10. TOPICS PREVIOUSLY BEFORE MRC

Today's Item **Information** ☒ **Action** ☐

Receive updates on items previously discussed by MRC and provide guidance on further efforts.

Summary of Previous/Future Actions

A. Fisheries Bycatch

- FGC referred bycatch to MRC — Jun 4, 2014; Eureka
- MRC hears overview of bycatch guidance in MLMA — Aug 5, 2014; San Diego
- FGC approves MRC to form Bycatch Working Group — Dec 3, 2014; Van Nuys
- **Today receive update** — **Nov 4, 2015; Ventura**

B. Pier and Jetty Fishing

- MRC hears pier fishing issue and petition — Nov 5, 2014; Los Alamitos
- FGC directs staff to undertake pier project in S CA — Dec 3, 2014; Van Nuys
- **Today receive update** — **Nov 4, 2015; Ventura**

Background

A. Fisheries Bycatch

Staff will update MRC on a process toward initiating a staff-directed fisheries bycatch workgroup, as endorsed by FGC in Dec 2014.

At its Aug 2014 meeting, MRC had an initial discussion of bycatch in the context of California's fisheries and guidance provided in the Marine Life Management Act (MLMA) and master plan for fisheries. MRC discussed the importance of focusing on fisheries under FGC's direct authority, applying the standards set forth in the MLMA, and recommended that a bycatch workgroup be formed to jump-start a review of current guidance, available and needed data for state fisheries, and principles to consider in the master plan update. In Dec 2014, FGC accepted the MRC recommendation to form a staff-directed workgroup. Staff has compiled a list of volunteers interested in participating, and is ready to initiate the formation of the workgroup.

B. Pier and Jetty Fishing

Staff will update MRC on collaborative efforts to review pier and jetty fishing concerns and interests in Southern California, as endorsed by FGC in Dec 2014.

To date, focus has been on the Santa Monica Bay piers, where the precipitating pier fishing-hooked shark-swimmer event occurred. A "Santa Monica Bay Pier Stakeholders Summit" was held on May 7, 2015 by Heal the Bay in coordination with FGC staff, which brought together over 30 stakeholders from municipalities, the pier fishing community, state agencies, academics, environmental non-governmental organizations, sport fishing community, lifeguards, surfers, aquaria, and public safety agencies. See Exhibit B.1 for a meeting summary. While FGC progress has been

hampered by staff capacity limitations, staff is now available to focus on this effort into early 2016.

C. Other

This is a place-holder for updates or comments regarding previous agenda items not included in today's agenda.

Significant Public Comments

A1. Support for commencing the bycatch workgroup and a white paper with background information to inform the beginning stages of the workgroup (exhibits A.1 and A.2).

Recommendation (N/A)

Receive update from interested parties on efforts to date; following the meeting, staff will reach out to FGC listserv soliciting interest in participation and report back to MRC in Mar 2016.

Exhibits

A.1. Letter from Geoff Shester, Oceana, received Oct 22, 2015

A.2. Report prepared by Oceana on California fisheries bycatch issues, dated Oct 22, 2015

B.1. Summary prepared by Heal the Bay, Santa Monica Bay Pier Stakeholders Summit, dated May 7, 2015

Committee Direction (N/A)

OCEANA Protecting the World's Oceans

99 Pacific Street, Suite 155C
Monterey, CA 93940 USA

+831.643.9266
OCEANA.ORG

October 22, 2015

Commissioner Eric Sklar and Commissioner Anthony C. Williams, Co-Chairs
Marine Resources Committee
California Fish and Game Commission
1416 Ninth Street, Room 1320
Sacramento, CA 95814

RE: Marine Resource Committee Meeting Agenda Item 10(A): Fisheries Bycatch Workgroup

Dear Commissioners:

Effectively assessing and minimizing bycatch is a fundamental cornerstone of sustainable fishery management. The unintended catch and discarding of marine life is widely considered among the top ecological impacts of fisheries, and can also have major economic ramifications. California generally boasts clean, sustainable fisheries that serve as a model for the world. However, some California fisheries have identified bycatch concerns that have yet to be addressed and many fisheries lack sufficient information on bycatch. Minimizing bycatch is a primary goal of the Marine Life Management Act and there is a need to develop a systematic approach for addressing this critical conservation issue.

We strongly support the newly formed Fisheries Bycatch Workgroup to be overseen by the Marine Resource Committee. We have provided suggestions to Commission staff regarding the charge and activities of this Workgroup, including developing a common language around bycatch, drafting potential revisions to the MLMA Master Plan "Bycatch" section, drafting an overarching Commission policy on bycatch, proposing a consistent criteria for determining "acceptable levels" of bycatch that can be applied across diverse California fisheries, and developing a "Bycatch Action Plan". To this end, we are submitting the attached document "An Overview of Fishery Bycatch Issues in California State-Managed Fisheries", which was co-authored by former Oceana Research Intern Azian Akpan from Cornell University. We hope you find this document to be a helpful primer on the suite of issues involved in managing fishery bycatch, and that it helps the Fishery Bycatch Workgroup hit the ground running toward successful outcomes.

We look forward to participating in this newly formed Fishery Bycatch Workgroup to constructively develop a path forward for addressing bycatch issues in a collaborative forum with other stakeholders.

Sincerely,

Geoffrey Shester, Ph.D.
California Campaign Director, Oceana

CC. Sonke Mastrup, Executive Director, California Fish and Game Commission
Susan Ashcraft, Marine Advisor, California Fish and Game Commission
Craig Shuman, Marine Regional Manager, California Department of Fish and Wildlife

An Overview of Fishery Bycatch Issues in California State-Managed Fisheries

Azian Akpan
Oceana Research Intern
Cornell University

Geoffrey Shester, Ph.D.
California Campaign Director
Oceana

October 22, 2015

OCEANA Protecting the World's Oceans

TABLE OF CONTENTS

EXECUTIVE SUMMARY……3

INTRODUCTION……..3

SECTION 1: BYCATCH ASSESSMENT

1.1 Marine Life Management Act Bycatch Goals……...……4
Reviews existing bycatch goals in MLMA and Master Plan. Conclusion: Need to develop clear criteria for management across all fisheries (FMP and non-FMP)

1.2 Clarifying California Bycatch Definitions…….……..6
Reviews definitions currently existing in CA Game Code, identifies ambiguities and limitations of definitions, and provides specific recommendations to address concerns

1.3 Bycatch Metrics……..…….....9
Identifies various bycatch metrics and summarizes applications, limitations, and guidelines for interpreting metrics

1.4 Bycatch Criteria Used Elsewhere…….……...…..…14
In response to lack of consistent bycatch criteria for non-FMP fisheries, this section has overviews of two existing criteria which includes scoring factors applicable to bycatch assessment:

SECTION 2: STRATEGIES FOR ADDRESSING BYCATCH

2.1 Bycatch Reduction Techniques….…….……..…….....16
Overview of bycatch management strategies for scenarios with sufficient and insufficient available bycatch data. Features when strategy is applicable, examples of employing the strategy, caveats, and recommendations

APPENDIX 1: Seafood Watch Methodology for Wild Capture Fisheries……..22

APPENDIX 2: Marine Stewardship Council Fisheries Certification Requirements and Guidance……28

Acknowledgments: The authors wish to thank California Fish and Game Commission Marine Advisor Susan Ashcraft and Oceana staff Ashley Blacow, Jon Warrenchuk, and Mariel Combs for their reviews and feedback on earlier drafts of this report.

EXECUTIVE SUMMARY

The goal of this report is to provide a synopsis of topics relevant to the current and future goals for California bycatch management policy. The immediate purpose of the document is to act as a resource for the California Fish and Game Commission's Bycatch Working Group and the upcoming update of the Marine Life Management Act (MLMA) Master Plan pertaining to Bycatch. Section 1 of the report summarizes key information in the current MLMA, namely bycatch goals and definitions, and subsequently includes analysis and recommendations on strengthening the policy. The key recommendations are to 1) clarify ambiguous language by incorporating more specific vocabulary within existing California Game Code definitions for bycatch and discards, and 2) develop explicit criteria to determine acceptable levels of bycatch in a manner that can be applied consistently and comprehensively for all California state-managed fisheries. Prior to exploring further what these criteria may look like, the report summarizes existing bycatch metrics: identifying and summarizing common metrics, explaining their specific applications and limitations, and informing on guidance in how to correctly interpret and compare metrics. After establishing this framework for approaching bycatch metrics, Section 1 concludes with a review of bycatch criteria utilized by two fishery assessment methods: Seafood Watch and the Marine Stewardship Council. The intent of this section is to provide insight and specific guidance on features to consider in creating statewide criteria for acceptable bycatch. The final section of the document is an overview of bycatch management strategies, featuring guidance for when a given technique is appropriate to employ, real-world examples of the technique, caveats, and summary recommendations and commentary.

INTRODUCTION

Bycatch, the incidental catch of non-target fish and ocean wildlife, is an issue of concern in maintaining sustainable fisheries. California is an international leader in sustainable fishery management, and minimizing bycatch is one of the primary goals of California's Marine Life Management Act (MLMA). Many of California's state-managed fisheries are very clean from a bycatch perspective, however, some California fisheries have identified bycatch concerns, and many have insufficient data on bycatch. The current gaps in bycatch information, due to inconsistent and undetailed data collection, result in an overall lack of knowledge around the exact magnitude of the issue in certain fisheries.

The California Fish and Game Commission is required to regularly review and assess bycatch information in certain fisheries (e.g., California halibut trawl grounds), and the MLMA requires that fishery management plans contain measures to minimize bycatch. However, the Commission currently lacks an overall strategy, policy, and means to prioritize bycatch concerns for management. There is a need for consistent, comprehensive bycatch reporting so that progress can be tracked and management can be held accountable. Ultimately, fishery management measures should aim to stop harmful bycatch and wasteful discarding by employing adequate monitoring and using innovative measures to control the problem.

The purpose of this document is to assist the Commission's Bycatch Working Group in its initial task and to inform updates and revisions to the Marine Life Management Act (MLMA) Master Plan sections related to Bycatch. This document provides relevant background information to facilitate these decision-making processes.

