Evaluation of the California Halibut Trawl Grounds

California halibut, *Paralichthys californicus*.
Photo credit: S. Lescht-Smith, CDFW

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Contributors: Travis Tanaka, Shoshana Lescht-Smith, Kirsten Ramey, Paul Reilly, Michael Patton, Matthew Warren

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LIST OF ACRONYMS

CCR	California Code of Regulations
CHTG	California Halibut Trawl Grounds
EFI	Essential Fishery Information
ERA	Ecological Risk Assessment
ESR	Enhanced Status Report
FGC	Fish and Game Code
FMP	Fishery Management Plan
IUCN	International Union for Conservation and Nature
LE	Limited Entry
MLMA	Marine Life Management Act
MPA	Marine Protected Area
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OA	Open Access
PSA	Productivity Susceptibility Analysis
WCGOP	West Coast Groundfish Observer Program

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EXECUTIVE SUMMARY

Background

The Marine Life Management Act (MLMA) (Fish and Game Code (FGC) Sections (§) 7050-7090) provides for the conservation, sustainable use, and restoration of California's living marine resources. It requires an ecosystem-based approach for managing the State's fisheries, using the best available science, and involving stakeholders in a comprehensive and transparent process. The 2018 MLMA Master Plan for Fisheries (Master Plan) provides guidance and a toolbox for implementing MLMA goals and objectives, and it is the Department of Fish and Wildlife's (Department) primary guidance document for managing state finfish, invertebrate, and algal commercial and recreational fisheries.

The California Halibut Trawl Grounds (CHTG), created through legislation in 1971, has provided trawl fishermen nearshore soft bottom access to target California halibut, *Paralichthys californicus* (halibut) off the coast of Santa Barbara and Ventura counties. Current legislation requires the Fish and Game Commission (Commission) to evaluate trawl gear effects on specific Performance Criteria contained within FGC (§8495). The first and last evaluation of the CHTG occurred in 2008.

Recent legislation modified FGC §8495 creating potential trawl grounds off San Luis Obispo County and within Monterey Bay. Trawl fishermen local to these areas have asked the Department and Commission to take action to open these areas to halibut trawl fishing. Concurrently, stakeholders requested the Commission to assess the southern CHTG as required in FGC. FGC §8495 requires the Commission to close any area within the CHTG where trawl gear: 1) does not minimize bycatch; 2) is likely damaging the seafloor; 3) is adversely affecting ecosystem health; or 4) impedes restoration to kelp, coral, or other biogenic habitats (Performance Criteria).

Fishery Performance Criteria

In 2021, the Department proposed to assess the existing and new sections of the CHTG, using the performance criteria in FGC §8495(e). While the new sections were created by the Legislature, statute requires these areas remain closed to trawling unless the Commission takes action to open them. Department staff evaluated the potential permitting pathways to allow commercial trawling to occur as part of an evaluation effort within the new trawl grounds off Port San Luis and within Monterey Bay. A Scientific Collecting Permit could allow for the activity to occur; however, the sale of the trawled catch would be prohibited, which would be cost prohibitive for permittees to participate. An Experimental Fishing Permit is a program that is intended to support exploratory fishing and limited testing in commercial and recreational marine fisheries; however, the

statutory language for the program limits bottom trawling to locations where bottom trawling is already an authorized fishing activity. Due to these constraints of existing regulations and statute, the Department paused efforts on evaluating the new trawl areas and proceeded with evaluating the existing southern CHTG in 2022. The data collected and analyzed in this study will provide the Commission with information to determine if the CHTG fishery meets the mandated Performance Criteria and could provide the Commission with guidance on how to evaluate the additional potential trawl areas.

Department staff observed 29 tows, documenting catch and disposition (live or dead) of available catch according to the Performance Criteria. Staff counted and assessed 21 invertebrate and 34 finfish species totaling 2,152 organisms. Of the 2,152, 77.9% were assessed as live and released, 12.9% were assessed as dead, and 9.2% were retained and sold. No finfish or invertebrate species of concern were caught, and no significant bottom contact was evident. While California sea lions, *Zalophus californianus*, were observed taking fish from the net and following the vessel, none were observed to be caught, injured, or killed during the study. No marine birds were observed by staff to be caught, injured, or killed during the study.

Performance Criteria 1. Does not minimize bycatch

One of the key ecosystem-based objectives in the Master Plan is to characterize bycatch of nontarget organisms in California's fisheries and develop appropriate management measures to minimize impacts to habitats and species. The Department used the four-step process, as outlined in the Master Plan, to identify bycatch from the halibut trawl fishery and assess its potential impacts on sustainability and the ecosystem within the CHTG:

1. collection of information on the types and amounts of bycatch.
2. distinguishing target, incidental, and bycatch species.
3. determining "acceptable" types and amounts of bycatch and
4. addressing unacceptable bycatch.

During the evaluation, staff observed 29 tows over nine trawl trips aboard permitted trawlers fishing in the CHTG during the period July 2022 through March 2023. To assess Performance Criteria 1, staff counted and assessed (live or dead) 21 invertebrate species and 34 finfish. No finfish or invertebrate species of special concern, marine mammals, or birds were taken or injured. Of the 2,152 organisms counted, 77.9% were assessed as live and released and 9.2% of species caught were retained and sold. Based on total count, staff used the bycatch criteria from the Master Plan to evaluate the top ten bycatch species encountered during the observation period.

