OREGON DEPARTMENT OF FISH AND WILDLIFE REPORT ON RESEARCH AND DATA NEEDS

The Oregon Department of Fish Wildlife (ODFW) offers the following comments on the Pacific Fishery Management Council's (Council) Draft Research and Data Needs (Agenda Item F.1, Attachment 1, September 2018). ODFW appreciates the Council's efforts to identify and prioritize research and data needs, and encourages the Council to use this process to clearly and concisely communicate high priority research and data needs to organizations which may be able to support continuing or additional research and data collection and management.

We find that the length of the draft Research and Data Needs document (Agenda Item F.1, Attachment 1, September 2018) and its current approach to organization and prioritization to be an obstacle to effectively communicating the Council's needs. Over 350 individual topics or bullets are found in the main document, of which 181 are explicitly identified as "Highest Priority". For the Groundfish Fishery Management Plan chapter, which lacks any indication of priority level in the main document, we took inclusion in the main document to indicate a "Highest Priority" ranking. Council discussion and several advisory body statements in June focused on the need to identify a smaller number high priority items. ODFW recommends that for the 2018 Research and Data Needs final adoption, the Council identify a limited number of topics or subject areas as "Highest Priority" and reclassify the remaining items at some lower priority level. Specific recommendations are provided in Table 1 at the end of this report. An Executive Summary or similar mechanism may be useful in this regard.

ODFW also provides recommendations regarding organization and prioritization with the intent of facilitating a more clear and concise document. Recognizing that the Council is already well along in the process of developing 2018 Research and Data Needs, these recommendations may be more appropriate to consider early in the development of 2023 Research and Data Needs.

Highest Priority Research and Data Needs

Long-term fishery-independent biological, ecological and physical monitoring programs are fundamental to the process of assessing fish stocks, setting sustainable harvest specifications, and managing fisheries in the face of a changing ocean environment. Such programs are likely to prove invaluable for understanding and forecasting the impacts of the changing climate, ocean acidification and hypoxia, and other ecosystem-level trends on managed fish stocks. ODFW generally recommends that the Council consider continuation, refinement, and expansion (e.g., to new habitats or species) of such programs as highest priorities.

In reviewing the June document, we found substantial overlap and redundancy in the individual items identified throughout. Therefore, we have identified overarching subject areas from each chapter which we recommend the Council elevate as highest priority for research projects or data improvements, and attempt to list the individual items from the document that relate to the subject area (Table 1). Prioritization of projects within a subject area would then fall to the post-adoption process outlined in Council Operating Procedure 12 (COP 12).

Chapter 2.0 Ecosystem Based Fisheries Management and Marine Protected Areas

1. Research and data in support of the Climate and Communities Initiative

   Long-term monitoring of physical (e.g., currents, ocean chemistry, temperatures, upwelling) and ecological (e.g., phytoplankton production, zooplankton abundance and composition, predator population densities) attributes of the California Current Ecosystem is critical to understanding how the ocean environment is changing and predicting potential impacts on fisheries and communities. For example, NOAA's Integrated Ocean Observing Systems are a valuable resource for collecting, modeling, and disseminating some such information and require continued federal support.

   The Ecosystem Workgroup (EWG) identified a number of priorities in their June report (Agenda Item C.4.a, June 2018) which may support the development of the Climate and Communities Initiative. The priorities identified by the EWG largely capture those related to physical and ecological ocean monitoring and modeling. ODFW supports the EWG recommendation to prioritize research and data efforts that support the initiative, especially those that relate to maintenance, evaluation, and improvement of these monitoring systems.

Chapter 3.0 Economics and Social Science Components

1. Community indicators

   The Council has identified development and improvement of community-level indicators for fishery dependence, well-being, and resilience as a need for the annual California Current Ecosystem Status Report. In addition, development of community-level indicators is likely to be useful in the Council's development of the Climate and Communities initiative. ODFW recommends that the Council identify related items as a highest priority.

