. Meanwhile, pink salmon stocks are more tightly bunched with a predominance of stocks exhibiting stable harvests and slightly declining escapements. The pink salmon plot includes stocks in the Prince William Sound fishery, where the impact of hatchery fish upon wild stocks has been hotly debated. Notably, most (12 of 16) Prince Wiliiam Sound stocks (district-broodyear combinations) currently exhibit positive trends in escapement, and harvest of wild fish has increased dramatically in odd years while exhibiting moderate (2.5%) declines in even years. The inclusion of hatchery fish in escapement counts may result in overestimation of the estimates for this region.

Figures 9 and 10: Adapted Kobe plots for stocks of Alaska sockeye salmon (left) and five species of British Columbia salmon (right) over the last 15 years. In the case of pink salmon stocks with separate goals for even- and odd-year broodlines, escapement and harvest trends were calculated for 12 returns of a particular broodline, or a 24-year series. Alaskan sockeye salmon stocks are fairly bunched, with most stocks exhibiting stable escapement and harvest trends. Among sockeye salmon stocks in the "red zone" for escapement, most are located in Kodiak. A predominance of British Columbia stocks, meanwhile, exhibit declining harvest (~5%) and escapement (~4%) trends. There are some prominent exceptions, most notably Area 6 odd-year pink salmon (P6O) in the right-hand corner of the plot. However, the rising harvest of this stock has been associated with undesirable bycatch of troubled Area 6 chum salmon (C6, grouped in the blur of overlaid stocks), which has exhibited >6% declines in harvest and escapement.
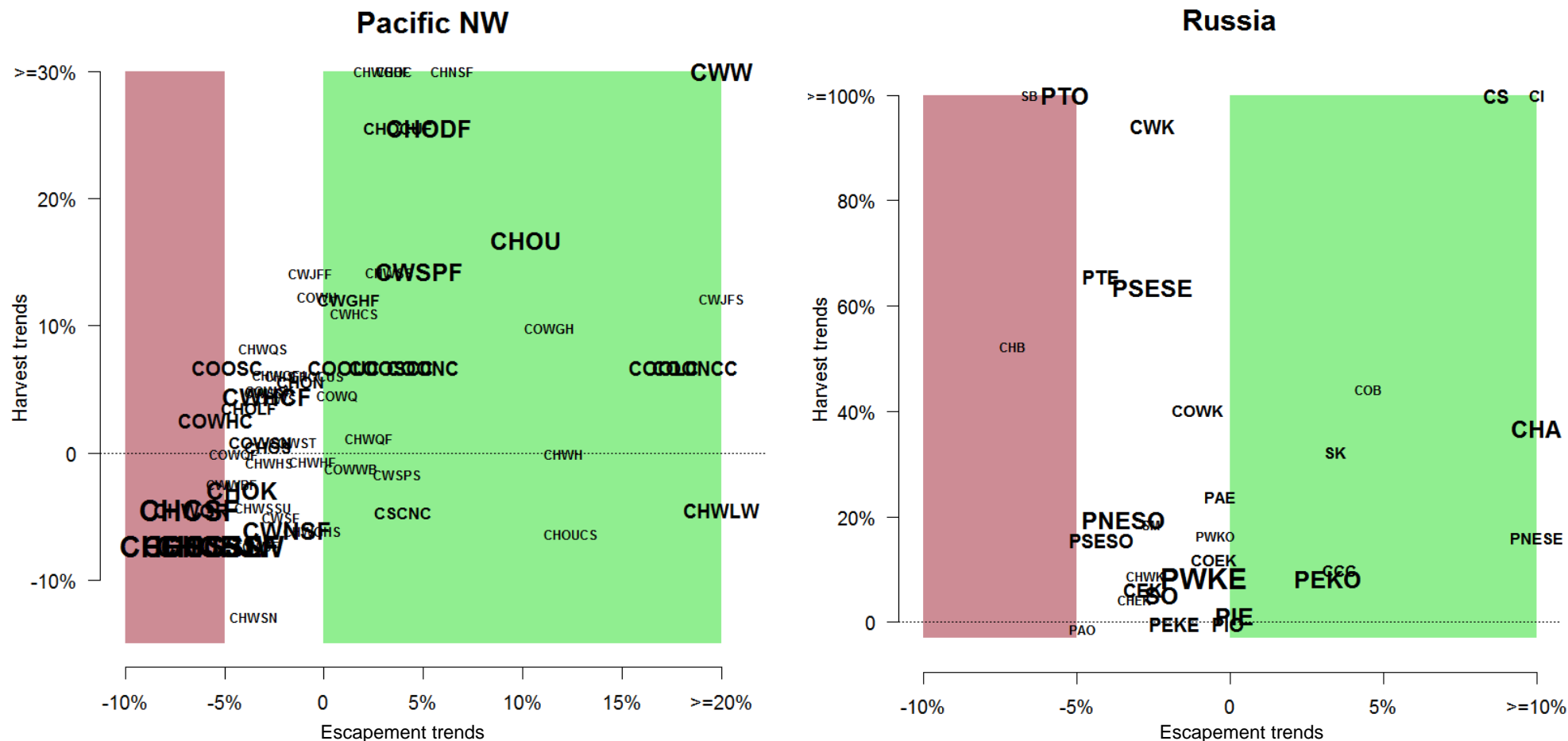
Figures 11 and 12: Adapted Kobe plots for Pacific Northwest US Chinook, chum, and coho salmon stocks (left) and five species of Russian salmon over the last 15 years. In the case of Russian pink salmon stocks with clearly discrete even- and odd-year trends, escapement and harvest trends were calculated for 12 returns of a particular broodline, or a 24-year series. The majority of Pacific Northwest stocks exhibit declining escapements, with meaningful (>5%) declines among Chinook stocks in California and Oregon. Russia, meanwhile, presents a stark contrast, with almost all stocks exhibiting harvest increases. A preponderance of Russian stocks exhibits slight or moderate (<5%) declines in escapement; prominent exceptions are Chinook and sockeye stocks of the Bolshaya River (CHB and SB), where declines in escapement exceed the 5% threshold, yet harvest is increasing. Problems with poaching in this basin are well recognized. Meanwhile, escapements of odd-year Terpeniya Bay Sakhalin pink salmon (PTO) have also declined by over 5% in recent years, although there is not a recognized problem here and escapement estimate accuracy may not be reliable.