SECTION 1: BYCATCH ASSESSMENT

1.1 Marine Life Management Act Bycatch Goals

The Marine Life Management Act (MLMA) is California law for the management of all marine wildlife taken by commercial and recreational fishermen. The MLMA emphasizes an ecosystem-based perspective for sustainability that is rooted in science-based management.[1] Current California law acknowledges bycatch as a key element in achieving sustainability within state recreational and commercial marine fisheries (CA FGC §7056, see below).

§7056. "In order to achieve the primary fishery management goal of sustainability, every sport and commercial marine fishery under the jurisdiction of the state shall be managed under a system whose objectives include all of the following:
…(d) the fishery limits bycatch to acceptable types and amounts, as determined for each fishery."

Addressing bycatch is integral component of FMPs

In achieving the objective of limiting bycatch to acceptable types and amounts, the MLMA mandates the development of fishery management plans (FMPs) as a tool.
One of the long-term goals of the MLMA is to develop fishery management plans (FMPs) for all the State's major recreational and commercial fisheries. FMPs function as comprehensive documents featuring best available scientific information, and are intended to serve as the primary basis for managing California's recreational and commercial fisheries (CA FGC §7072(a)-(b)). Information on bycatch and discards are required components of all FMPs under the MLMA (CA FGC §7085, see below).

§7085. Consistent with subdivision (b) of Section 7072, each fishery management plan or plan amendment prepared by the department, in fisheries in which bycatch occurs, shall include all of the following:

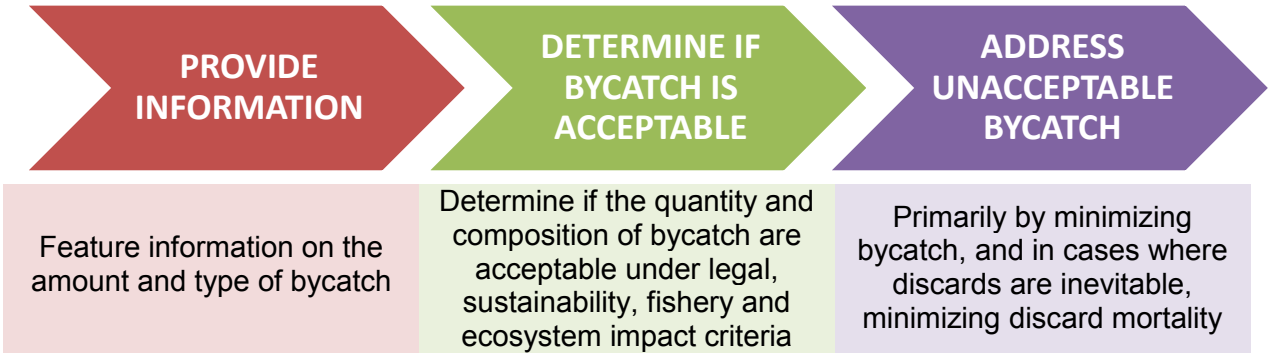
- Information on the amount and type of bycatch
- Analysis of the amount and type of bycatch based on the following criteria:
  - Legality of the bycatch under any relevant law
  - Degree of threat to the sustainability of the bycatch species
  - Impacts on fisheries that target the bycatch species
  - Ecosystem impacts
- In the case of unacceptable amounts or types of bycatch, conservation and management measures that, in the following priority, do the following:
  - Minimize bycatch
  - Minimize mortality of discards that cannot be avoided

All FMPs are required to include information on the amount and type of bycatch and to have bycatch maintained within appropriate limits (legally and ecologically).

[1] CA DFW website (Accessed July 2015). Marine Life Management Act Summary <https://www.wildlife.ca.gov/Conservation/Marine/MLMA>

Existing California Bycatch Assessment Criteria for FMP fisheries

The MLMA outlines a three-step approach for addressing bycatch for fisheries under FMPs (CA FGC §7085):



FMPs are intended to facilitate the assessment of acceptable levels of bycatch, as they are required to provide best available scientific information, and are mandated to include thorough information on a fishery's bycatch status. However, addressing bycatch in this way has only been done in four state-managed FMPs completed to date (abalone, nearshore, white seabass, and market squid) since the establishment of the MLMA in 1999. There are no consistent criteria for determining acceptable levels of bycatch across state-managed fisheries. The MLMA Master Plan for Fisheries ("Master Plan") was created as a means to prioritize fisheries based on their needs for an FMP. The current language of the Master Plan identifies issues relevant to achieving this objective.

2.5 Issues Relevant to the Development of Fishery Management Plans

"It has become clear during the development of this initial Master Plan that several issues need extra consideration or clarification; and the full implementation of the MLMA will take several years. Policies or guidelines on issues such as allocation, bycatch, optimal yield…are crucial to the success of an FMP" (MLMA Master Plan, 2-11)

According to the MLMA Master Plan, the goal is to eventually have FMPs for all fisheries, but this is a long process. The MLMA acknowledges that the creation of FMPs for all fisheries will take a long time, but it doesn't establish a clear way to systematically assess bycatch for non-FMP fisheries, which is the majority of existing state fisheries.

Need for Assessment Criteria for non-FMP fisheries

The MLMA currently mandates that "the fishery limits bycatch to acceptable types and amounts, as determined for each fishery" (CA FGC §7056(d)). This language is intended to be complemented by a FMP that allows for systematic and thorough assessment of bycatch. Aside from four fisheries (abalone, nearshore, white seabass, and market squid), fisheries in California are managed under different authorities, each using different methods and management systems that will include varied amounts of information on bycatch. The Commission has significant regulatory authority to implement measures to reduce bycatch in fisheries that aren't yet in FMPs. To do this, it is necessary to establish a new set of criteria that can be utilized for both FMP and non-FMP fisheries, ensuring that bycatch is assessed consistently and robustly across all of California's state managed fisheries.

1.2 Clarifying California Bycatch Definitions

Language around bycatch is susceptible to ambiguities and there are different definitions across statutes and jurisdictions in fisheries, therefore it is essential to review the language and definitions the California Fish and Game Code and MLMA Master Plan use when discussing bycatch issues, and to provide clear definitions for use in a common language about bycatch in California fisheries.

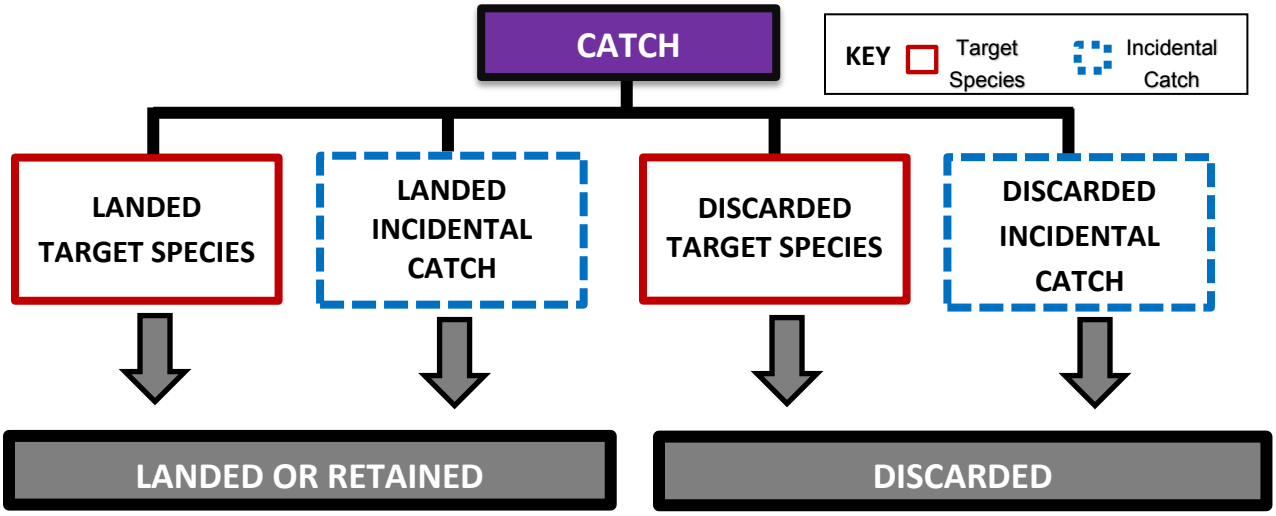
Existing California State Definitions

Bycatch "Fish or other marine life that are taken in a fishery, but which are not the target of the fishery. Bycatch includes discards." (CA Fish and Game Code § 90.5)

Discards "Fish that are taken in a fishery but are not retained because they are of an undesirable species, size, sex, or quality, or because they are required by law not to be retained." (CA Fish and Game Code § 91)

California's current definitions capture some key concepts, but further clarification and specificity would be helpful for future management processes. Bycatch is a very complex issue, and the language that is used to discuss different types of bycatch should be very inclusive, as well as specific, so that the policy communicates clearly how any given scenario should be addressed.

Clarifying definitions to account for diverse bycatch scenarios



One of the primary conservation concerns about bycatch is the mortality of discarded marine life, which results in impact without benefit (i.e., discard mortality). This concern arises in several specific situations, thus building on existing state definitions with more specificity allows these issues to be communicated effectively. For example, the presence of bycatch is not concerning in all scenarios because it doesn't consistently result in wasteful dead discards (see figure above). Some bycatch is landed and sold, which may not be a cause for concern if it is

managed sustainably and consistent with Commission goals (for example, it may be desirable in some scenarios to catch multiple species with one fishing gear).

Meanwhile, not all discards are equally concerning. Regulatory discards (such as releasing endangered species, or adhering to landing size minima/maxima) are sometimes encouraged to support healthy populations of target species, or prevent targeting of certain species. However, discretionary discards where catch is disposed to keep more valuable fish, could have negative and wasteful impacts that thwart sustainable goals.

As there are no currently existing state definitions for regulatory and discretionary discards, the figure below provides a description of how they are defined in federal guidance.