Discard mortality observed during the 29 tows for all assessed species combined, was 12.9%. California sea lion, *Zalophus californianus,* induced mortality on finfish and debris plugging the cod-end mesh contributed to an overall increased mortality percentage. The plugged cod-end had the greatest effect on small finfish species.

Using West Coast Groundfish Observer Program (WCGOP) data for the last five years (2018-22), observers documented 148 finfish and invertebrate species, including species groups, from trawl tows within the CHTG. WCGOP does not assess for disposition and except for a few species, all other species have a default mortality rate of 100%. Noted finfish species of concern were five giant sea bass, *Stereolepis gigas* and one soupfin shark, *Galeorhinus galeus*. WCGOP observers also take data on marine mammals and seabird interactions. Observers documented four California sea lions and eight Brandt's cormorants, *Phalacrocorax penicillatus* were observed entangled or killed by trawl gear while fishing within the CHTG.

Performance Criteria 2. Likely damaging the seafloor

The CHTG is located in the Santa Barbara Channel (SBC) over a shallow, broad shelf with an average depth of 28 fathoms. The total area of the CHTG is 172.05 nm^2. The seafloor within the CHTG is comprised of approximately 98.7% soft substrate and 0.92% hard substrate. The Department utilized logbook data to evaluate fishing locations. Additionally, the Department reviewed information prepared by the National Marine Fisheries Service (NMFS) that indicates that habitat impacts by bottom trawl gear in areas where California halibut trawling occurs have the lowest sensitivity classification for impacts to seafloor habitat by bottom trawl gears. Mean recovery time for trawl gear impacts in the CHTG is estimated by NMFS to be less than one year in the absence of continued fishing (CDFG 2008).

Staff observed net retrieval at the conclusion of every tow looking for evidence of significant bottom contact. The only consistent signs of direct bottom contact were where rust was removed from hanging chains on the foot rope and the bottom, leading edge of the trawl doors. This contact was consistent with the results from a 2013 NOAA study where bottom contact with light touch trawl gear was documented with GoPro cameras mounted on the head rope and trawl doors (Wick et al. 2014). Video analysis showed the footrope skimmed the bottom without contact. The footrope was seen going over the top of several flatfish and crab. Light touch trawl doors were shown to have minimal contact, depending on the contour of the soft bottom.

Performance Criteria 3. Adversely affecting ecosystem health

There are no agreed upon quantitative measures of ecosystem health that can be specifically applied to this fishery. Current state and federal halibut management measures were not implemented to specifically address ecosystem management,

although the current management measures may collectively foster a sustainable bottom trawl fishery and indirectly promote a healthy ecosystem by reducing potential fishery impacts on the system. These measures include:

- Limited entry program to control fishing capacity
- Logbook program to monitor catch location and effort information
- Seasonal closure in the CHTG to protect spawning adults
- Minimum size limit of 22 inches total length (TL) to allow spawning before being available to the fishery
- Within the CHTG, minimum cod-end mesh size of 7.5 inches in length and cod-end not less than 29 meshes long and 47 meshes in circumference to reduce bycatch of immature fish
- Area restrictions (Essential Fish Habitat [EFH] and non-trawl zone)
- Federal at-sea observer coverage to document catch, discards, and bycatch
- Federal and state incidental trip limits for non-target groundfish and non-target halibut to minimize mortality of overfished groundfish species and non-target species
- If taking groundfish in the CHTG and transiting federal waters, or fishing with trawl gear in federal waters, vessel monitoring system is required

The Master Plan provides guidance on how to apply the principles of ecosystem-based fisheries management when making management decisions and identifies a three-step practical approach, including additional inquiries, to managing ecosystem health:

Step 1. Identification of species that play key roles in the ecosystem.

There are many finfish and invertebrate species that utilize the soft bottom habitat of the CHTG. Based on species observed by Department staff and those within the WCGOP dataset, staff identified their key roles and ecological function.

Step 2. Consider management strategies with multiple control measures.

Staff identified management strategies and subsequent control measures which ensure ecosystem health. All control measures are currently in place as regulations governing fishing in the CHTG.

Step 3. Conduct ecological risk assessments (ERA) to understand which links are most critical.

Department subject matter experts identified and scored ERA attributes on multiple fisheries, including halibut trawl. For halibut trawl, the risk to species was considered high, mostly due to high scores for the bycatch and habitat attributes. Samhouri et al. (2018) found that bycatch risk for this fishery was higher compared to other fisheries

evaluated due to the amount of bycatch and perceived relative mortality. Similarly, risk to habitat was considered high for halibut trawl due to possible impacts to soft bottom and structure forming invertebrates (Samhouri et al. 2018). The authors noted that while risk was elevated, soft bottom and habitat forming invertebrates are not that sensitive. Samhouri et al. (2018) suggested that regional ERAs would improve accuracy and are better to address local issues.

Performance Criteria 4. Impedes restoration to kelp, coral, or other biogenic habitats

Giant kelp, *Macrocystis pyrifera* is the dominant canopy-forming kelp species in southern California. Aerial surveys of coastal kelp beds since 1989 have not shown kelp beds in the CHTG, although it can be found in adjacent waters. At least four taxa of coral or coral like species occur in waters within and adjacent to the CHTG, and all but sea pens require hard substrate for attachment. Coral habitats are susceptible to damage from bottom trawling, however direct study of the areas impacted by the halibut trawl fleet in the CHTG has not been done. While trawlers generally avoid hard substrate where corals are found, trawling does occur on the soft substrate where sea pens occur.