Chapter 4.0 Groundfish Fishery Management Plan

1. Continue existing fishery-independent surveys

   Existing fishery-independent surveys relevant to groundfish include the NWFSC Shelf-Slope trawl survey, the Southern California Bight Hook and Line survey, the California Cooperative Oceanic Fisheries Investigations (CalCOFI) egg and larval production survey, the International Pacific Halibut Commission longline survey, and the mid-water acoustic survey of Pacific hake. The hake acoustic and halibut longline surveys were listed as priorities in the 2013 Research and Data Needs document but appear to have been dropped from the 2018 document for unclear reasons. ODFW recommends that the Council identify continuation of fishery-independent surveys as a highest priority, including the hake acoustic and halibut longline surveys.

2. Develop new fishery-independent surveys

   There are a number of important groundfish stocks that are poorly surveyed by the existing fishery independent surveys, especially those associated with rocky habitats (i.e., untrawlable) such as yelloweye rockfish, most demersal nearshore stocks such as cabezon, greenlings and nearshore rockfishes, and mid-water schooling stocks such as black rockfish, blue rockfish, deacon rockfish, yellowtail rockfish, and widow rockfish.

Assessments for these stocks are typically highly uncertain, and many support large recreational and commercial fisheries or are limiting due to incidental catches. ODFW recommends that the Council identify development and implementation of new fishery-independent surveys in the next 5 years as a highest priority. ODFW recommends emphasizing methods that are more likely to provide information on absolute number or biomass of a stock within the survey area, such as acoustic, visual, or combination surveys over those that are more likely to only provide a relative index of abundance such as hook-and-line only surveys.

3. Research to support assessment of Amendment 28 habitat impacts

   Implementation of Amendment 28 will open areas that have been closed to commercial groundfish bottom trawl gear for many years in both the RCAs and EFHCAs, and will establish new and expanded closures via EFHCAs. This presents a unique and ephemeral opportunity to study the habitat impacts of bottom trawl gear as well as habitat recovery. ODFW recommends that the Council identify research that will support assessment of the impacts of re-openings and closures implemented through Amendment 28, including baseline data collection.

4. Catch Reconstructions

   Comprehensive estimates of commercial and recreational removals (i.e., catch) are another fundamental data need for assessing the status of stocks and setting harvest specifications. The complexity of mixed-stock groundfish fisheries, with a large number of stocks, gear types, sectors and jurisdictions, and a long history of exploitation with little to no sampling conducted until at least 1980 makes such comprehensive estimation particularly problematic. Despite this, much progress has been made since the Council initially identified it as a priority, and promising developments are on the horizon. ODFW feels that addressing this issue is achievable within the next five years, and recommends the Council identify these items as highest priority.

5.0 Salmon Fishery Management Plan

1. Research to improve stock identification and use in management

   Given the number of stocks managed in the salmon FMP, the fact that several are listed under the ESA, and the realities of weak-stock management, improving the ability of fisheries managers to identify stocks impacted by fisheries with high spatial and temporal resolution is an important aspect of salmon fisheries management. There are a large number of individual needs listed in the document, some of which may be more likely to be useful than others. ODFW recommends that the Council identify research that supports this effort as highest priority.

2. California Central Valley Fall Chinook Assessment and Management

   The need to manage impacts on this stock has led to significant restrictions in salmon fisheries, and the stock is now considered overfished. A better understanding of the population dynamics of this stock is needed, and ODFW recommends that the Council identify research and data supporting this need as a highest priority.

3. Mark-Selective Fisheries

   Mark selective fisheries are an important management tool for conducting mixed-stock ocean salmon fisheries that attempt to optimize harvest opportunities while limiting impacts on stocks of concern. ODFW recommends that the Council identify research and data that support development and implementation of mark-selective fisheries as highest priority.

6.0 Coastal Pelagic Species Fishery Management Plan

1. Continue the Southwest Fishery Science Center acoustic-trawl survey and conduct research to refine and improve the methodology

   While a number of potential issues regarding the acoustic-trawl methodology have been raised through council Advisory Bodies, methodology review, and public comment, ODFW recommends that the Council identify continuation of the survey as a highest priority, in conjunction with research that is needed to refine and improve the methodology.