REGULATORY DISCARDS	
Catch that is required to be discarded when caught, or retained and not sold[2]	
Examples:	
ETP species	Endangered, threatened, and protected species
Below MLS	When catch is below minimum landing size[3]
Quota	When vessel doesn't have allocated quota for species[3]

DISCRETIONARY DISCARDS	
Catch that is discarded because of undesirable species, size, sex, quality etc.[2]	
Examples:	
Economic discard (High Grading)	Marketable species not retained because they are of an undesirable size, sex, quality, etc.[4]
Economic discard (No Market)	When there is no market for certain species[3]

Subsequent language in the MLMA Master Plan alludes to these diversities in the outcomes of bycatch (see MLMA Master Plan, 2.5.2 below), but even then, they are only vaguely touched upon. More importantly, these diversities should be encompassed in the initial definitions.

> "Bycatch occurs in most sport and commercial fisheries, but the amount varies considerably based on the type of gear used, fishing techniques, fish behavior, and so on. Marketable or desirable fish are kept by sport and commercial fishermen. Fish that are undersized, out of season, or undesirable are discarded by both sport and commercial fisherman, and may be alive or appear to be alive when discarded". (MLMA Master Plan, 2.5.2 Bycatch)

There are many diverse situations to consider, that hold different implications and require different management actions. Due to these complexities, it would be valuable to have separate definitions that reflect the different outcomes for bycatch and discards.

[2] National Marine Fisheries Service (1998). Managing the nation's bycatch: priorities, programs and actions for the National Marine Fisheries Services. Page 10.
[3] Oceana (2011). By-Catch and Discard Management: The Key to Achieving Responsible and Sustainable Fisheries in Europe. Page 1.
[4] Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA) of 2006. 104-297 (9): Page 6.

Clear, inclusive definitions are essential for effective management

In management, ambiguities such as these undermine efficiency in achieving policy objectives. It is therefore essential to ensure there is a consistent vocabulary that clearly encompasses the diversities in definitions for bycatch, and accounts for managing the type of bycatch and Discards that are of concern. The upcoming MLMA Master Plan update provides a foundation for future management; clear, inclusive definitions are a fundamental building block for this foundation. Distinct vocabulary is necessary to understand the full implications of a given bycatch scenario. Incorporating a more specific vocabulary within state definitions will promote effective management. The following contains recommended specific vocabulary to achieve this in alignment with existing California Game Code definitions:

Recommended complementary bycatch vocabulary

Bycatch composition – a measurement that illustrates the nature of observed bycatch by categorizing it into subgroups. Examples include:

> **Bycatch composition by vulnerability** – a measurement that illustrates the vulnerability levels of species caught incidentally
>
> **Bycatch composition by species** – a measurement that illustrates the species groupings of incidental catch

Discard mortality – Dead catch that is not retained and unobserved mortality due to a direct encounter with fishing gear

Discard rate – a measure of frequency for which a fishery catch is not retained

> **Discard rate *by number*** – the number of animals not retained
>
> **Discard rate *by weight*** – the collective weight of animals not retained
>
> **Discard rate *per landings*** – measure calculated by discards divided by total landings
>
> **Discard rate *per total catch*** – measure calculated by discard divided by total catch, where total catch = landings + discards
>
> **Discard rate *per unit revenue*** – measure of the economic value of discarded catch

Discretionary discards – Catch that is not retained because they are of an undesirable species, size, sex, quality, etc.

Post-release survival (or discard mortality rate) – the measure of release viability of discarded catch. For some species (i.e. Groundfish) cautionary rate of 100% discard mortality is assumed, but for others, calculated based on condition of animal upon release (i.e. visible injury)

Regulatory discards – Catch that is required by law not to be retained

Retention rate – landed target species and retained bycatch as a percentage of total catch

1.3 Bycatch Metrics

Comparing the issues of bycatch across fisheries is not always an intuitive process. Without accounting for the vast diversities across fisheries and how data on bycatch is collected, it is challenging to compare (and subsequently prioritize) bycatch issues for fisheries within the state. There are a variety of bycatch metrics that are used to standardize data. Bycatch ratios, mortality rates, and discard percentages are some metrics used in quantifying bycatch. These bycatch metrics are not interchangeable, as they provide different information about bycatch. For example, some methods will express bycatch in terms of weight, while another will represent bycatch in terms of number of individual animals. Being aware of the information a given metric provides is important to interpreting bycatch in fisheries. The following pages will provide an overview of common bycatch metrics, and what can and cannot efficiently convey.

TYPE OF DATA: Bycatch, discards and retention

In bycatch metrics, the quantitative measurement can be based on bycatch, retention or discards data. Commonly, these data types are expressed in terms of rates, ratios, percentages, or total quantities. Although bycatch, retention and discards metrics provide information relevant to bycatch, each of these three measures allows for certain specific information about bycatch. It is also important to know how the data is calculated. For example, discard rates are commonly calculated as discards divided by *total catch* (with total catch equaling landings plus discards), but in some cases, are calculated as discards divided by *landings*. With discards/landings, discard rates calculated can be over 100%, whereas this is not possible for discards/total catch (as it is impossible to discard more than your total catch[5], but is very possible to discard more than you land). Therefore, it is necessary to clarifying numerator and denominator when reporting and comparing rates across fisheries.

Discards / landings ≠ Discards / total catch

Numerical ranges for these metrics are different, so directly comparing the two yields erroneous results.

It is possible for discard/landings > 100%
Discards/total catch is ***always*** ≤ 100%

General rule-of-thumb Awareness of units and calculations (and converting to consistent units prior to comparing) is a necessary practice when interpreting metrics

BYCATCH METRICS	DISCARD METRICS	RETENTION METRICS
Measurement of total incidental catch	**Measurement of total disposed catch**	**Measurement of total utilized catch**
All non-target catch	*Regulatory and discretionary discards of target and bycatch*	*Landed target catch and retained bycatch*
Advantages Informs the selectivity of fishing practices • Indicates portion of catch that is incidental **Shortcomings** Does not inform of the outcome of bycatch (i.e. retained vs. discarded)	**Advantages** Informs sustainability of fishing practices • Indicates portion of catch that is disposed **Shortcomings** Does not inform on the magnitude of incidental catch	**Advantages** Informs sustainability of fishing practices • Indicates portion of catch that is utilized **Shortcomings** Does not inform on the magnitude of incidental catch

[5]Using mathematical definition, Total Catch = Landings + Discards. Discards can be equal to total catch, but never greater (Impossible for discards be greater than total catch, because it is impossible for landings to be less than zero).

UNITS: Bycatch by number versus by weight

Typically, bycatch is either measured by counts or by weight. These units are advantageous in certain scenarios: numerical are better when dealing with rare species, whereas weights are preferential when dealing with large quantities of biomass.

The uncertainty in what a bycatch measurement represents is exacerbated if the measurement is not affiliated with a specific species. This makes interpreting the metrics more complicated, as it makes accounting for the bycatch implications for a certain species impossible.

100 KILOGRAMS OF BYCATCH

300 Pacific Sardines[6] ≈0.33 kg. each	8 White Sea Bass[7] ≈12.5 kg. each

5 COUNTS OF BYCATCH

5 Dungeness Crabs[8] ≈5 kg. total	5 Green Sea Turtles[9] ≈750 kg. total

Even when the species is known, measurements are still prone to ambiguities that cloud the implications of bycatch data. As displayed below, there are vast and relevant differences between adults and juveniles of the same species. Knowing whether bycatch is a large adult or a small juvenile is just one example of the wide breath of scenarios a standard measure can encompass.

150 KILOGRAMS OF BLUEFIN TUNA

1 Adult[10] ≈150 kg.	100 Juveniles[11] ≈1.5 kg. each

5 COUNTS OF SALMON

5 Full-Grown Adults[12] ≈90 kg. total	5 Juveniles[13] <1 kg. total

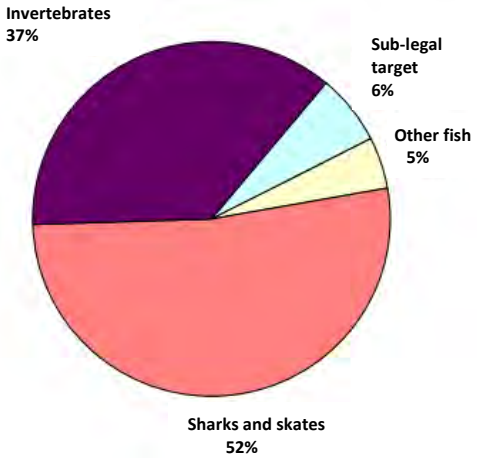
[6] Image from NOAA <http://www.fishwatch.gov/seafood_profiles/species/sardine/species_pages/pacific_sardine.htm>
[7] Image from San Diego Reader <http://www.sandiegoreader.com/news/2015/mar/11/fish-report/>
[8] Image from Alaska Department of Fish and Game <http://www.adfg.alaska.gov/index.cfm?adfg=dungenesscrab.main>
[9] Image from Widecast
< http://www.ticotimes.net/2013/11/05/conservation-group-finds-70-dead-sea-turtles-off-costa-rica-s-pacific-coast>
[10] Image from Fishing Website <http://www.fishing.net.nz/forum/id-your-fish-here_topic64723.html>
[11] Photo Credit: Ken Neill <http://phys.org/news/2011-08-global-status-tuna-billfish-stocks.html>
[12] Image from USGS <http://wfrc.usgs.gov/fieldstations/hq/chinook.html>
[13] Photo Credit: M Sparkman <http://www.savetheredwoods.org/grant/salmon-numbers-fall-but-restoration-offers-hope/>

BYCATCH COMPOSITION METRICS

Interpreting bycatch can be very reliant on context; therefore the specificity of bycatch data is crucial. Bycatch composition metrics can be valuable tools in communicating important details on the nature of observed bycatch.

SPECIES COMPOSITION

Composition of Fish Discards



Expressing bycatch or discards in terms of species composition provides helpful information. The figure to the left displays a hypothetical bycatch scenario, grouping discarded species into four major categories.