The MLMA (FGC §7056(b)) emphasizes the importance of habitat protection and that protecting habitat from potential fishery impacts is essential for preserving healthy and productive marine resources. The Master Plan provides guidance on assessing and addressing potential impacts to achieve the goal of protecting habitats. Staff used the current halibut Enhanced Status Report (ESR) to address the Master Plan's three steps:

Step 1. Describe the habitat utilized by the target species at each life stage.

Step 2. Describe the threats to the habitat utilized.

Step 3. Minimize or mitigate adverse effects fishing activity may have on habitat.

Based on up-to-date information on sensitive habitat, staff mapped current locations and calculated coverage within the CHTG. Mapping showed no kelp habitat within the CHTG and that biogenic/hard bottom habitat within the CHTG was minimal at less than 0.9% coverage. Trawl tows from both vessel logs and Department observations were also mapped to show that the fishermen avoid these sensitive habitats.

INTRODUCTION

Trawling, an effective method for catching California halibut, *Paralichthys californicus,* (halibut), is allowed only in Federal waters and designated trawl ground areas within State waters. Legislation (Fish and Game Code (FGC), Sections (§)8494 to 8497) created the original California Halibut Trawl Grounds (CHTG) in 1971. The original trawl grounds were described as not less than 1 nautical mile off the coast of Santa Barbara and Ventura counties. Subsequent legislative amendments modified the scope and dimensions of the CHTG. In 2004, Senate Bill 1459 was passed, which amended FGC §8495 and §8842, and added §8494 and §8841.

FGC §8495(e) required the Fish and Game Commission (Commission) to review every 3 years, beginning January 1, 2008, information from the groundfish observer program, monitoring information, and any other relevant research, and close any area within the CHTG where trawl gear: 1) does not minimize bycatch; 2) is likely damaging the seafloor; 3) is adversely affecting ecosystem health; or 4) impedes restoration to kelp, coral, or other biogenic habitats. The Department of Fish and Wildlife (Department) considers these four factors as Performance Criteria*,* which are described below in the Methods section of this report. The Department evaluated the four CHTG sub-areas (A-D) which were defined in 2008 (Figure 1) with the caveat that they must meet the Performance Criteria.

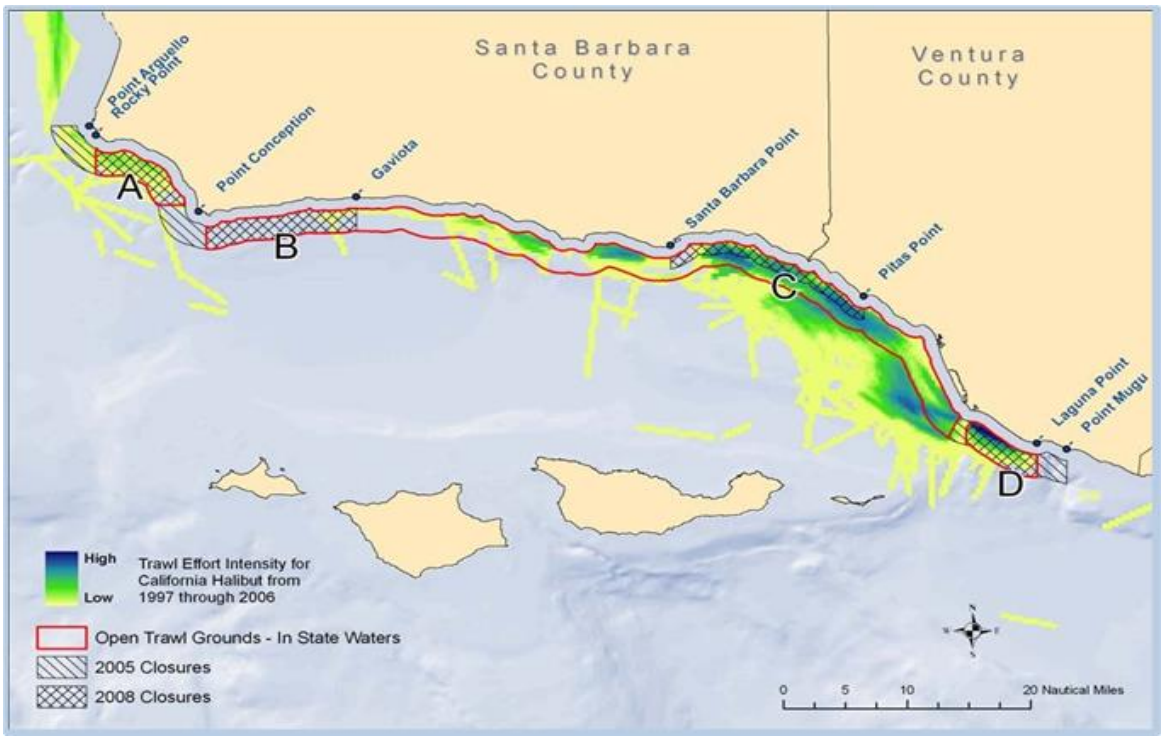

Figure 1 Southern California Halibut Trawl Grounds, including trawl activity based on logbooks, pre-2008. The areas A, B, C, D were evaluated for possible closure by the Commission if performance criteria were not met (CDFG 2008).