2. Continue to explore additional fishery-independent survey methods for priority Coastal Pelagic Species (CPS) fisheries.

   The acoustic-trawl survey as currently configured does not survey the entire population of any CPS for operational and practical reasons. ODFW recommends that the Council identify exploration of fishery-independent survey methods that will complement or supplemental the acoustic-trawl survey as a highest priority. In particular, methods that are able to survey the area inshore of the acoustic-trawl survey for priority CPS (Pacific sardine, Northern anchovy, and Pacific mackerel) should be prioritized.

7.0 Highly Migratory Species Fishery Management Plan

The document identifies two items as "most important highest priorities" in the current document. ODFW appreciates the effort to highlight these items and agrees with identifying them as highest priority for HMS. For completeness, we include them here and recommend that the Council identify these plus one additional item as highest priority.

1. Management Strategy Evaluation for bluefin and albacore tuna

   These ongoing projects will be useful for consideration of reference points, status determination criteria, and biological and economic impacts in international management forums.

2. Swordfish stock structure

   There is evidence that a portion of swordfish taken in Council managed fisheries is likely from the Eastern Pacific Ocean (EPO) stock instead of the Western and Central North Pacific (WCNPO) stock as assumed. While the WCPO stock is considered healthy, the last assessment of the EPO stock (2014) found that harvest rates likely exceeded Maximum Sustainable Yield based reference points may have occurred in several years from 1998-2012 (the terminal year of the assessment). Given the council and public interest in

increasing west coast based harvest of swordfish, ODFW recommends that the Council identify research on swordfish stock structure as a highest priority.

3. Bycatch reduction using dynamic ocean modeling (e.g., EcoCast)

   Reducing bycatch in the drift gillnet HMS fishery has been a focus of the Council deliberation and action over the last several years. ODFW feels that dynamic ocean modeling holds promise for this and other applications, and recommends the Council identify this as a highest priority research need.

Organization and Process

The chapters are inconsistent in organizational and prioritization scheme, and contain many redundancies both within and between chapters. In a number of instances, nearly the exact same paragraph or bullet point is repeated several times. In some cases, the redundancy is explicitly stated and is done "for emphasis". ODFW believes that redundancy dilutes the document as a whole rather than providing emphasis, and an effort should be made to consolidate individual items into topic areas and reduce redundancy. For example, in Chapter 7 improvements in fisheries statistics are called for in the overall needs as well as in sections for many individual species. This chapter could be significantly streamlined by calling for improvements in fisheries statistics as a single topic, and listing the species that would benefit rather than repetition. Similar redundancy is found between chapters, in particular there is substantial overlap between Chapters 2 and 3 and the individual FMP chapters. This type of redundancy is unnecessary and ultimately counter-productive.

Each chapter uses a different prioritization scheme, to the extent that it is extremely difficult to compare categorizations across chapters. Often times no prioritization level is identified at all, with categories such as "Emerging" and "Ongoing" leaving the reader to wonder what the lack of an assigned priority level means. ODFW recommends that the Council instruct contributors to and collators of the document to develop and apply a consistent prioritization scheme throughout the document.

Each chapter contains a section that attempts to track progress on research and data needs identified in the previous iteration of the document. The characterizations of progress are often incomplete and focused on one or two examples. The effort required to conduct a complete accounting of progress is high, likely beyond what the Council would consider reasonable for this task. While some review of progress is perhaps necessary to evaluate current needs, it does not seem to be particularly relevant or useful in communicating the Council's priorities to interested parties. ODFW recommends that it not be included as part of future Research and Data Needs documents in the interest of streamlining and focusing the Council's priorities.

It may be desirable to revisit COP 12 prior to beginning development of the 2023 Research and Data Needs. Revisions could include additional specification regarding the organization and prioritization of the document, clearer definition of the roles of Council Advisory Bodies, or an opportunity for Council to provide guidance to staff and Advisory Bodies at the start of development in advance of considering adoption of the public review draft.