Valuable information displayed by example:

- More than half of fishery's discards is sharks and skates
- 89% of discards are sharks, skates and invertebrates

Ideally, this information would be more specific, but this alone informs on general trends in incidentally captured species.

Bycatch composition can be a helpful measurement in illustrating the characteristics (and subsequently implications) of observed bycatch

VULNERABILITY COMPOSITION

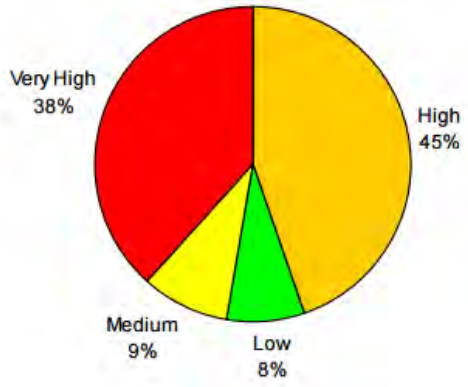
Composition data can also communicate valuable information on bycatch in terms of species vulnerability. The example to the right expresses hypothetical discarded catch according to FishBase vulnerability scores[14].

Valuable information displayed by example:

- 83% discarded species ranked High or Very High in vulnerability

This information should be complemented with specific species information, but nonetheless can deliver important summary information on the ecological impacts of bycatch.

Composition of Fish Discards according to FishBase Vulnerability Scores



[14] FishBase is an international database featuring comprehensive species data. The FishBase vulnerability scores are based on information (including but not exclusively) on age at first maturity, annual fecundity, natural mortality, and geographical range.

BYCATCH MORTALITY METRICS

Metrics on mortality inform on the impact of bycatch by the survivorship likelihood of a species. A caveat for this metric is survivorship of incidental catch can be variable, and influenced on a combination of factors, including species, gear types, handling methods and geographical areas.

Discard mortality and post-release survival

Discard mortality rates and post-release survival are measurements that estimate the portion of discards that die. These estimates are only available for certain species, and require observer data to calculate. For example, discard mortality rates are estimated from observer data detailing the release viability or injury of halibut during incidental catch for the Pacific Halibut and groundfish fisheries in Alaska.[15]

Real life example: Alaskan octopus: Discard mortality metrics are highly variable across both species and gear types[16]

Typically for federally managed groundfish in Alaska, discard mortality is assumed to be at the conservative rate of 100%. Unlike many groundfish, octopi do not have a swim bladder, thus sudden pressure from being brought to the surface does not cause traumatic injury. Because of this, there have been efforts to better estimate discard mortality of octopus and only count dead octopus toward the overall "take" of the fishery.

Observer special projects (conducted in 2006 – 2007, and 2010 – 2011) are exploring the potential of this measure in studying the release conditions of octopus bycatch. These special projects have resulted in data detailing trends in survivorship based on gear types:

- POT GEAR: Less than 5% octopus dead or visibly injured
- BOTTOM LONGLINE GEAR: Approximately 20% of octopus dead or injured
- TRAWL GEAR: 50 – 85% of octopus were dead or seriously injured
    - Survivorship decreased because trawls have longer time between capture and processing out of all other gear types

Further research into post-release mortality will enable better estimates of catch accounting, to give "credit" for species that are released alive. Octopus bycatch survivorship is a great illustration of how species with similar habitats can vary significantly in discard mortality, as well as how survivorship varies greatly by gear type.

[15] G.H. Williams (2011). Incidental catch and mortality of Pacific Halibut 1962 – 2011. IPHC Report of Assessment and Research Activities. [Information and Image]

[16] Conners, E.M. 2012. Discard mortality for octopus. NOAA Fisheries, Alaska Fisheries Science Center. Status of Stocks & Multispecies Assessment Program. http://www.afsc.noaa.gov/quarterly/jfm2012/divrptsREFM9.htm

NORMALIZING BYCATCH DATA BY REVENUES

Metrics incorporating monetary values can be helpful in communicating the economic and ecological implications of bycatch. It allows a more a direct assessment of the tradeoffs inherent in reducing bycatch. Moreover, normalization can be utilized as a tool for comparison, enabling the cross-analysis of fisheries that are vastly different in target species and fishing methods.

Example Calculation Method[17]

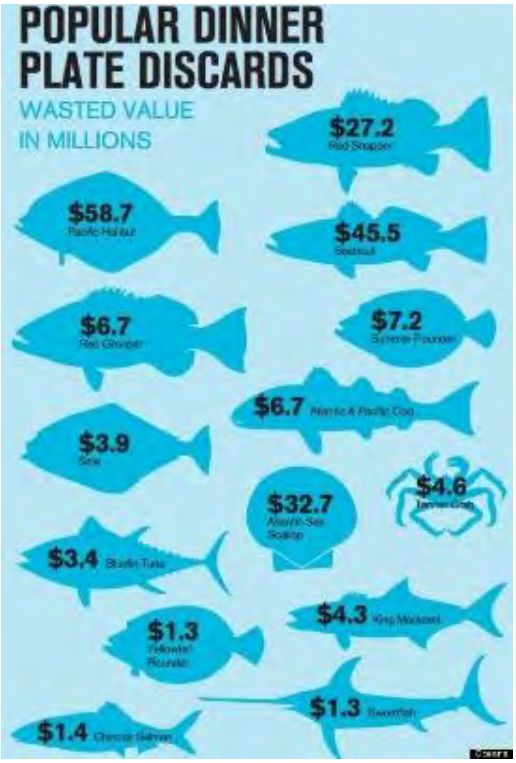
Keledjian et al.'s report on the economic price of bycatch features an example of a calculation procedure that can be used to put a price on discards. These calculations factor in both reported and unreported bycatch, relying on the following assumptions on unrecorded bycatch. These assumptions vary based on the magnitude of the estimates (low to high end).

Assumptions made in accounting for unrecorded bycatch

i. Low end = negligible
ii. Mid-range = ½ the average rate of other fisheries in region
iii. High-end = the average rate as other fisheries in each region

The next step is applying the appropriate monetary value to the bycatch. This calculation's main assumption is that unreported discards were half the regional average in value (for mid-range estimates) and equal to the regional average (for high-end estimates). Values were calculated by:

Discard Monetary Value of a species
= Discards (lb.) x price/pound ($USD/lb.)



Caveats/Assumptions with this approach

Calculations don't account for include cost of retaining bycatch species onboard until the point of sale (varies considerably from vessel size and amount and value of target and non-target species within fishery)

A Minimum Estimate

This approach may underestimate the total value of bycatch because it does not include future value of discarded fish, their unrealized offspring, their functional roles in the ecosystem, or the larger losses in total sales and jobs for the seafood industry and overall economy.

[17] Keledjian et al. (2014) Wasted Cash: The Price of Waste in U.S. Fishing Industry. Oceana. http://oceana.org/reports/wasted-cash-price-waste-us-fishing-industry

1.4 Bycatch Assessment Criteria Used Elsewhere

As the existing MLMA does not have a consistent criteria for determining acceptable levels of bycatch, it may be valuable to look at existing criteria elsewhere as guidance in factors to consider in developing a clear acceptable bycatch criteria for California state-managed fisheries. We have included the criteria used by existing wild seafood sustainability assessments used by the Monterey Bay Aquarium's Seafood Watch Program (Appendix 1) and the Marine Stewardship Council (Appendix 2). These criteria include several useful principles and components, summarized below:

Summary and Comparison of Bycatch Criteria

Seafood Watch	MSC Sustainability Certification
GUIDING PRINCIPLES/MISSION STATEMENT	
• Minimize bycatch • Fishing mortality does not threaten the population or impede the ecological role of any marine life	Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.
CRITERION COMPONENTS	
• Inherent Vulnerability • Abundance • Fishing Mortality • Modifying Factor: Discards and Bait Use	• Secondary Species Outcome • Secondary Species Management Strategy • Secondary Species Information
UNIQUE ADVANTAGES	
• Has detailed comprehensive definition for main bycatch species • More geared and specific to assessing fish stock • Scoring scheme translated into real life terms (i.e. "high concern, low concern")	• Considers minor bycatch species in addition to major bycatch species • More policy and management-oriented • Emphasizes confidence in data used in scoring
LIMITATIONS IN APPLICATION TO CALIFORNIA BYCATCH CRITERIA DEVELOPMENT	
• Does not account for minor bycatch species • Does not consider policy in management, a noteworthy factor in maintaining and promoting sustainable practices • Conservation concern thresholds do not consistently err on the side of caution (i.e. permits qualification for "low concern" abundance rating even if there is significant uncertainty or controversy in stock assessment estimates)	• Maintains raw score scheme and does not provide interpretation of scores in real life terms • Is less thorough in scientific assessment of species, because criteria must be general enough to account for any unit of assessment seeking sustainability certification (target stocks, fishing method, gear type etc.) • Defines bycatch separate from retained catch (therefore may not account for all factors relevant to landed bycatch assessment) •

Concluding Remarks on Bycatch Assessment Criteria

There are several relevant elements from both criteria in developing acceptable bycatch criteria for California state-managed fisheries. Since these are only two of many existing criteria available, the features of these criteria may not encompass all that the state needs to consider in creating its criteria for acceptable bycatch. Important takeaways from this section are that both scientifically robust factors, as well as review of existing management strategies are valuable considerations for establishing (and eventually assessing and maintaining) acceptable levels of bycatch within state fisheries. It is also important to assess different metrics of bycatch including total levels of bycatch, bycatch rates, the effects of bycatch on various species, and the level of information available on bycatch. Also, it is important for the criteria to be simultaneously detailed (in specifying how acceptable level thresholds can be calculated and assessed), but also general enough to encompass the potential diversities of bycatch situations that may arise for any state fishery.