3.2 Highlighted management issues

This section summarizes priority, cross-sector sustainability issues and conclusions drawn from our review of relevant fisheries.

3.2.1   Illegal fishing

Eight of 26 Russian fisheries included in this sector report received scores of <6 for illegal, unreported, and unregulated (IUU) fishing, meaning that illegal fishing exceeds the legal catch by more than 25%.[3] These fisheries comprise 31% of total Russian salmon harvest. Efforts to limit illegal harvest in the Russian salmon fishery would greatly improve the fishery's ranking and sector performance as a whole.

Traceability systems that allow for the tracking of seafood from fishing area to destination retailer have the potential to curb illegal fishing in Russia. Presently, international buyers of Russian salmon can request certificates that verify the legality of catch, referred to as "certificates of catch origin," from those local producers and suppliers that have Chinese or European Union (EU) registration numbers (i.e., companies allowed to export their products to China or the EU). Use of the certificates, which are issued by Russian Federal Fisheries Agency local branches, is rising due to the EU's 2010 IUU Regulation and the December 2012 China-Russia bilateral IUU agreement (see below), both of which include relevant regulations. However, according to industry sources, Russian producers and suppliers that operate legally and sell their harvest domestically, or to countries other than China and the EU, cannot obtain these certificates and provide them to buyers at their request. Furthermore, exporters to the EU and to China may still face problems when trying to obtain certificates due to conflicting interpretations of documentation requirements among Federal Fisheries Agency local branches. For example, it is unclear whether or not different certificates are required for export to China and to the EU, meaning that some shipments (salmon to be processed in China and then re-exported to the EU) may require two certificates rather than one, an additional headache for local companies.

Despite these problems with catch documentation, the increasing use of certificates of catch origin in the trade of Russian salmon is a promising development. As Russia presently exports approximately 20% of its pink and chum salmon production to China, the bilateral IUU agreement between the two countries (Fishnews 2012), for which implementation began in earnest in 2014, has particularly motivated recent activity with respect to catch documentation. Similar bilateral agreements with other trade partners have potential to be equally influential:

-    In September 2012, Russia and Japan signed a bilateral agreement describing cooperation in

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[3] Generally there are few estimates of illegal fishing volumes in Russia, and even fewer that have been published in the last 5 years since major management reforms (long-term leases to fishing plots, elimination of quota-based management in favor of escapement-based management) were enacted on Kamchatka and Sakhalin. One recent publication does indicate that, due to the management reforms, illegal fishing volumes on Kamchatka have dropped from 30–50% of legal catch in 1990–2008 to 8–15% in 2009–2012 (Shevlyakov 2013b). The article, however, does not provide data specific to particular species or regions, such as the three Kamchatka fisheries that received <6 scores due to illegal fishing (West Kamchatka chum, East Kamchatka chum, and West Kamchatka sockeye). In light of this and recent reports in popular media indicating that poaching continues to be a major problem on Kamchatka (Kamchatka-Inform 2014), FishSource scores have not been changed on the basis of Shevlyakov's report.

preventing IUU fishing. Included in the agreement is a requirement that every shipment of fish products originating in Russia and delivered to Japan be accompanied with a certificate of catch origin (Fishnews 2014a). Implementation of this agreement has not yet been initiated, while a similar agreement with Korea has already entered into force. The requirement to attach certificates to all seafood exports could limit shipments of illegally harvested sockeye salmon into Japan, which imports approximately 75% of Russian harvest of the species. However, unlike the China-Russia agreement, the agreements with Japan and Korea do not include specific reference to salmon. The Japanese agreement particularly focuses upon crab. None of the agreements (with China, Japan, and Korea) include a sample certificate of catch origin.

- Bilateral negotiations are underway between Russia and the United States on a similar agreement (but presumably are paused due to American economic sanctions against Russia). The US Congress is also considering at least two pieces of legislation related to combatting IUU fishing.

Meanwhile, the EU's IUU Regulation also plays a role in discouraging trade of IUU salmon, as some of the product processed in China is re-exported to Europe. The Regulation represents the only wide-ranging legal provenance traceability requirement applied by a national authority to almost all wild-caught fish imports. Russia and China have taken steps to comply with the Regulation with respect to salmon; for example, Chinese authorities now verify Russian certificates of catch origin attached to shipments intended for the EU, and also issue re-export certificates for these shipments. However, a recent study identified existing loopholes in the EU legislation that continue to allow for entry of illegally harvested fish into the export supply chain (Clarke and Hosch 2013):

- Certificates of catch origin are generally issued after shipments have left Russia, and the temporal and spatial gap between the harvest of the fish and the beginning of traceability proceedings leaves room for falsification.
- Shipments can be split into separate lots without adequate tracking of the quantities of fish in each lot.
- There is no requirement to validate processing yields (the new weight of the fish after processing) when issuing re-export certificates for processed fish.
- There is no requirement to maintain batch integrity for traded shipments (mixing of fish from various sources occurs).
- There is no requirement to publish performance data indicating the effectiveness of the IUU Regulation.