In 2008, the Department completed the first evaluation and produced The Review of California Halibut Trawl Fishery in the California Halibut Trawl Grounds that was provided to the Commission at their June meeting (CDFG 2008). As a result of that analysis, the Commission adopted a closure of one sub-area within the CHTG, located between Gaviota and Point Conception (Figure 1, area B). This area, based on data at the time, had the highest percentage of hard bottom substrate and smallest economic benefit. The Commission found that the halibut trawl fishery satisfied the Performance Criteria in the three other subareas and no other changes were made. Since the first evaluation in 2008, the CHTG have not been reviewed.

In 2018, Senate Bill 1309 (which became FGC §8495 (a)(2) and (a)(3)) created two additional CHTG areas within State waters, one in the formerly trawled area of Monterey Bay and the other near Port San Luis (San Luis Obispo County). While created in FGC, both areas remain closed to trawling since neither area has been fully assessed. Industry has requested the Commission open these new areas so Monterey Bay and Port San Luis trawl fishermen can fish their local trawl grounds. Concurrently, stakeholders requested the Commission to assess the southern CHTG as required in FGC. In 2021, the Department proposed to assess the existing and new sections of the CHTG, using the Performance Criteria in FGC §8495(e). However, due to constraints of using trawl gear in a closed area and the inability to sell fish taken under a scientific study, the Department paused efforts on evaluating the new trawl areas and proceeded with evaluating the existing southern CHTG (Figure 2) in 2022.