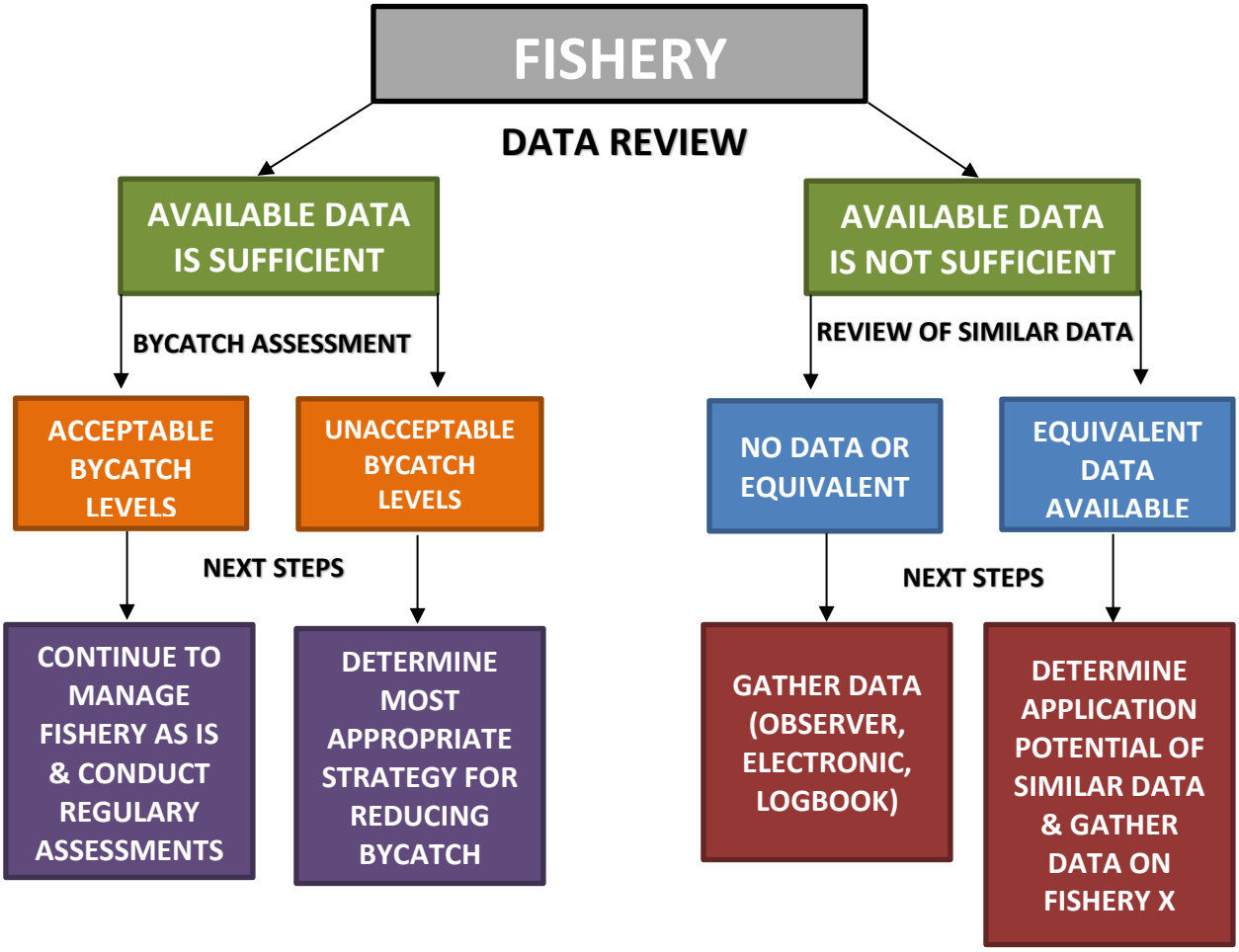
SECTION 2: STRATEGIES FOR ADDRESSING BYCATCH

2.1 Bycatch Reduction Techniques

Addressing bycatch concerns does not adhere to a "one size fits all" approach. Bycatch issues are subject to variation not only across fisheries, but within fisheries. This is due to the differences such as fishing location, gear type, fleet size, and environmental factors. Therefore it is very possible that a strategy that proves highly successful in one scenario can be useless, or even counterproductive, in another. One must also consider the viability of techniques given resource restraints (especially economic feasibility). In many cases, it is possible that a combination of techniques is necessary to efficiently address bycatch.

Example Flowchart

The availability of sufficient data is the core determining factor in assessing and addressing bycatch in a fishery. The flowchart below illustrates the hypothetical steps that may be taken to systematically approach a bycatch issue in Fishery X.



ADDITIONAL DATA COLLECTION	
APPLICABLE WHEN	• Insufficient available data on bycatch (data is old, infrequently collected, not detailed enough to perform assessment etc.)
EXAMPLES	• A compulsory requirement to record all discards in logbooks and that priority be given to assessing discard rates during routine inspection by fishery officers[18] • Electronic log books - real time reporting of catch composition- especially where Real Time Closures are considered[41] • Increased use of observers to help with discard monitoring[41] • Full retention requirements so catch composition can be assessed at the dock • Electronic/video monitoring
ADVANTAGES	• Provides crucial information on the current status and nature of existing bycatch issues • Fills data gaps • Specific, detailed data enables for effective management
CAVEATS	• Observers can be expensive • Electronic logbooks may require additional data collection by fishermen • Observer data not always accurate data due to the "observer effect" where fishermen alter their typical behavior, or underreport bycatch to yield more favorable recordings[19] ○ Would need substantial, if not 100%, observer coverage to control for this • Dockside market sampling contains little to no information on bycatch
CONCLUSION	Compulsory data collection is technically not a bycatch reduction technique in itself, but a necessary stepping stone in eventually identifying and subsequently addressing any discovered bycatch issues within a fishery.

[18] Marine Conservation Society (2009). Discards and Bycatch in fisheries: information sheet.
[19] Burns et al. (2008). Observer effect on fisher bycatch reports in the New Zealand ling bottom longlining fishery. NZ Journal of Marine and Freshwater Research.

UPGRADE GEAR TECHNOLOGY	
APPLICABLE WHEN	• Evidence of bycatch due to the employment of low-selectivity gear • Availability of gear that has evidence of higher selectivity
EXAMPLES	• Use and development of selective gear[20] • Monitoring and control of fishing gears[43]
ADVANTAGES	• Increased proportion of target species in catch • Fishery practices more sustainable • Less bycatch (and subsequently less bycatch mortality)

CAVEATS	• Economic consequences of introducing gear modification
	  ○ Transition process likely to result in reduced productivity
	  ○ Concern that more selective gear will encumber catch acquisition
	  ○ Selective gear may be more expensive than less selective gear
	  ▪ Therefore transitioning voluntary is a hard sell to fishermen

CONCLUSION	As this methodology puts the burden of implantation on fishermen, success of technique employment would increase if paired with incentives to make economically feasible or management strategies (monitoring/controlling gear types)

[20] Marine Conservation Society (2009). Discards and Bycatch in fisheries: information sheet.

TIME-AREA MANAGEMENT	
APPLICABLE WHEN	• Good data available indicating where bycatch hotspots are
EXAMPLES	• Area closures - Real time closures[21]
ADVANTAGES	• Promotes sustainability: protect juvenile and spawning fish[44] • Protects ecosystem and habitat
CAVEATS	• Communication and enforcement of boundary restrictions is essential • Reduces bycatch by avoidance rather than modifying fishing behavior: potentially not practicable • Could result in more concentrated fishery activity in another area, must account for sustainable practicality of this measure when prohibiting areas
CONCLUSION	Time-area management needs to be consistently and strongly enforced to be effective (i.e. monitoring, fines)

QUOTAS AND HARD CAPS	
APPLICABLE WHEN	• An upper limit on bycatch is desired
EXAMPLES	• Multiple-species quota arrangements for mixed demersal fisheries[22] • Establish bycatch caps in all fisheries[23] • Several countries, such as Norway, have set a "discard ban package" to reduce fishing exploitation[24]
ADVANTAGES	• Shifts accountability onto fisherman to regulate bycatch • Motivates development of technologies and practices
CAVEATS	• In countries, such as New Zealand, discard dumping is made illegal, it still occurs[25] • Caps contingent on having accurate bycatch information
CONCLUSION	Recommended to safeguard caps • i.e. Pair (caps) with other reduction technique • Provide a margin of error by making caps more robust

[21] Marine Conservation Society (2009). Discards and Bycatch in fisheries: information sheet
[22] Marine Conservation Society (2009). Discards and Bycatch in fisheries: information sheet
[23] Keledjian et al., (March 2014). Wasted Catch: Unsolved Problems In U.S. Fisheries. Page 16.
[24] Gullestad, P. (2013). The "Discard Ban Package" – Norwegian experiences in efforts to improve fisheries exploitation patterns. Norwegian Directorate of Fisheries report.
[25] FAO: Fishery Industries Division (1997). A study of the options for utilization of bycatch and discards from marine capture fisheries. Section 11.1.4

INCENTIVE AND UTILIZATION PROGRAMS	
APPLICABLE WHEN	• More target catch can be harvested before a fishery is closed for exceeding bycatch limits • Funds are available to compensate financial incentive efforts • There is a desire to promote transition to cleaner gear types
EXAMPLES	• Taxes imposed on discards based on the estimated value of the entire catch (including discards)[26] • Iceland has operated a "bycatch bank" to assist in commercializing unwanted fish[27] • License and fee discounts for the use of bycatch reduction devices[49]
ADVANTAGES	• Provides support and encouragement for adapting to more sustainable fishery measures
CAVEATS	• It must be ensured that the profit from selling discards does not go back to the fishermen[28] ○ It is essential that fish which are landed but would normally be discarded (because they are undersized) do not enter the market, but rather are used for fishmeal, for example[50] • Placing monetary value on discards raises theoretical problems of valuation of natural resources (an inevitably subjective process, as no objective valuation framework exists)[50]
CONCLUSION	Incentive and utilization programs are an especially valuable technique as it can relieve the burden of reduction on fishermen by providing support in conjunction with mandates.

[26] FAO Technical Paper 470 (2005). Discards in the worlds marine fisheries: An update. Section 4.6.3
[27] Fisheries in Iceland. Policy Department B: Structural and Cohesion Policies (2008). Page 18.
[28] Marine Conservation Society (2009). Discards and Bycatch in fisheries: information sheet.