Developments in catch documentation described above could limit illegal salmon harvest in Russia, although they are unlikely to completely eliminate the problem because they currently address only internationally traded products. The majority of the Russian salmon harvest remains in the domestic market. Demand for salmon roe, a higher-value commodity than flesh, is particularly heavily weighted to the domestic rather than international market. On the domestic front, the following update is noted:

- In December 2013, Russia formally adopted a National Plan of Actions to Prevent, Deter, and Eliminate IUU Fishing (NPOA-IUU). It is expected that adoption of the plan will ease the process

of amending other Russian legislation regarding illegal fishing, and also facilitate speedier implementation of the aforementioned bilateral agreements (Russian Federation 2013). In February 2014, the NPOA-IUU underwent further development with the adoption of a list of changes to the current domestic legislation required for effective implementation of the Plan (Rossiskaya Gazeta 2013).

3.2.2   Hatcheries

Hatcheries, where fish are bred and reared in captivity before release into the wild, have been used in various salmon fisheries throughout the North Pacific over the last 150 years as a means of supplementing harvest or recovering declining populations. A growing body of research indicates that unsustainable hatchery practices can result in the loss of adaptive genetic variation in wild stocks, the spread of diseases and parasites, fishery management's loss of control of wild-stock harvest rates, and unwanted ecological interactions between hatchery fish and other fishes (reviewed in Naish et al. 2008 and Rand et al. 2012). While the science varies according to geography, species studied, method used, and other variables, all of these potential problems have either been observed in experimental conditions or in nature. Furthermore, a new area of research explores the hypothesis that too many hatchery releases could stretch nutrient resources and initiate trophic cascades in the ocean. A recently published article linking the 2-year abundance cycle of pink salmon to population dynamics in seabirds, a species group not thought to directly interact with pink salmon in the ocean, indicates that the sphere of influence of salmon in the ocean is wider than previously considered (Springer and van Vliet 2014).

In response to best available science, the FishSource salmon method devotes a score and five nested sub-scores to hatchery impacts (Table 1). Other organizations in the sustainable fisheries sphere are also adapting their assessment methods to address the issue (notably, Marine Stewardship Council and Monterey Bay Aquarium). The adapted methods paint a picture of sustainable integration of hatchery programs into wild stock fisheries in which hatchery fish are identifiable and interactions with wild fish are tracked, straying of hatchery fish into wild spawning grounds is minimized, and wild stock harvest rates are controllable and not overly influenced by hatchery fish. Perhaps most importantly, there is science-based oversight and evaluation of hatchery programs.

A survey of the 53 fisheries with hatchery programs that are included in this sector report indicates that the majority of these fisheries (41 of 53, or 77%) are managing hatchery impacts well or reasonably (Table 3). A correlation between the scale of the hatchery program (the percent contribution of hatcheries to total fishery harvest) and rankings is visible—fisheries scored at ≥8 averaged 16% hatchery-origin proportion of harvest, while <6 fisheries averaged 66%. This is not unexpected, as wild stock harvest rates become more difficult to control and straying becomes more difficult to limit as the hatchery contribution to harvest increases. A closer examination of fisheries receiving scores of <6 revealed that most of these scores can be explained by absence of mark-and-recapture monitoring programs, demonstrated failure to manage for wild stocks amidst high hatchery contributions, high stray rates, or absence of straying studies (Table 4).

Two fisheries with large (>50%) hatchery contributions to harvest, the Prince William Sound Alaska and Iturup Island Russia fisheries, notably have invested in hatchery impacts monitoring over the

past several years. The Iturup Island fishery has initiated a mass marking and fishery recovery program at local hatcheries and straying studies, while the Prince William Sound fishery is conducting a joint state-, hatchery-, and processor-funded, multi-year study of interactions between

Table 3: A survey of FishSource scoring of the 53 fisheries included in this sector report that have hatcheries. Results indicate that most (77%) of these fisheries are well or reasonably managed with respect to hatchery impacts. A correlation between rankings and the proportion of fishery harvest comprised by hatchery fish was noted—when hatcheries contribute more to harvest, fisheries tend to score lower. In the case of Alaska's four fisheries rated <6, three of the four are located in Prince William Sound (targeting pink, chum, and sockeye salmon, respectively), and one, which targets sockeye salmon and accounts for insignificant harvest volumes, is located in the Annette Island Reservation.

Score on Hatchery Criterion (#5)	Average % Contribution of Hatcheries to Harvest	No. of Fisheries					
		Alaska	Russia	Japan	B.C.	PNW	Total
≥ 8	16%	9	6	-	6	-	21
≥ 6	37%	8	7	-	4	1	20
< 6	66%	4	4	3	-	1	12

Table 4: Frequency of occurrence of various rationales for failing scores among the 12 fisheries receiving scores of <6 for hatchery impacts (Score 5). Note: some fisheries had more than one problem and received more than one score of <6 on nested sub-criteria within Score 5, resulting in more than 12 occurrences of <6 scores.