Table 1. Sections, topics, or bullets from the September 2018 Research and Data Needs document (Agenda Item F.1, Attachment 1, September 2018) related to subject areas which ODFW recommends the Council identify as highest priorities.

Chapter	ODFW Subject Area	Section, topic, or bullet	Page #
2. *Ecosystem Based Fisheries Management and Marine Protected Areas*	Research and data in support of the Climate and Communities Initiative	Identify key physical and biological indicators for prediction of salmon early ocean survival and groundfish recruitment, as well as other conditions that are directly applicable to management.	5
		Identify how the climate might be changing on long time scales in a way that will affect fisheries (i.e., climate change).	6
		Investigate how viability and resilience of coastal communities are affected by changes in ecosystem structure and function, including short- and long-term climate shifts.	13
		Monitor, model, and predict changes in distribution of species related to changes in ocean conditions and climate. Identify how climate change will affect spatio-temporal ocean distributions and the overlap between predator-prey assemblages. Identify how distribution shifts will impact jurisdictions and communities.	13
		Continue development of ecosystem-based models (including Atlantis) that incorporate environmental variation and anthropogenic disturbances to guide harvest policies and enable risk assessment for fishing strategies.	13
		Assess high and low frequency changes in the availability of target stocks, and the vulnerability of bycatch species, in response to dynamic changes in climate and oceanographic conditions (such as seasonal changes in water masses, changes in temperature fronts or other boundary conditions, and changes in prey abundance).	14
		Develop indicators of harmful algal blooms (HABs) and the phytoplankton community (diatoms vs. dinoflagellates) for the entire CCE to identify and track changes to the base of the marine food web. Evaluate relationships with other indicators of climatic and oceanographic conditions, fisheries productivity, and fisheries participation (because HAB toxins can close important fisheries such as Dungeness crab, potentially redirecting effort to other fisheries).	14

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Chapter	ODFW Subject Area	Section, topic, or bullet	Page #
2. *Ecosystem Based Fisheries Management and Marine Protected Areas*	Research and data in support of the Climate and Communities Initiative	Evaluate the influence of climatic/oceanographic conditions on the population dynamics of FMP species. Develop indicators to track that influence, such as for upwelling, sea surface temperatures, Pacific Decadal Oscillation, chl-a, and zooplankton index.	14
		Direct physiological effects of temperature, pH, and dissolved oxygen changes on managed and non- FMP forage species, including, but not limited to: tolerance limits, growth rate, and reproductive rate.	16
		Current spatial and depth boundaries of all FMP and non-FMP forage species in regards to temperature, pH, and dissolved oxygen.	16
		Spatially-specific trend analysis of temperature, pH, and dissolved oxygen changes specific to the EFH of all FMP and non-FMP forage species.	16
		Spatially-specific forecasts of temperature, pH, and dissolved oxygen changes specific to the EFH of all FMP and non-FMP forage species.	16
		Spatially-specific trend and forecast of temperature, pH, and dissolved oxygen effects on food chain base (primary and secondary production) for all FMP and non-FMP forage species.	16
3. *Economics and Social Science Components*	Community indicators	Development of data sources for community-level indicators related to recreational fishing	20
		Continued development and validation of community-level indicators	21
4. *Groundfish Fishery Management Plan*	Continue existing fishery-independent surveys	Continue the annual NWFSC Shelf-Slope trawl survey.	34
		Maintain the California Cooperative Oceanic Fisheries Investigations (CalCOFI) egg and larval production surveys.	34
		ODFW Recommendation – include continuation of the Whiting Acoustic-Trawl Survey and Southern California Bight Hook and Line Survey in this subject area	NA