MARKET INCENTIVES	
APPLICABLE WHEN	• Outreach to consumer base is possible and practicable • Consumer knowledge and communication regarding seafood is substandard
EXAMPLES	• Encourage consumers to choose sustainable alternatives, relieving demand for less sustainable seafood options[29] • Eco-labelling – environmental performance certification used around the world, indicates to consumer environmental quality of product[30] ○ Credited as contributing factor in global bycatch reduction[31]
ADVANTAGES	• Puts responsibility on consumer to be cognizant of the large scale repercussions of purchase choices • If consumers refuse unsustainable products, fisheries will be forced to accommodate market interests
CAVEATS	• Cannot quantify the degree to which public awareness will contribute to achieving bycatch reduction targets • Cannot control or estimate the degree in which consumers care about the impacts of their purchases, therefore a volatile strategy for reducing bycatch
CONCLUSION	This is a method that could hypothetically be practicable for all seafood commodities, as it expands the contexts of bycatch and can speak to consumer awareness of product sustainability as a whole.

[29] Marine Conservation Society (2009). Discards and Bycatch in fisheries: information sheet.
[30] Global Ecolabelling Network (GEN) (2004). Information paper: Introduction to ecolabelling
[31] FAO Fisheries Technical Paper 470 (2005). Discards in the worlds marine fisheries: An update. Section 4.2.2

APPENDIX 1: Seafood Watch Methodology for Wild Capture Fisheries

Seafood Watch assesses the sustainability of fisheries for the purpose of providing recommendations to consumers and businesses on the selection of sustainable seafood. Seafood Watch considers the following 4 criteria in assessing the sustainability of a fishery, of which Criterion 2 has direct relevance to bycatch assessment as it considers the impacts of a fishery on other "non-target" species:

Criterion 1	Criterion 2	Criterion 3	Criterion 4
Impacts on the Species Under Assessment	**Impacts on Other Species**	**Management Effectiveness**	**Impacts on the Habitat and Ecosystem**
• Inherent vulnerability • Abundance • Fishing Mortality	• **Inherent vulnerability** • **Abundance** • **Fishing Mortality** • **Modifying Factor: Discards and Bait Use**	• Harvest strategy • Bycatch management strategy	• Impacts of Fishing Gear on the Habitat and Substrate • Modifying Factor: Mitigation of Gear Impacts • Ecosystem–based Fisheries Management

Criterion 2 Guiding Principles[32]

1. **The fishery minimizes bycatch**
   Bycatch includes:
   - Discards, endangered or threatened species catch, pre-catch mortality and ghost fishing[33]
   - All discards, including those released alive, are considered bycatch unless there is valid scientific evidence of high post-release survival and there is no documented evidence of negative impacts at the population level

2. **Fishing mortality does not threaten the populations or impede the ecological role of any marine life**
   Fishing mortality should be appropriate given each impacted species abundance and productivity, accounting for scientific uncertainty, management uncertainty and non-fishery impacts such as habitat degradation

Steps for Assessment Methodology

Seafood Watch's assessment procedure is prefaced by a determination of existing main bycatch species. Subsequently, it considers four assessment factors prior to determining the final score for Criterion 2.

1. *Determining main species for assessment*
2. *Perform Assessment*

[32] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 8

[33] "Ghost fishing occurs when lost or discarded fishing gear that is no longer under a fisherman's control continues to trap and kill fish, crustaceans, marine mammals, sea turtles and sea birds." Definition provided by: NOAA (2015). What We Know about "Ghost Fishing".

- *Factor 2.1 – Inherent Vulnerability*
- *Factor 2.2 – Abundance*
- *Factor 2.3 – Fishing Mortality*
- *Factor 2.4 – Modification Factor: Discards and Bait Use*

3. *Final Scoring*

Preliminary Step – Determine Main Species for Assessment[34]

OBJECTIVE	
Determine the main species of bycatch. Subsequently main species are subject to assessment procedure	
QUALIFICATIONS	
Any of the following scenarios would be considered a main species	
SCENARIO 1	Species catch is more than 5% of fishery's catch
SCENARIO 2	Species catch is more than 1% of fishery's catch AND Causes more than 5% of the species' total mortality across all fisheries
SCENARIO 3	Species catch is less than 1% of fishery's catch AND Causes more than 20% of species' total mortality across all fisheries
SCENARIO 4	Species is overfished, depleted, a stock concern, endangered, threatened, IUCN Near Threatened, US MMPA strategic species and/or subject to overfishing and the fishery causes more than 1% of the species' total mortality across all fisheries
If there are no other "main species" (based on the above guidance) besides the one considered the main/target stock (assessed under criterion 1), but the total catch of other discarded and retained species is more than 5%, assess the top 3 species by volume of catch.	

Factor 2.1 – Inherent Vulnerability

GOAL	
Ensure fishing mortality and other management measures are appropriate for the inherent vulnerability of all bycatch stock(s).	
PROCEDURE OUTLINE	
For when bycatch species is known:	
Utilizes FishBase Vulnerability Scores Where available, Seafood Watch uses	***Species without FishBase data*** Seafood Watch provides a comprehensive

[34] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 8

FishBase[35] "vulnerability" scores to assign a score for inherent vulnerability of the stock.	scoring procedure to assess species' vulnerability, considering relevant factors such as life span, reproductive potential (see table below)
For when bycatch species is unknown:	
For fisheries for which the species for bycatch are unknown, bycatch impacts by gear type is used to determine the likelihood for a non-target species to interact with the gear. Gear impact studies provide guidance on interaction likelihood. Detailed guidelines provided in Appendix 3.[36]	

Step 1 of procedure Seafood Watch utilizes for determining inherent vulnerability for species without available FishBase data.[37]

Resilience attribute	Fish			Invertebrates		
	Score = 1	Score = 2	Score = 3	Score = 1	Score = 2	Score = 3
Average age at maturity	> 15 yrs	5–15 yrs	< 5 yrs	>15 yrs	5–15 yrs	< 5 yrs
Average maximum age	> 25 yrs	10–25 yrs	< 10 yrs	> 25 yrs	10–25 yrs	< 10 yrs
Fecundity	< 100 eggs/ yr	N/A	N/A	< 100 eggs/ yr	NA	NA
Average maximum size	> 300 cm	100–300 cm	< 100 cm	N/A	N/A	N/A
Average size at maturity	> 200 cm	40—200 cm	< 40 cm	N/A	N/A	N/A
Reproductive strategy	Live bearer	Demersal egg layer	Broadcast spawner	Live bearer	Demersal egg layer or brooder	Broadcast spawner
Trophic Level	>3.25	2.75-3.25	<2.75	N/A	N/A	N/A
Density dependence	N/A	N/A	N/A	Depensatory dynamics at low population sizes (Allee effects) demonstrated or likely	No depensatory or compensatory dynamics demonstrated or likely	Compensatory dynamics at low population sizes demonstrated or likely

Factor 2.2 – Abundance[38]

GOAL

Stock abundance and size structure of all main bycatch species/stocks is maintained at a level that does not impair recruitment or productivity

PROCEDURE OUTLINE

Interpret the health of stocks, using the most conservative relevant tier (using table below)
I.e. a species that is both overfished and endangered is classified as "endangered"

[35] FishBase is an international data resource featuring best available data on fish species. Site: www.fishbase.org
[36] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 48.
[37] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 4.
[38] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 5.

For ***species with unknown*** stock data, unknowns are based on type of fishing gear used and likelihood data for species interaction (detailed guidelines provided in Appendix 3[39]). Use appendix 3, unknown bycatch matrix, and additional bycatch guidance

Assessment scheme for Abundance (Example from Procedure)[40]

CONSERVATION CONCERN	DESCRIPTION
VERY LOW	• Biomass estimated to be above or fluctuating around appropriate target reference point (and no controversy around that estimate) OR • Species near historic high/virgin biomass OR • Non-native species
LOW	• Stock classified as not overfished, but stock assessment is lacking OR • Biomass above limit, but below target OR • Biomass above limit reference, but estimated to be above target reference (but with significant uncertainty, i.e. widely varied data results, scientific controversy)
MODERATE	No evidence stock is either below or above reference points
HIGH	• Stock is listed by management body as overfished/depleted OR • Stock is species of concern under management body
VERY HIGH	State, national, or international scientific body labels as endangered or threatened

Depletion Thresholds: Very Low to Moderate = Not Depleted (Green),
High to Very High = Depleted (Red)

Factor 2.3 – Fishing Mortality[41]

GOAL
Fishing mortality is appropriate for the current state of all main bycatch species/stocks
PROCEDURE OUTLINE
Utilizes fishing mortality/exploitation rate
Rule of thumb: Err on side of caution when there is uncertainty in determining whether a fishery is a substantial contributor and/or whether a fishery is at or below a sustainable level
For unknown species: Utilize Appendix 3[42], featuring overview and guidelines based on studies correlating gear type and likelihood for certain species being caught incidentally. Emphasizes to only use Appendix ONLY as a general guide to help rate bycatch potential.

[39] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 48

[40] NOTE: Table is based on current abundance or biomass metrics, not on fishing mortality. In this context, "overfished" means that the biomass is below a threshold, not that overfishing is occurring.

[41] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 6.