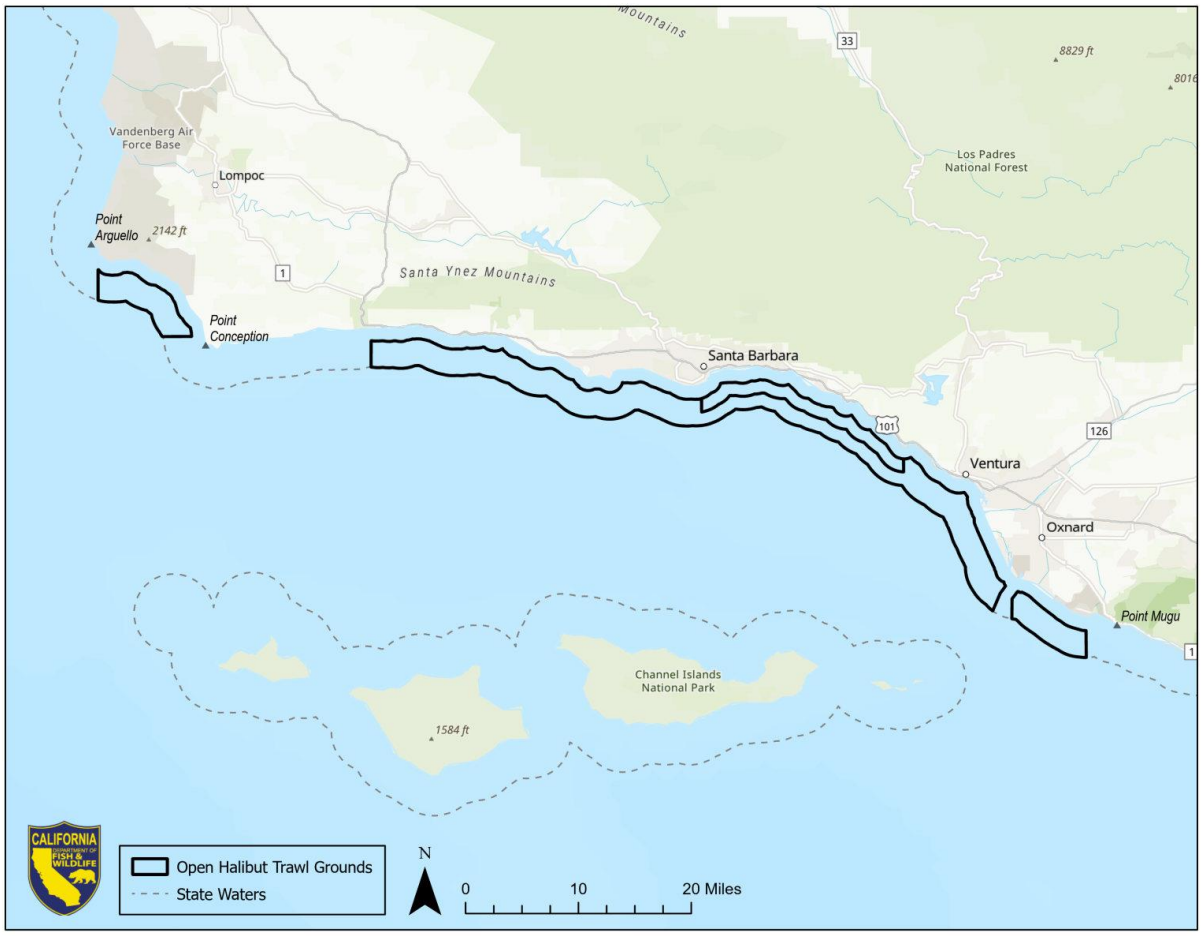

Figure 2 Current California Halibut Trawl Grounds

Overview of the Southern Trawl Fishery

Halibut is an important flatfish species in the commercial fisheries of central and southern California. Historically, the trawl fishery operating within the CHTG was a low-volume, high-price fishery that supplied local seafood restaurants with a live product that generally commanded a premium price about 1.5 times greater than a dead product. This component of the fishery was developed in the early 1990s, continuing into the mid-2000's, and was unique because the tow duration for live halibut is approximately a third of the average tow duration for the northern dead fish fishery. However, the live halibut fishery ceased in the early 2010's due to a decline in market demand for live halibut and competition for market share by lower priced halibut imports. Despite these challenges, a small vessel CHTG fishery continues to supply fresh and local halibut to consumers, utilizing the same short tow duration to provide a high-quality product.

Fleet Profile

Statewide, there are 41 Halibut Bottom Trawl state permitted trawlers (2022-23 license year) with vessel lengths up to 71 feet (ft). These vessels operate from federal waters near San Francisco to federal waters off southern California and within the CHTG. Groundfish trawlers, using conventional trawl gear in federal waters, may land up to 150 pounds (lb) of incidentally taken halibut without a Halibut Bottom Trawl Permit. Halibut trawlers with groundfish and Halibut Bottom Trawl Permits are considered Limited Entry (LE) under federal standards and trawlers without a groundfish permit are classified as Open Access (OA). In 2011, all West Coast Groundfish Observer Program (WCGOP) observed data from LE trawl activities, whether groundfish or halibut, were included in catch share trawl estimates (Jannot et al 2021). As of 2023, the halibut trawl fishery has seven LE trawlers, but none have been active in the halibut fishery since 2013 (Somers et al. 2023). South of Point Arguello, there are 14 state permitted trawlers with vessel lengths from 26 to 50 ft with an average length of 41 ft. Of the 14, 11 trawlers have home ports within the area of the CHTG (CDFW 2022). Vessels are usually fished with a single fisherman; some may take a deckhand. However, not all permitted trawlers are active in the fishery.

CHTG Regulatory History and Current Regulations

The laws governing the CHTG reside in FGC and Title 14, California Code of Regulations (CCR). Since 1971, the design of the CHTG off the Santa Barbara coast and laws governing trawl fishing have changed (Table 1). No vessel can use bottom trawling gear without a state or federal permit. FGC §8494 requires anyone who uses bottom trawl gear in state-managed halibut fisheries to possess a Halibut Bottom Trawl Permit issued by the Department. A total of 61 permits were initially issued in 2006 and through attrition these permits have decreased in number. For the 2022-23 license year, there were 41 Halibut Bottom Trawl permits renewed. There is a 3-month seasonal closure (March 15-June 15) for trawl gear within the CHTG.

Table 1 Rules governing trawl fishing within the CHTG (CDFW 2022).

Year enacted	FGC section	Action
1971	8495	California Halibut Trawl Grounds (CHTG) creation, 1 nautical mile (nm) minimum from shore and 25 fathoms (fm) maximum depth. Point Arguello (Santa Barbara Co) to Point Mugu (Ventura Co).
1971	8496	Established CHTG season of June 1-January 30. Amended in 1972 to open season of June 16-March 14.
1971	8497	Gives Director authority to close any part of the CHTG if irreparable damage to the halibut resource or other fishery operations were to occur due to trawl nets.
1972	8843	Minimum cod-end mesh of 7.5 inches (in) required.
1989	8495	25 fm maximum depth removed.

Year enacted	FGC section	Action
1993	8495	3 nm seaward boundary established.
2005	8495	Area closures at Point Arguello, Point Conception, and Point Mugu. These areas account for 13% of the CHTG.
2008	8495	Four sub-areas identified for possible closure (additional 42%). Performance criteria to evaluate trawling in the CHTG established. The Commission was granted authority to close any of these areas if Performance Criteria were not met. Only one sub-area (B) has been closed. Requires a review of the CHTG every 3 years.
2008	124	Defines and requires light touch trawl gear within the CHTG.
2018	8495	Additional CHTG areas created off Port San Luis and within Monterey Bay. Areas to remain closed unless the Commission takes action to open these areas to halibut trawl fishing.

Permitted trawlers must use light touch trawl gear within the CHTG. Required in Title 14 CCR §124(b), light touch trawl gear limits door weight to 500 lb, requires 7.5-in cod-end mesh, and prohibits use of rollers or bobbins. Nets are also constructed with thinner twine and shall have a maximum headrope length of 90 ft. Drop loop chains (Figure 3) are allowed and commonly used by fishermen.