Problem	No. of Occurrences of <6 Scores				
	Alaska	Russia	Japan	PNW	Total
No mark-and-recapture program demonstrating temporal and spatial separation of hatchery and wild fish, or there is evidence indicating that efforts to manage wild stocks are not succeeding.	3	1	3	-	**7**
Studies indicate high stray rates (e.g., >10% in some cases), or studies have not been conducted, but meaningful stray rates are likely.	3	4	3	-	**10**
Hatchery run strength predominantly determines the fishery's catch limit.	-	-	-	1	**1**
Hatchery-wild mixing commonly occurs among target stocks in the fishery, reflected by the siting of hatcheries or release sites at wild stock run locations.	-	-	-	-	**0**
Management objectives for wild stocks, management oversight over hatchery programs, and/or hatchery evaluation systems either do not exist or are frequently ignored.	3	-	3	-	**6**

wild and hatchery fish and their comparative fitness[4] (ADFG 2012; SCS 2014). However, while

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[4] Alaska Department of Fish and Game scientists have identified concerns regarding the study design of the hatchery-wild comparative fitness study—for example, planned sample sizes for the collection of genetic samples in Prince William Sound will only allow for detection of a ≥80% difference in the productivity of wild and hatchery fish, meaning that sizeable differences in productivity below 80% could go undetected (Shedd 2014). The Department is planning to publish a series of technical reports describing how these concerns are being addressed.

carrying out this research, both fisheries have simultaneously raised hatchery release quantities, with Iturup starting chum salmon production at two new hatcheries since 2011, while the Solomon Gulch hatchery in Prince William Sound successfully applied for a 40-million-egg capacity increase in 2014, potentially increasing district pink salmon hatchery releases by 5.5% in 2016–2018, during which time the increases are slated to occur in two increments (ADFG 2014b; SCS 2014). Continuing the trend of increasing production draws into question the integrity and the reliability of monitoring efforts, and whether or not study results will prompt appropriate response from the respective management agencies.[5]

3.2.3   Harvest control practices for depleted stocks

British Columbia's ongoing initiative to establish biologically-based *Lower Evaluation Benchmarks* for 457 salmon population units (*Conservation Units*) under the *Wild Salmon Policy* has raised the topic of appropriate reference point setting approaches in salmon fisheries—at what scale should stocks be delineated, and should limit reference (stop fishing) points be set in addition to target reference points? These questions are particularly important when stocks are depleted. A review of management practices from around the North Pacific indicated that population units for salmon fishery management purposes (*stocks*) generally encompass the part of a fish population that is under consideration from the point of view of actual or potential utilization. These units balance biology with practicality, and may group one or more genetically distinct groupings of fish. When *stocks* are in a detectably perilous state, however, it is considered best practice to delineate finer, sub-stock units for conservation purposes and set management objectives for these units (i.e., B.C.'s *Conservation Units* or the Pacific Northwest's *Evolutionarily Significant Units*) (Portley and Geiger 2014a).

As for reference point setting, the main salmon management jurisdictions of Alaska and Russia do not use limit reference points at this time. Alaska uses temporal rules (i.e., a number of years with stock size below the target reference point) to trigger regulatory stock-of-concern status and conservation measures including harvest reductions. Meanwhile, the Pacific Northwest US states have enacted limit reference points in order to comply with the Magnuson-Stevens Act's imperative to define overfishing. British Columbia appears to be striking a middle ground with its Lower Evaluation Benchmarks intended to inform but not directly limit harvest (Portley and Geiger 2014b).

While we acknowledge that Alaska' temporal approach is reasonable, we voice our support for management authorities that are working toward straightforward approaches to defining overfishing and regulatory stock-of-concern status. As part of its certification of B.C. salmon fisheries and associated audits, Marine Stewardship Council (MSC) has been tracking progress toward implementation of Lower Evaluation Benchmarks in B.C., particularly in the Skeena and Fraser sockeye salmon fisheries. Progress over the last year in these fisheries is visible as the fishery has closed several of its MSC conditions (see Section 3.4 below), but the extent to which Limit Evaluation Benchmarks will inform harvest management down the road in these fisheries is still unclear.

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[5] Existing research indicates that Solomon Gulch-produced hatchery fish stray less than those released by the other three hatcheries in Prince William Sound that produce pink salmon (Brenner et al. 2012). Therefore, the release increase at this facility likely poses less of a problem for the ongoing research effort than would an increase at one of the other hatcheries.

3.2.4   Offshore fishery management

The Alaskan, British Columbia, and Pacific Northwest troll fisheries accounted for over half of Chinook salmon commercial harvest in these regions in 2012–2013. Over this period of time, volatility in returns up and down the continental coast was apparent, with State of Emergency declarations issued in two regions of Alaska due to poor Chinook returns in 2012, but also record 2013 returns to the Columbia River in the Pacific Northwest (Dischner 2012; PFMC 2014). Instability in the status of this most iconic of the salmon species highlights the need for sustainable management of offshore salmon fisheries.

Because they occur in open rather than coastal waters and cannot be regulated in real time to achieve spawning escapement goals in rivers, salmon offshore fisheries are predominantly managed with preseason regulations. They also target a mixed-stock aggregate of fish that spawns in multiple rivers, regions, or even countries. In light of these specificities of offshore fisheries, FishSource applies a slightly modified set of criteria to their assessment, establishing that a sustainably managed offshore salmon fishery, in addition to the regular guidelines for sustainable salmon fishery management, (1) does not exceed catch limits in multiple consecutive seasons (cumulative error) and corrects for overages and underages in subsequent seasons; (2) tracks the stock composition of the fishery through ongoing stock identification studies; and (3) prioritizes wild stock rather than hatchery stock status in setting the catch limit.

Our analysis of 10 offshore fisheries indicates that these fisheries account for a minority (3%) share of total North Pacific salmon harvest, with an average cumulative annual harvest of 30,000 metric tons in 2012–2013. The Russian and Japanese offshore driftnet fisheries in the Russian EEZ account for over half of this volume. 37.5% of offshore volume comes from Category B fisheries located in Alaska and British Columbia. The remainder comes from Category C fisheries (Figure 13). The following sustainability challenges were noted in our assessments (FishSource 2014):

- There are no ongoing genetic- or tag-based stock identification studies associated with the offshore driftnet fisheries in the Russian EEZ, which have been implicated in declining abundance of Kamchatkan Chinook salmon, particularly that of the Bolshaya River (Vakhrin 2014).