CONSERVATION CONCERN	FISHERY DEEMED SUBSTANTIAL CONTRIBUTOR TO MORTALITY	FISHERY CONTRIBUTION TO MORTALITY IS LOW OR UNKNOWN
VERY LOW	• Non-native species OR • Large portion of population protected AND not depleted OR • Highly likely that fishing mortality is at or below a sustainable level, allowing for population to maintain current level or rebuilt if depleted	• Fishery's contribution to mortality is negligible OR • Meets definition of very low in in left column
LOW	• Probable (>50% chance) fishing mortality is at or below sustainable level allowing population stasis or growth, some uncertainty OR • Pop trends increasing in short and long term due to management	• Contribution is not negligible, but does not adversely affect population OR • Contribution is unknown, but population is not depleted OR • Meets low concern in left column
MODERATE	• Fishing mortality fluctuating around maximum sustainable yield OR • Fishing mortality unknown, but for any depleted populations, effective management is in place	Fishery contribution is unknown, but population may be depleted (and if so, management in place) or susceptibility to fishery is moderate to high
HIGH	• Overfishing occurring, fishing pressure may be too high to allow species to maintain abundance/recover, but depleted populations have management that is reasonably expected to curtail fishing (ensure doesn't achieve critical rating below) OR • Fishing mortality is unknown and no effective management in place	Fishery contribution is unknown, but population is depleted and no reasonable management to curtail overfishing is in place
CRITICAL	• Overfishing is occurring/cumulative fishing pressure may be too high to allow species to maintain abundance/recover AND reasonable management is not in place	

Factor 2.4 – Modifying Factor: Discard and Bait Use[43]

GOAL

Fishery optimizes the utilization of marine resources by minimizing post-harvest loss and by efficiently using marine resources as bait

PROCEDURE OUTLINE

The collective scoring for Factors 2.1 – 2.3 are penalized based on magnitude of waste of marine resources. The results of this Factor determine the final score for Principle 2. Seafood Watch emphasizing the efficiency of bait use simultaneously with the minimization of waste via discarded catch. In this factor, discard mortality factor is assumed to be 100%.

EQUATION

[42] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 48
[43] Seafood Watch Criteria for Wild-Capture Fisheries (March 31, 2014). Page 12.

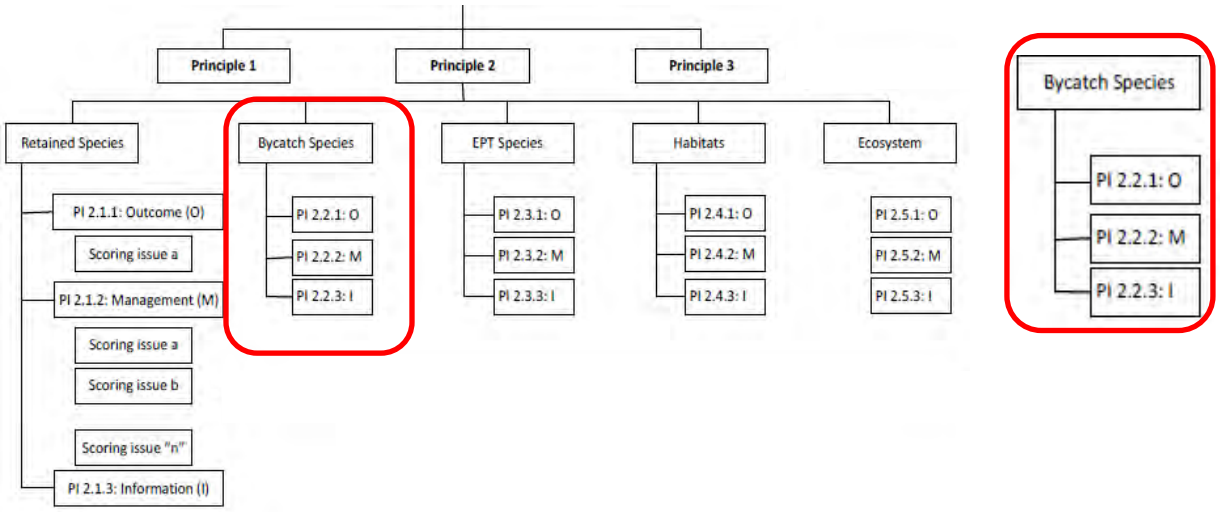
Discard and bait use rate are defined as $\frac{discards+bait\ use}{landings}$
UNITS
Metrics to use for calculation: either biomass or numbers. • Instructions indicate to use whichever metric is numerically higher

DISCARD + BAIT USE OVER LANDINGS RATE	DEDUCTION USED TO CALCULATE FINAL CRITERION 2 SCORE
Less than 20%	No deduction
20 – 40%	5% deduction
40 – 60%	10% deduction
60 – 80%	15% deduction
80 – 100%	20% deduction
More than 100%	25% deduction

APPENDIX 2: Marine Stewardship Council Fisheries Certification Requirements and Guidance

The Marine Stewardship Council (MSC) has an ecolabel and fishery certification program, which serves to promote health of world oceans in recognizing and applauding sustainable fishery practices. This contributes to a greater mission in positively influencing choices made in seafood purchases and facilitating collaborations in progressing towards a sustainable seafood market. MSC has intricate criteria for its ecolabel and fishery certification program (outlined in the flowchart below) that hold valuable insights that are worthy considerations in the future goal of clarifying acceptable levels of bycatch criteria for California policy.

MSC Principles & Criteria for Sustainable Fishing (MSC Standard)[44]



The above figure is merely provided to indicate the scope of considerations the MSC Certification considers. Only Bycatch Species (encircled in red) criteria are discussed here.

Principle 2: Environmental impact of fishing

Principle 2 Mission Statement[45]

Fishing operations should allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species) on which the fishery depends.

This principle considers encompasses many factors aside from bycatch (i.e. habitat ecosystem, ETP species and primary species), but for the following overview will only focus on the requirements for Bycatch species.

[44] MSC Fisheries Certification Requirements and Guidance (October 2014). Page 377.
[45] MSC Fisheries Certification Requirements and Guidance (October 2014). Page 7.

Assessment Procedure for Bycatch Species

The assessment procedure for bycatch species considers three major factors.

- Bycatch Species Performance Indicators (PI)
  - PI 2.2.1 – Secondary Species Outcomes
  - PI 2.2.2 – Secondary Species Management Strategy
  - PI 2.2.3 – Secondary Species Information

PI.2.2.1 Secondary Species Outcomes[46]

OUTCOME STATUS: The unit of assessment[47] aims to maintain secondary species above a biologically based limit and does not hinder recovery of secondary species if they are below a biologically based limit

ASSESSMENT COMPONENTS

- Main secondary stock status[48]
- Minor secondary species stock status

MINIMAL REQUIREMENTS	HIGHER SCORES REWARDED WHEN:
Biologically based limits • Main secondary species is likely above its biological limits • If below biologically based limits, measures at least need to be in place to ensure that there is not a hindrance in recovery and rebuilding	*Greater data confidence* • Main secondary species is "highly likely" or has a "high degree of certainty" of being above biological limits *Management robustness* • Measures in place with evidence of recovery or demonstrably effective partial strategy in place (For species below biological limits) *Consideration of minor secondary species* • Minor secondary species are highly likely to be above biologically based limits • Evidence that unit of assessment for certification does not hinder recovery and rebuilding of minor secondary species

PI.2.2.2 Secondary Species Management Strategy[49]

[46] MSC Fisheries Certification Requirements and Guidance (October 2014). Page 142.

[47] Unit of assessment varies based on what is being assessed in a given certification process. Could refer to: target stock, fishing method, gear type, and/or practices, fishing fleets/groups of vessels, or individual fishing operations pursuing stock, and any other eligible fishermen. Unit of assessment defined in MSC Fisheries Certification Requirements and Guidance (October 2014). Page 25.

[48] Main species is defined by catches at 10% or more than the total catch by weight of the unit of assessment. MSC Fisheries Certification Requirements and Guidance (October 2014). Page 89.

Management strategy: There is a strategy in place for managing secondary species that is designed to maintain or to not hinder rebuilding of secondary species; and the unit of assessment[50] regularly reviews and implements measures, as appropriate, to minimize the mortality of unwanted catch	
ASSESSMENT COMPONENTS	
• Management strategy in place • Management strategy evaluation • Management strategy implementation • Shark finning • Review of alternative measures to minimize mortality of unwanted catch	
MINIMAL REQUIREMENTS	**HIGHER SCHORES REWARDED WHEN:**
Management Strategy • Measures in place (if necessary) to maintain acceptable limits, or not hinder rebuilding of main secondary species to levels above biologically based limits • Measures are considered likely to work	*Management robustness, confidence, and implementation* • Partial or full strategy in place to rebuild or maintain main secondary species[51] above biological based limit levels • Objective basis for confidence, or high confidence, that partial/full strategy will work • Some/clear evidence that partial/full strategy is implemented successfully • Evidence of achieving overall objective
No Shark Finning Likely that shark finning is not taking place	*Higher Confidence in No Shark Finning* • Highly likely/high degree of certainty that shark finning is not taking place
Consideration of alternative measures • There is a review of potential effectiveness and practicality of alternative measures to minimize mortality of unwanted catch of main secondary species	*Review frequency* • There is regular/biennial review of potential effectiveness and practicality of alternative measures to minimize mortality of unwanted catch of main secondary species • Review is implemented as appropriate

P1.2.2.3 Secondary Species Information[52]

Information on the nature and amount of secondary species taken is adequate to determine the risk posed by the unit of assessment[53] and the effectiveness of the strategy to manage

[49] MSC Fisheries Certification Requirements and Guidance (October 2014). Page 144.

[50] Unit of assessment varies based on what is being assessed in a given certification process. Could include: target stock, fishing method, gear type, and/or practices, fishing fleets/groups of vessels, or individual fishing operations pursuing stock, and any other eligible fishermen. Unit of assessment defined in MSC Fisheries Certification Requirements and Guidance (October 2014). Page 25.

[51] Main species is defined by catches at 10% or more than the total catch by weight of the unit of assessment. MSC (October 2014). Page 89.

[52] MSC Fisheries Certification Requirements and Guidance (October 2014). Page 146.

secondary species	
ASSESSMENT COMPONENT	
• Information adequacy for assessment of impact on main secondary species[54] • Information adequacy for assessment of impacts on minor secondary species • Information adequacy for management strategy	
MINIMAL REQUIREMENTS	**HIGHER SCORES REWARDED WHEN:**
Impact estimations • Qualification information is adequate to estimate the impact of the unit of assessment on secondary species status *Management Strategy* • Adequate information to support measures to manage secondary species	*Greater data confidence* • Quantitative information is available and adequate to assess with a high degree of certainty the impact of the unit of assessment on secondary species *Management Robustness* • Information is adequate to support a partial or full strategy to manage main/all secondary species • Evaluations with high degree of certainty of achieving management objective *Consideration of minor species* • Some quantitative information is adequate to estimate the impact of the unit of assessment on secondary species with respect to status

[53] Unit of assessment varies based on what is being assessed in a given certification process. Could refer to: target stock, fishing method, gear type, and/or practices, fishing fleets/groups of vessels, or individual fishing operations pursuing stock, and any other eligible fishermen. Unit of assessment defined in MSC Fisheries Certification Requirements and Guidance (October 2014). Page 25.