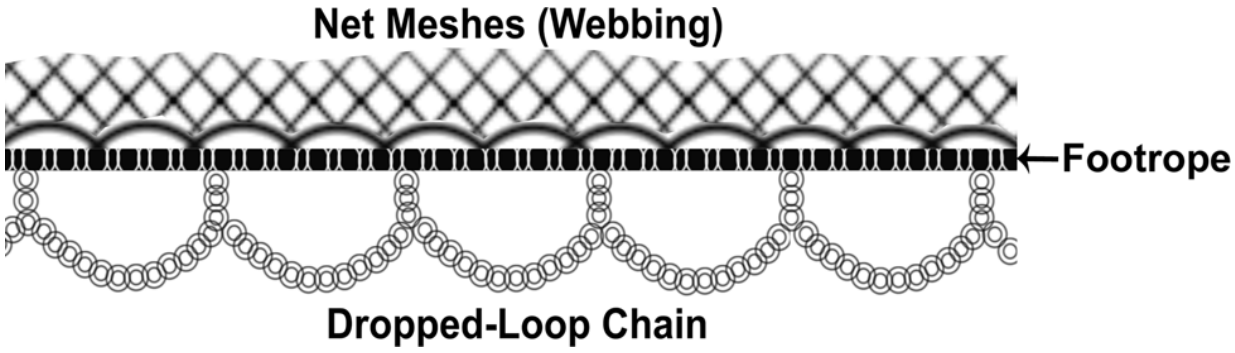

Figure 3 Example of dropped-loop chain common on light touch trawl gear (CDFG 2008).

While each fisherman will design and make their nets to comply with legal standards, each fisherman's net is a variation of the paranzella net (Figure 4).

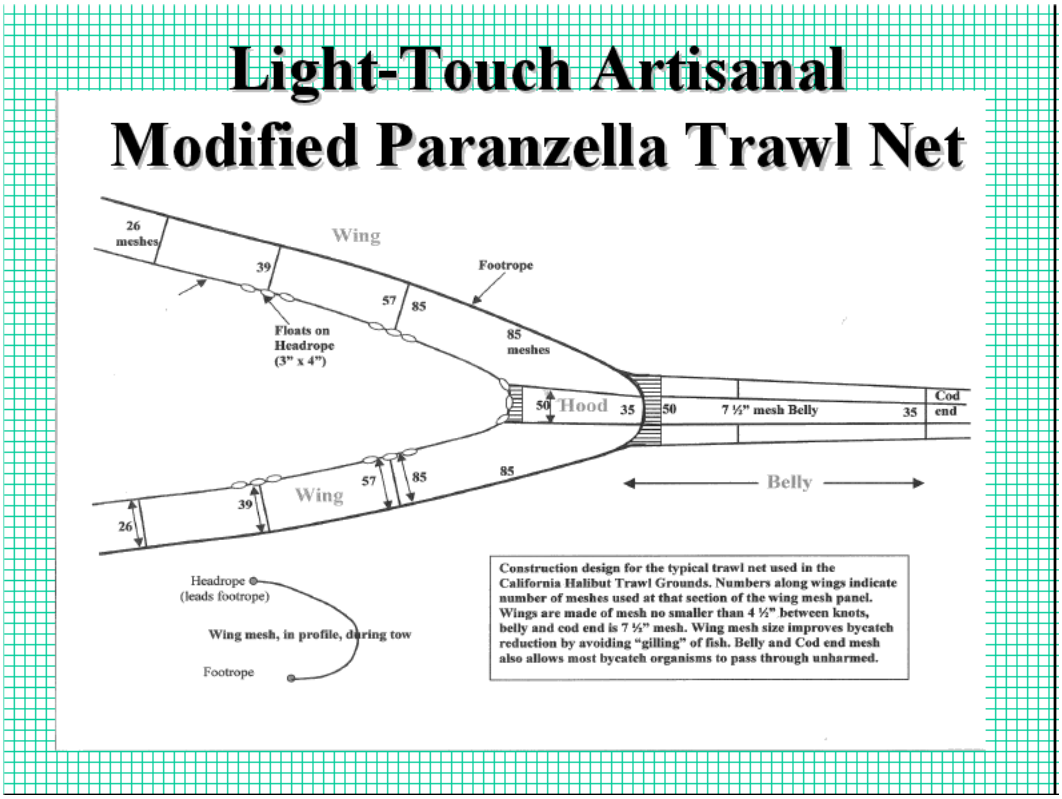

Figure 4 Diagram of a light touch trawl paranzella net (CDFW 2022).

Vessel operators are required to self-report fishing activities through a mandatory logbook and submit these monthly to the Department. Trawl vessels are also subject to mandatory observation by NMFS' WCGOP due to the incidental capture of groundfish species. WCGOP observers document discarded species and encountered protected species (including marine mammals and sea birds) and collect biological data depending on management needs. Historically, median observer coverage for the statewide OA halibut trawl fleet is 7% with coverage of 4% in 2022 (Somers et al. 2023). LE coverage is 100%, but none of the vessels have targeted halibut since 2013 (Somers et al. 2023). The data collected by WCGOP observers contributes to fleet level catch estimates produced by National Oceanic and Atmospheric Administration's (NOAA) Fisheries Observation Science Program.

Southern Trawl Landings

Trawl gear is a significant producer of southern halibut catch, second to commercial set gill net and greater than hook and line gear. Halibut trawl catch from the CHTG contributes a majority of southern trawl halibut landings (Table 2) and about 19% of all southern commercial halibut landings.

Table 2 Halibut catch (2018-22) from CHTG compared to catch from southern trawl and all commercial gears combined.