- The West Coast Vancouver Island Chinook troll fishery in British Columbia has exceeded its post-season allowable catch limit 8 times in a 13-year period (1999–2011).

- Mark-selective fisheries (MSFs)[6] in the Pacific Northwest US are continuing to expand with little understanding of their likely long-term effects. The advent of the mark-selective fishing era has provided harvest opportunities, primarily for recreational fishers targeting Chinook and coho salmon in the state of Washington, which would otherwise be constrained or prohibited due to conservation requirements. At the same time, MSF practices have conflicted with the long-established, coastwide coded-wire tag stock assessment program upon which offshore fisheries

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[6] In mark-selective fisheries (MSF), instead of or in addition to marking hatchery fish with coded wire tags, adipose fins are clipped so that the hatchery fish are readily recognizable. MSF management regimes generally aim to maximize harvest of hatchery fish and minimize harvest of wild fish.
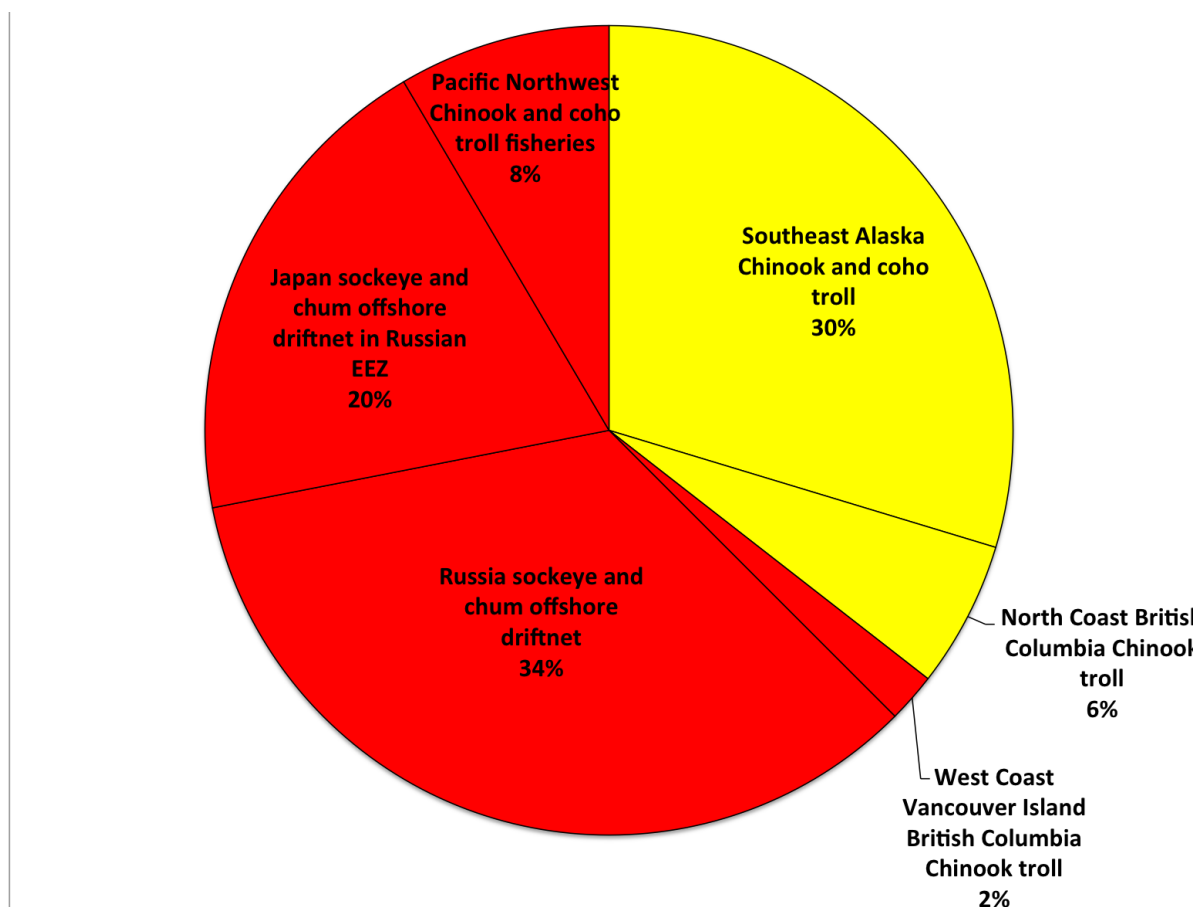
Figure 13: FishSource rankings for 10 offshore fisheries that account for 30,000 metric tons of annual harvest. A little over a third of these fisheries are ranked Category B (yellow), with the remainder in Category C (red).

are reliant for effective management. Managers have adapted to these challenges such that impacts are presently tolerable. However, further expansion of these fisheries accompanied by increasingly complex, uncoordinated, and variable management practices could disrupt region-wide stock assessment programs to the point where there is a detrimental loss of data integrity and ability to manage and monitor wild stocks effectively. Meanwhile, efforts to validate costs and benefits of MSFs with respect to wild stock conservation and harvest opportunities (e.g., Pyper et al. 2012) should be continued.

3.3 Mining

While not implicated in any Category C ratings of salmon fisheries in FishSource, and therefore not included among the priority sustainability issues described in Section 3.2, mining and associated habitat impacts can result in devastation of salmon runs and associated fisheries. The mining industry in Alaska receded throughout much of the twentieth century after a burst of activity in the early 1900s associated with the gold rush and the Alaska railroad. However, it is now once again a growth industry, with planned and ongoing mining projects in many key salmon habitat zones, including Bristol Bay, the Matanuska-Susitna basin of Cook Inlet, and the transboundary Southeast region (Northern British Columbia). There are also mining operations under way within British

Columbia's iconic Fraser River basin and major salmon-producing regions of Russia, including Sakhalin, Kamchatka, and Chukotka.