[54] Main species is defined by catches at 10% or more than the total catch by weight of the unit of assessment. MSC Fisheries Certification Requirements and Guidance (October 2014). Page 89.

Santa Monica Bay
Pier Stakeholders Summit
May 7th, 2015

Welcome and Introductions by Fish & Game Commission and Heal the Bay

30+ attendees of stakeholder group include municipalities, pier fishing community, state agencies, academics, NGOs, sport fishing community, lifeguards, surfers, aquaria, and public safety. Main reason meeting – July 5th, 2014 white shark hooked, agitated, swimmer bit, public safety issue, MB closed, and conflict between users. Santa Monica Bay beach cities and stakeholders concerned about potential conflicts between anglers, swimmers, surfers, ocean wildlife (sharks, sea lions). How do we prevent something like that happening again, without piers closing?

Objectives:

1. **Share education and knowledge of fishing, wildlife, and ocean recreation conflicts**
2. **Research and gather anecdotal information on how each pier is used**
3. **Review existing pier management documents/existing regulations**
4. **Develop pier management plans/joint management plan for the Bay**
5. **Create a report of pier management strategy to present at FGC**

1. Informational Items

a. Presentation: Frankie Oralla – Heal the Bay – Shark Ambassador Program

Following the shark bite incident in Manhattan Beach in 2014 and subsequent closing of the MB Pier, Heal the Bay decided to build upon existing Pier Angler Outreach Program, by creating a pilot Shark Ambassador Program to educate pier anglers of Santa Monica Bay about local shark populations and sustainable fishing techniques. Program partners and funders of the pilot project stepped up, including the City of Manhattan Beach, City of Santa Monica, County of Los Angeles, City of Hermosa Beach, and the City of Redondo Beach. In the fall of 2014, Heal the Bay staff trained as "Shark Ambassadors" approached anglers to educate fishermen and collect survey information. Through outreach to over 700 anglers, outreach included distributing educational materials focused on responsible fishing techniques, how to avoid catching large sharks and what to do if a shark is caught. Through survey questions to anglers, Heal the Bay also collected information on demographics, targeted species, caught species and other recreational activities at all Santa Monica Bay piers. Besides fishing, the study also looked at other recreational activities that occur near the piers. According to the research, Manhattan, Hermosa and Venice piers all have a high potential for interaction among anglers, surfers and swimmers. A report of the findings can be found here: http://www.healthebay.org/blogs-news/angling-solution-shark-fishing-piers

b. Presentation: Dr. Chris Lowe – Cal State Long Beach Shark Lab - Sharks of Santa Monica Bay

Santa Monica Bay is unique with nearshore sandy habitat, rocky reef habitat, and as sharks make migratory paths they will pass by sandy beach habitats. Seasonal migrating sharks are caught off local piers. White sharks – typically pups that we are seeing nearshore – are usually found just outside the surf break; sub-adult and adult typically offshore islands. Mako and salmon sharks easily mistaken for white sharks. White sharks, mako, thresher, salmon, and blues use the southern California Bight – primary nursery that ranges from oceanic to coastal areas. Populations are recovering with fisheries management and more people are using the ocean. These sharks are highly vulnerable to overfishing – life history characteristics similar to humans. CA passed protection of white sharks in 1994; and near shore gill net ban same year. Satellite tagging gives snapshots of what is going on-acoustic receivers show a high number at Will Rogers State Beach, Manhattan Beach Pier increased (shifted from Malibu). Return of the predators has taken decades - better water quality and fisheries management has allowed for ecosystem recovery. Now we need to get used to sharing ocean with large predators – public not used to large predators over the last 2-3 decades. Is it safe? Attacks in Southern California are extremely rare - more people in water but number of attacks not going up. Big adult predatory sharks avoid most populated area. Juvenile white sharks use our coastal beaches and need to make sure that continues by not chasing or harassing sharks. Best tool

is education, population (human and shark) is going to increase, so we have to be smart and share the water. https://www.csulb.edu/explore/shark-lab

2. Stakeholder discussion: Issues identified at piers

- **a.** Shared issues: Getting regulations to pier anglers is a challenge; Gear size/line type- debate on monofilament VS steel; Swimming/surfing around piers; Treble hooks; Snagging
- **b.** Malibu Pier: Concerned about fishing activities attracting birds and reducing water quality
- **c.** Santa Monica Pier: Concerned about fishing activities attracting birds and reducing water quality; No chopping bait on SM Pier
- **d.** Redondo Pier: No swimming, surfing in the U-shaped part and within 25 yards of the pier; Fishing and ocean recreational use not a problem; 24 hours a day, the pier is open. Pier jumping at night is an issue. Lobster snagging at night
- **e.** Manhattan Beach Pier: Group of 20-30 people causing the problems at night; Police and fishermen not totally clear on regulations and causing arguments; Police officer and fisherman made sheet with CDFW codes, laminated it, and handed out to officers and fishermen; Crux of conflict between ocean swimmers/surfers and pier anglers targeting sharks
- **f.** Hermosa Pier: Fishing-related litter; No overhead casting; 200 foot buffer around pier – swimming and surfing; No bicycles, animals, smoking – these regulations have more violations than fishing; Fishing – issue of deliberate fishing for sharks and how to address that. Safety-risk. Don't want to see that happening in Hermosa. Concerns with steel, heavy lines- what are our options there? Hermosa decision-makers would like to see some regulations around monofilament vs steel. No steel leaders on the pier.

3. Stakeholder discussion: Ideas/Solutions proposed by stakeholders

- **a.** Better education handouts on piers → forming a committee
- **b.** Cal-tip on pier signs
- **c.** Building a support-system on the piers/relationship-building/stewards/docents to relay info.
- **d.** Pier-buck, angler-to-angler giving positive reinforcement
- **e.** Compile pier use data: Maria/Redondo Sea Lab, Shark Ambassador Program, FCEC surveys, Rec Fin
- **f.** Line cutters
- **g.** Restricting steel leaders at MB and HB Piers
- **h.** What about some common sense best practices that we can agree on? Not saying new regulations or policies- more about what the best thing to do in certain scenarios would be.

4. Other Topics/Comments:

- **a.** Can swimmers be kept out of water around pier when a shark is sighted? Clarifying swimming/surfing around piers, Dan Murphy/ LA Co Fire and Lifeguards: Constitutional right to swim in the waters, unless there is a safety risk. County Code 17.12.480 Sailboards, kite boards, surfboards, paddleboards, ocean kayaks, surf skis, rigid hull surf-craft, and similar objects—Use Restrictions: G. No person shall swim, surf, skin dive, scuba dive, or otherwise recreate in the Pacific Ocean within 100 feet of any pier. This code would apply at county beaches, so it does not apply at Malibu, Santa Monica, Venice or Hermosa Beach but could be enforced at Manhattan and Redondo. Generally, this is the case in Redondo. It is enforced there but doesn't really impact the fishing community because the fishing isn't done near the sandy beach on the south side that is used by beachgoers. At Manhattan Beach, swimming is prohibited on the south side and we keep them about 300 feet away from the pier (if they enter from the sand). We don't chase after swimmers who are off shore and rounding the end of the pier. On the North side, we will set up flags dependent on the current to keep swimmers away from the pilings. Thirty yards is pretty typical, but again, we don't chase down the people coming around the pier. The area of contention regards surfers. We do not actively pursue surfers who get close to the pier unless they demonstrate a lack of skill that puts them at risk.
- **b.** Aquarium/Ocean User Rep: We need to change as nature changes. Monofilament vs steel lines/leaders. Steel leaders keep a shark on the line- let's revisit those on MB and HB.

- **c.** Pier Fishing Rep: If you want to change the fishing regulations in the area due to sharks, then you need to change the ocean recreation allowed too.
- **d.** How can we dissuade anglers from targeting white sharks? It is illegal to target white sharks.
- **e.** What about thinking about things seasonally? Example: swimmers in the water between Manhattan and Hermosa in June-July or Seasonality of sharks- certain times of year where steel leaders shouldn't be in the water?
- **f.** Keep in mind local traditions and customs to create a way we can get along and share the water.
- **g.** This is a work in progress, we are just starting to meet. You can tell other stakeholders that we're working on it, and they can speak up with solutions and ideas.
- **h.** Best practices for ethical fishing around white sharks includes: No steel leaders, Cut leader as close to mouth as possible- but hard to do on piers, Use "line cutter" (tied to a rope, drop it down the line, swirl it around and cut the line)
- **i.** Can there be a compromise for a couple specific piers (MB and HB) and look at not using steel leaders there? How do the fishing stakeholders feel about this?
    - i. Want to see consistency with pier regulations up and down the state
    - ii. Can you outlaw targeting big game on piers? Don't want to see eliminating a way to catch legal big game b/c we want to reduce chance of catching illegal fish

5. Looking Forward:

- **a.** Form Education Materials & Outreach Group: Linda Chilton (USC Sea Grant), Ryan Denton (CDFW), Tom Raftican (Sport fishing Conservancy), Eric Martin (Roundhouse Aquarium on MB Pier), Rebecca Hartman (CDFW enforcement), Frankie Orrala (Heal the Bay), Sonke Mastrup (FGC)
- **b.** Issues: people (both anglers and police) not knowing fishing regs, undersize, contamination
- **c.** Outreach Materials: need outreach materials that are multi-lingual, waterproof, streamlined/simple, common species and limits, ruler, species photos, cal-tip info. What already exists? Do we want SM Bay-wide? Do we want each pier-specific?
- **d.** Share notes from meeting.
- **e.** Start creating report based on communications at this meeting, BMPs on pier use, fishing, etc.
- **f.** FGC sending letter to all pier management municipalities with state regulations.