Year	Southern California Halibut Landings All Gears Combined	Southern Trawl Landings All Areas	CHTG Landings Only	CHTG Percentage of Southern Trawl Catch	CHTG Percentage of All Commercial Gears
2018	220,497	65,486	41,412	63%	19%
2019	248,831	54,555	41,786	77%	17%
2020	201,139	49,111	40,950	83%	20%
2021	246,154	59,117	46,334	78%	19%
2022	221,868	49,982	41,435	83%	19%

METHODS

During the CHTG open season of June 16, 2022 to March 14, 2023, Department staff conducted nine observation trips aboard permitted trawlers to document species composition and disposition of catch caught by light touch trawl gear within the grounds. FGC §8495(e) mandates the Commission evaluate information from WCGOP and other available research and monitoring information to determine the acceptability of bycatch, assess seafloor and habitat impacts from trawl gear, determine if trawling negatively effects ecosystem health, and determine if trawling harms coral, kelp, or other biogenic habitats. The statute specifically mandates that special attention be paid to areas with kelp, hard bottom, and other biogenic habitats that may be particularly sensitive to bottom trawl impacts.

Observation day selection and fishing location

Department staff observed trawl trips aboard permitted trawl vessels targeting halibut within the CHTG. With an observation goal of one trip per month, days were selected pending staff availability, weather, and federal observer assignments for that vessel (the latter to avoid duplication of effort). Other scheduling considerations included market orders which dictated delivery dates and each fisherman's availability to fish on the day staff was available.

Onboard observations reflected trawl fishing reality with participating fishermen selecting their trawl locations based on swell direction, depth, forage, previous halibut catch at that location, presence of storm runoff debris, and fuel cost. Tow duration and direction were at the discretion of the fisherman and not directed by the observer. Observers recorded start, mid, and end positions/time and depths for each tow. Mapped in GIS, tow positions were compared to known areas of biogenic habitat and kelp beds.

Onboard catch observation and bycatch assessment

Once the contents of the cod-end from an observed trawl tow were emptied on the deck, Department staff and the fisherman separated catch by species type into bins containing fresh seawater. For high numbers of a single species, a single bin was used for that species. The fisherman would then set course and prepare to set again. All assessed catch remained in bins with fresh seawater and then were released when the next tow was hauled to avoid double counting of individuals. Department staff documented observed catch and discard information to inform bycatch acceptability as directed by the MLMA Master Plan (CDFW 2018).

For each tow, except for legal-sized halibut and marketable finfish, all finfish and invertebrates caught were assessed as live or dead when the contents of the bag were emptied. All finfish and invertebrates were counted and weighed to the nearest 0.1 lb (if possible) in aggregate by species and disposition. Species not retained for market or scientific sampling were released at the end of the preceding tow. All live sublegal-sized halibut were assessed for condition and released. Dead sublegal-sized halibut were retained by Department staff for Essential Fishery Information (EFI) if time allowed for processing. Legal-sized halibut were also sampled for EFI, including collecting otoliths from randomly selected fish for length at age information.

Analysis of WCGOP data

As described briefly above, the halibut trawl fishery is observed by NMFS' WCGOP. Observers document discarded species by counts and weights and retained species by weight (WCGOP 2022). While observers document bycatch species, disposition at time of capture (live or dead) is not recorded, with a few exceptions. Observers also document marine mammal and seabird interactions.

Historic data for evaluation

In 2007, legislation closed state waters within Monterey Bay to trawling for halibut. While this present study was not able to obtain new observer data in this area, a state/federal collaborative study from 2013 on the habitat impacts of light touch trawl gear within Monterey Bay is referenced to provide some perspective. This study (Wick et al. 2014) documented bottom impacts, species composition and disposition, and reviewed economic influence of light touch trawl gear. The Department also conducted two trawl surveys (2007 and 2010) (using 4.5 in. mesh) in the formerly trawled area of Monterey Bay. These surveys documented catch composition. No special status or species of concern were caught during either survey (CDFG 2007; CDFG 2010).

Applying Performance Criteria

Performance Criteria 1. Does not minimize bycatch

The MLMA defines bycatch as “fish or other marine life that are taken in a fishery but are not the target of the fishery. Bycatch includes discards” (FGC §90.5). The MLMA goes on to provide additional clarification on discards to include regulatory discards or discretionary discards. Discarded catch may be returned to the sea alive, dead, or dying, and it is important to assess the mortality rate to evaluate impacts. It is also important to note that while all discards are defined as bycatch under the definition, the discard of live catch may not pose a risk to a bycatch species, and discarding can be an effective management strategy to protect some individuals in which survival is expected to be high. To achieve the goal of minimizing unacceptable bycatch, the MLMA requires that the Department manage every sport and commercial marine fishery in a way that limits bycatch to acceptable types and amounts (FGC §7056). The Master Plan outlines a four-step process to identify bycatch and assess its potential impacts on sustainability, the ecosystem, and socioeconomics:

1. Collect information on the amount and type of catch
2. Distinguish which species are target, incidental, and bycatch
3. Determine acceptable types and amounts of bycatch as prescribed in §7085(b)
    a. Legality of catch
    b. Degree of threat to the sustainability of the bycatch species
    c. Impacts on fisheries that target the bycatch species
    d. Ecosystem impacts
    e. Address unacceptable bycatch as prescribed in §7085(c)
4. Are measures in place to minimize the impact of the fishery on bycatch species and ensure the fishery does not overfish or hinder the recovery of bycatch species?
    a. Are bycatch management measures likely to decrease unintended, non-retainable, and/or dead catch of non-target species?
    b. Are bycatch management measures being implemented successfully?
    c. Have bycatch management measures been shown to be effective at reducing bycatch and/or bycatch mortality in similar fisheries?
    d. What is the economic impact of implementing management measures to reduce bycatch and bycatch mortality to those participating in the fishery in which the bycatch occurs?