In early 2014, an important milestone in the decade-long battle over plans to build the world's largest gold and copper mine in Bristol Bay, Alaska (the "Pebble Mine"), was achieved with the release of the Environmental Protection Agency's (EPA's) final draft of its Bristol Bay Watershed Assessment. The report details likely impacts of the mine's construction and operation on the district's sockeye salmon runs, including irreversible loss of spawning and rearing habitat due to release of dredged material into streams, altered stream flows resulting from water withdrawal, and risk of catastrophic wastewater spill. In the report, the EPA invokes its authority under the Clean Water Act to place restrictions on the allowable amounts of stream, wetland, lake, and pond losses, as well as streamflow alterations, associated with the project (EPA 2014). For the time being, these restrictions, under public review throughout the summer of 2014, are preventing the project from going forward. However, the Pebble Partnership, the mining industry consortium to whom the mining claims belong, has vowed to continue fighting for the right to carry out the project, suing the EPA in May. In an interesting related development, Alaska Governor Sean Parnell named a Pebble Partnership spokesman as his fisheries advisor in August 2014.

Meanwhile, in late July 2014, a tailings pond dam failure at the Mount Polley open-pit copper and gold mine in the Quesnel portion of the Fraser River basin in British Columbia resulted in the release of millions of cubic meters of slurry and debris into salmon-bearing streams. After the spill, Department of Fisheries and Oceans Canada expressed the opinion that the wastes would settle before the annual Fraser River sockeye salmon runs achieved the Quesnel basin, limiting impacts upon the fish (Undercurrent News 2014d).

Finally, several mining projects in various stages of exploration and exploitation in the transboundary BC-Alaska region have raised concerns regarding potential impacts to Chinook salmon runs in the Unuk, Taku, and Stikine basins. These projects are coinciding with declines in Chinook salmon abundance along much of the North American coastline. As the region is transboundary, both Canadian and American environmental legislation is important in potentially limiting negative impacts to wild salmon. It is noted that the current version of the Canadian National Environmental Policy Act does not include a level of review of development projects equivalent to Environmental Impact Studies required under US law.

In addition to mining, other current environmental threats to salmon include dams (the proposed Susitna Dam project in Alaska is of concern with respect to declining Chinook populations), pipelines (the proposed Enbridge pipeline from Alberta to British Columbia would cross the Fraser and Skeena river basins), ocean acidification, and climate change.

3.4 MSC and fishery improvement project (FIP) information

Over half of the global wild salmon supply (50.3%) is engaged in the MSC program, a 4% increase in improvement activity over the last calendar year (Table 5). Engagement varies by species (Figure 14). The increased improvement activity in the salmon sector is accounted for by engagement of the Narody Severa-Bolsheretsk component of the West Kamchatka Russia salmon fishery in full MSC assessment. The sector's improvement would be negated, however, if the Prince William Sound

Alaska pink and chum salmon fishery fails to pass full MSC assessment. During the 2013 MSC re-assessment of the Alaska salmon fishery, the Prince William Sound unit was separated from the rest of the fishery into an independent unit on a slower assessment schedule (the public comment draft report is expected in the fall of 2015).

**Table 5**: Comparative engagement of the salmon regions in the MSC process and FIPs, 2013 and 2014. Increased Russian engagement in improvement processes has resulted in 4% more of global volume (metric tons, average of two seasons) entering the market from MSC fisheries in 2014. The quantity of FIPs is indicated in parentheses. The asterisk indicates the Narody Severa-Bolsheretsk FIP—no volume is indicated because the fishery is engaged in both a FIP and MSC full assessment, and the volume was counted toward MSC full assessment.

	Alaska		Russia		Japan		B.C.		PNW		Total	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
MSC Certified	345.4	280.1	45.3	74.8	-	-	18.3	10.2	-	-	409	365.1
MSC Full Assessment	1.8	93.4	2.7	16.4	12.6	0	0.8	1.1	-	-	17.8	110.9
FIP	-	-	0.1 (1)	0 (1)*	-	-	-	-	-	-	0.1	0
Not Engaged	0.05	0.03	372.92	313.4	96.7	128.3	2.3	2.4	10.2	12.6	482.2	456.8
% Change in engagement	no new fishery engagement		(+) 11%		(-) 11%		no new fishery engagement		no new fishery engagement		(+) 4%	

We could not attribute additional global salmon harvest volume to improvement processes other than the MSC program, including fishery improvement projects (FIPs), at the time of authorship of this report. A World Wildlife Fund-led FIP on the Tugur River in the Amur region has stalled this year. Meanwhile, the Narody Severa-Bolsheretsk fishery's improvement efforts are advertised as a FIP accomplished in partnership with US-based Wild Salmon Center (www.salmonfippartnership.org), but the FIP does not currently involve any fishing companies other than the MSC clients (and is reported in MSC volumes above). The progress of this FIP is currently rated "E" on www.fishsource.com due to absence to date of a complete FIP workplan, policy improvement, or management improvement.

Wild Salmon Center also announced in September that MSC pre-assessments are underway in two additional fisheries (the Karaginsky fishery in Northeast Kamchatka and fisheries conducted by the companies Vityaz Avto and Delta in West Kamchatka not heretofore engaged in the MSC program), which could lead to FIPs in the future should evaluation results and workplans addressing concerns be made public. In another development pertaining to Kamchatka, three local processors of pink and sockeye salmon achieved Friend of the Sea certification in 2014, but no information regarding catch volumes, harvest volumes, and required improvements has been made public (Friend of the Sea 2014). Finally, the Alaska salmon fishery is engaged in the Responsible Fisheries Management certification program, but this volume is entirely accounted for by the MSC program.