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4. *Groundfish Fishery Management Plan*	Develop new fishery-independent surveys	Develop a coastwide fishery independent nearshore survey.	34
		Continue to explore additional survey methods. **ODFW Recommendation – explicitly include exploration of acoustic methods for mid-water schooling rockfishes in both the nearshore (e.g., black, blue, and deacon rockfish) and on the shelf (e.g., widow, yellowtail, and canary rockfish).** **ODFW Recommendation – emphasize methods that provide information on absolute biomass or abundance over those that provide only a relative index of biomass or abundance.**	34
	Research to support assessment of Amendment 28 habitat impacts	Examine response of HFI to re-openings and closures of EFHCAs and RCAs.	45
		Conduct studies to map the distribution and abundance of HFI species, with emphasis in EFHCAs and areas of potential high risk from fishing and non-fishing impacts.	45
		Conduct studies in the core-RCA before trawling is re-initiated to establish a modern baseline for fish, mega-macroinvertebrates, and habitat conditions.	45
		Collaborate with trawlers to establish long-term research areas to serve as controls in the core RCA, as well as treatment areas to conduct controlled commercial trawling.	46
		Examine the relationship between an individual trawl pass and the level of disturbance and recovery of benthic macro-invertebrates.	46
		Conduct studies to characterize and quantify the effects of other bottom-contact gear types and mid-water trawl gear on soft bottom and rocky habitats.	46
		Examine the cumulative impacts of fishing gear (including line, weights, traps and pots) including derelict fishing gear on important habitats such as rocky reefs and eelgrass beds.	46

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4. *Groundfish Fishery Management Plan*	Research to support assessment of Amendment 28 habitat impacts	Conduct high-resolution seafloor mapping and high-resolution habitat maps in EFHCAs previously mapped at low resolution or not mapped.	47
		Collect baseline data on species and habitat condition in existing (Amendment 19) and future (Amendment 28) EFHCAs, and monitor effects of these closures on species and habitat over time.	47
		Monitor effects of new bottom trawling in EFHCAs identified for reopening under Amendment 28.	47
		Conduct studies in EFHCAs to determine the effects of benthic habitat protection for promoting groundfish productivity.	47
		Evaluate the boundaries of the EFHCAs as new seafloor habitat maps become available to identify area where protections should be refined.	47
	Catch Reconstructions	Complete the WA historical catch reconstruction.	35
		Thoroughly review the historical catch reconstructions; develop uncertainty measures.	35
		Provide better documentation of the process used to construct the historical catch and discard time series.	36
		Continue to improve the historical catch and discard time series.	36
		Transfer copies of state catch reconstructions and contributing databases to PacFIN so there is a single repository.	36
5. *Salmon Fishery Management Plan*	Research to improve stock identification and use in management	Advances in Genetic Stock Identification (GSI), Parentage Based Tagging (PBT), otolith marking, and other techniques make it feasible to use a variety of stock identification technologies to assess fishery impacts and migration patterns.	51
		Development and application of technologies to collect high-resolution at-sea and dockside genetic data and associated information (time, location and depth of capture, ocean conditions, scales, etc.).	62

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Chapter	ODFW Subject Area	Section, topic, or bullet	Page #
5. *Salmon Fishery Management Plan*	Research to improve stock identification and use in management	Identification of stock distribution patterns useful for fisheries management and appropriate management strategies to take advantage of these distribution patterns.	62
		Development of pre-season and in-season management models to implement these management strategies and integrate them with Council management.	62
		Continue to evaluate whether PBT sampling and tag recovery programs can be practically and cost-effectively implemented to provide information for annual stock assessment needs, and update or revise the analysis performed for the Pacific Salmon Commission as genotyping costs change or new marking/tagging/sampling strategies are proposed. Genotyping all spawners used for hatchery production would allow non-lethal identification of hatchery origin fish at any life stage.	62
		Tissue samples should be collected and saved from entire broodstock of programs desired to contribute to PBT while sampling regimes for mixed-stock fisheries are devised.	63
	California Central Valley Fall Chinook Assessment and Management	Development of a cohort reconstruction model for SRFC	53
		Continued evaluation of alternative forecast models for the Sacramento Index (SI).	54
	Mark-Selective Fisheries	A more accurate assessment of total fishing-related mortality for natural stocks of coho and Chinook is needed. The ability of existing management models to predict and assess non-catch mortalities needs to be evaluated and the models modified, if needed.	56
		Estimates of mark rates are essential for planning mark-selective fisheries. The accuracy of mark rates at release needs to be evaluated as well as the variability of mark-induced mortalities under operational conditions.	60