While the number of MSC-certified salmon fisheries (eight) has not changed over the last year, performance against conditions has improved (Table 6 and Figure 15). The Iturup pink and chum, B.C. sockeye, Annette Island salmon, and Ozernaya sockeye fisheries all succeeded in closing some conditions in 2013–2014. Iturup pink and chum and B.C. sockeye also reduced their respective amounts of conditions that are past due.
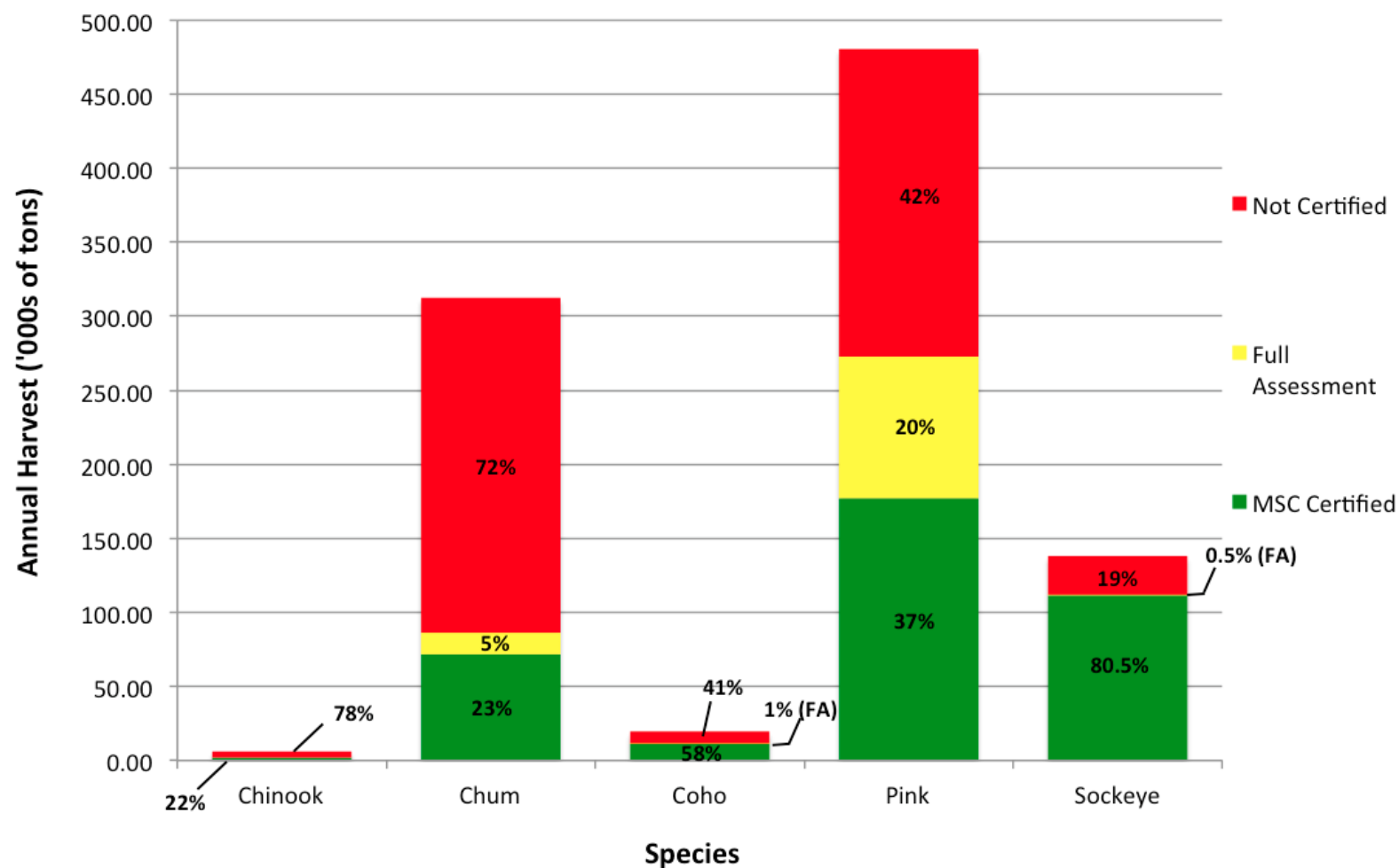
Figure 14: Level of engagement in improvement processes aggregated by species. On one end, 81% of sockeye salmon volume comes from fisheries engaged in the MSC program, while on the other end, 78% of Chinook salmon volume comes from fisheries that are not engaged. Note: FA = MSC Full Assessment.

Table 6: Comparison between status of MSC conditions among the eight MSC-certified salmon fisheries in 2013 and 2014. Several fisheries closed conditions or reduced the percent of open conditions that are past due.

Condition Status	Iturup pink & chum		B.C. sockeye		B.C. pink		Annette Island salmon		NE Sakhalin pink		Ozernaya sockeye		B.C. chum		Alaska salmon	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014 (new cert)
Closed	2	8	8	35	0	6	4	10	0	0	0	3	0	0	49	0
Open on Track	5	1	1	0	18	6	17	8	7	3	9	6	33	33	0	6
Open Past Due	2	0	26	10	4	10	1	4	0	4	0	0	0	0	19	0
% Closed	22%	89%	23%	78%	0%	27%	18%	45%	0%	0%	0%	33%	0%	0%	72%	0%
% Past Due	22%	0%	74%	22%	18%	45%	5%	18%	0%	57%	0%	0%	0%	0%	28%	0%
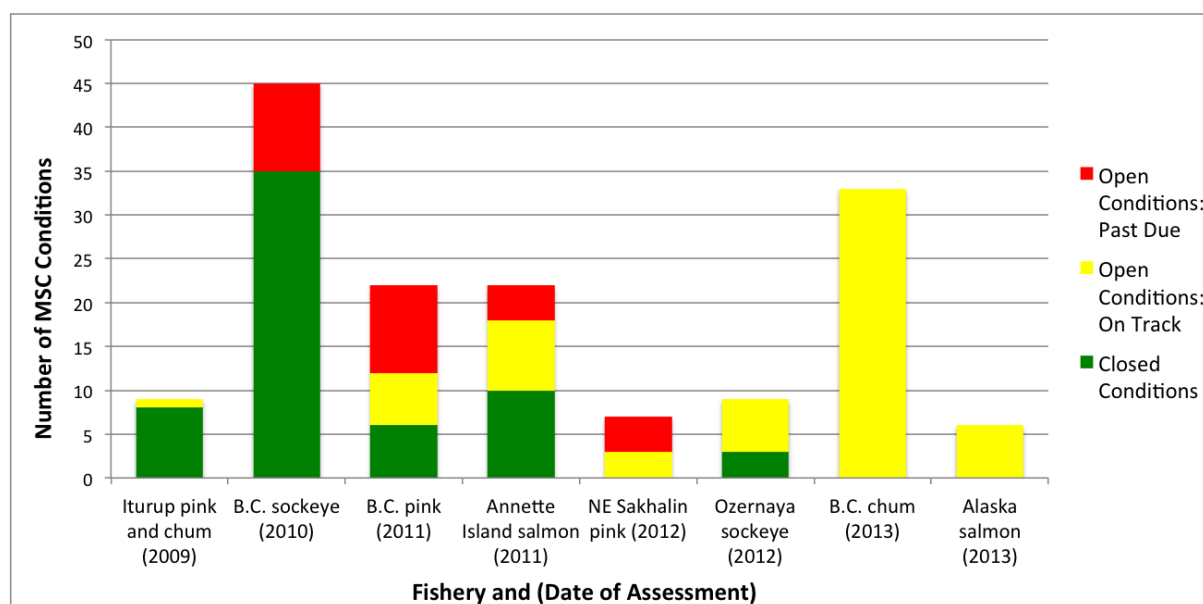
Figure 15: Bar graph indicating the number and status of MSC conditions among the eight MSC-certified salmon fisheries as of June 2014.

4   MAIN CONCLUSIONS AND RECOMMENDATIONS

The findings of this report are summarized as follows:

- The good: The majority of global salmon harvest by volume continues to be well or reasonably managed. Salmon fisheries are also exhibiting increased engagement in improvement processes.
- The bad: Region- and species-specific sustainability concerns persist around (1) illegal fishing, (2) hatcheries, (3) harvest control practices for depleted stocks, and (4) offshore fisheries.

We offer the following recommendations for the four topic areas of sustainability concern:

1. Illegal fishing: (1) International buyers of Russian salmon, particularly those in Japan or in western countries purchasing re-exported Russian salmon products processed in China, should request copies of the certificate of catch origin from suppliers and avoid purchase of products that lack an accompanying certificate. (2) International buyers should make written requests of the Russian Federal Fisheries Agency asking that documentation regulations be updated to specify that a single, standardized certificate of catch origin can be obtained and used by any Russian supplier exporting to any international destination. (3) Bilateral agreements between Russia and its export partners Japan and Korea regarding illegal fishing should be amended to include specific reference to salmon, following the example of the bilateral agreement with China. A sample certificate of catch origin should also be added to all three agreements. (4) The EU should follow recommendations described by Clarke and Hosch (2013), improving upon its IUU Regulation in order to close loopholes that presently allow for illegal fish to enter the supply chain for export to Europe. (5) Additional measures to curb illegal fishing, including observer programs, on-site inspection of fishing areas, and control documents, should be implemented in the Russian salmon fishery.

2. Hatcheries: A North Pacific-wide and individual fishery moratorium on hatchery expansion should be established until such time as risks to wild populations from hatchery impacts are, at the highest level, ascertained and integrated into management objectives. This recommendation is made particularly strongly for the Prince William Sound, Alaska, and Iturup, Russia, fisheries, where recent increases in hatchery releases threaten to compromise the accuracy of ongoing studies of hatchery impacts upon wild stocks.

3. Harvest control practices for depleted stocks: Managers should continue to improve upon approaches to defining overfishing and regulatory stock-of-concern status, and, particularly in British Columbia, integrate *Lower Evaluation Benchmarks* for salmon *Conservation Units* into harvest control rules.

4. Offshore fisheries: (1) The offshore driftnet fishery in the Russian EEZ should either close or integrate a genetic- or tag-based stock identification program into the management of the fishery. (2) In the Pacific Northwest US, mark-selective fisheries should not be expanded to new areas or sectors until further evidence of their relative costs and benefits is available

and important stock assessment data gaps are addressed. Specifically, there is need for increased or improved validation of wild stock escapement estimates, sampling for wild and hatchery fish on spawning grounds, and estimations of mortality for fish released in mark-selective fisheries.

We offer the following additional recommendation regarding mining and associated habitat impacts:

Overlap between mining projects and wild salmon habitat should be, when possible, avoided (for example, the fishing industry should continue to actively oppose construction of the Pebble Mine in Bristol Bay). In those cases where mining projects are going ahead in the midst of salmon habitat, best practices should be employed to minimize impacts.

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