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6. *Coastal Pelagic Species Fishery Management Plan*	Continue the Southwest Fishery Science Center acoustic-trawl survey and conduct research to refine and improve the methodology	Study the vertical distribution of fish to determine if CPS in the surface blind-zone represent a stable and/or variable portion of the overall density of significance to the stock assessment. This could be done using vessel sonars or acoustic moorings.	66
		Continue to collect target strength data using best available technology with associated relevant biological information to improve current target strength models.	66
		Use net monitoring devices to monitor the trawl during all hauls. The optimal instrumentation is trawl sonar, which monitors the variable geometry of the trawl opening, and the distribution of fish within and outside the trawl opening.	67
		Analyze the effect of the adaptive sampling on the bias of estimates of biomass using simulation or through reanalyzing various subsets of conducted transects.	67
		Test efficiency (and suitability) of the existing trawl.	67
		Develop methods to verify that the sizes and species encountered by the acoustic gear during the daytime are the same as those encountered using trawls at night.	67
		Explore options to quantify potential fish avoidance under a range of survey conditions. This could involve combining systematic collection of additional data during surveys, as well as dedicated experiments.	67
		Validate the assumption that all CPS finfish are spread out at the surface.	67

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6. *Coastal Pelagic Species Fishery Management Plan*	Continue to explore additional fishery-independent survey methods	Establish a long-term index of abundance(s) for the CPS assemblage off the USA Pacific coast that is based on a sound and representative sampling design, which necessarily will require systematic/synoptic survey efforts, both temporally (annual) and spatially (Mexico to British Columbia).	65
		Develop a method for estimating the variance of the biomass inshore of the ATM survey from the CDFG/CWPA aerial survey. The estimates of biomass from surveyed transects can be extrapolated to unsurveyed areas, but this will require additional sampling to ensure that the extent of between-area differences in density can be quantified to inform proper stratification of expansions and to allow variance to estimated.	66
		Continue to explore and expand independent nearshore survey methods and efforts to estimate the proportions of the populations that may not currently be surveyed by the ATM surveys.	67
		Ongoing aerial surveys in California should be expanded to cover more CPS habitat off California and PNW. Additional validation of assumptions concerning observer biomass estimations and species identifications are needed. The review panel noted that no adequate estimates of variance are currently available; it will be necessary to develop and implement a variance estimation method before estimates can be used for management. Review of a variance estimation method could be accomplished during a STAR Panel.	68

6. *Coastal Pelagic Species Fishery Management Plan*	Continue to explore additional fishery-independent survey methods	Population estimates of anchovy and jack mackerel are in need of an update. Reasonable estimates of their current biomass are needed for sound ecosystem management, particularly before ecosystem models can be used to accurately forecast dynamics of planktivorous organisms in the food web. One potential direction for these species is to use similar fishery-independent methods developed for species such as Pacific sardine and Pacific mackerel.	73
7. *Highly Migratory Species Fishery Management Plan*	Management Strategy Evaluation	Support the development of management strategy evaluations for North Pacific albacore and Pacific bluefin tuna, including the collection of economic data and specification of economic-related management objectives and performance metrics	78
	Swordfish stock structure	Understanding the stock structure of North Pacific swordfish.	78
		Further evaluate swordfish stock structure in the Southern California Bight, given that tagging studies indicate mixing of the Western and Central Pacific stock with the Eastern Pacific stock	82
	Bycatch Reduction	Examine habitat use of leatherback turtles and other species of concern, including target species, to better understand the potential for reducing bycatch	87
		Continue to explore whether hotspots or temperature bands can be identified in near-real-time to provide information to fishermen regarding locations with potentially high interaction risks (e.g., using EcoCast)	87