The Department evaluated select bycatch from the CHTG study using the above criteria from the Master Plan. Since no threatened, endangered, or species of concern were caught, staff selected ten species for analysis based on the number captured during the

study (Appendices 1a-1j). Each analysis considers the legality of take, current management, threats to sustainability, impacts to fisheries and impacts to ecosystems. The analysis was performed with reference to the West Coast Groundfish Fishery Management Plan (FMP) (Pacific Fishery Management Council 2022a), Fishbase.org, and input from Department subject matter experts.

Performance Criteria 2. Likely damaging the seafloor

The CHTG occurs over a shallow, relatively wide portion of the continental shelf within the northern section of the Southern California Bight. However, there are two deep submarine canyons, Hueneme Canyon and Mugu Canyon that also transect the CHTG. The average depth of the grounds is 28 fathoms and ranges from 6-212 fathoms. Most fishing effort is focused in the shallowest areas, over average depths of 18 fathoms. The seafloor is primarily described as soft bottom habitat (approximately 98.7%) that is relatively flat, with some sand ripples and burrows that provide vertical relief and some bedrock found between Pt. Arguello and Pt. Conception (Figure 5) and the shelf area between Gaviota and Goleta (Figure 6). There is limited hard substrate in the CHTG off Santa Barbara to Point Mugu (Figures 7 and 8). Overall, there are patches of hard or mixed substrate (approximately 0.87%) (CDFG 2023) throughout the CHTG; however, halibut trawlers generally avoid these areas.

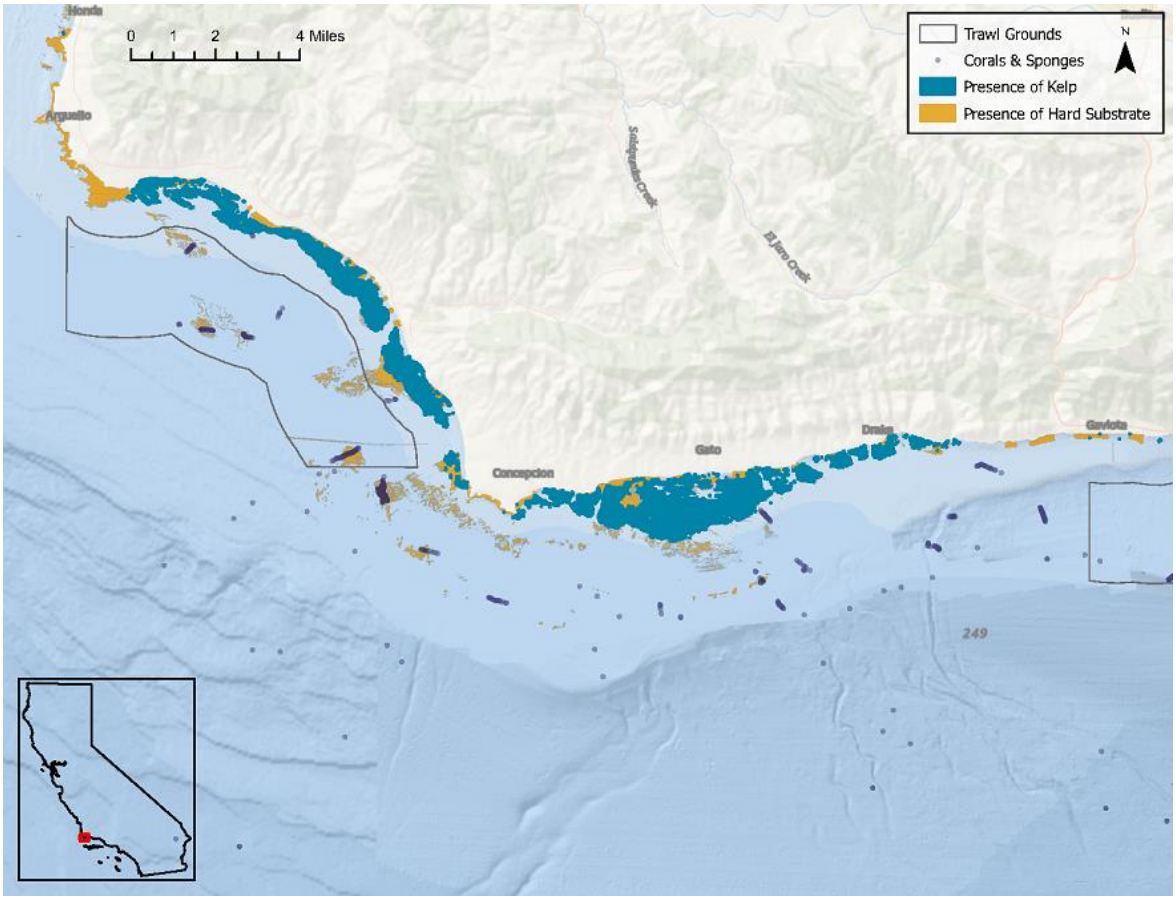

Figure 5 Biogenic habitat from Point Arguello to Point Conception (CDFW 2016, 2023) (NOAA 2023).

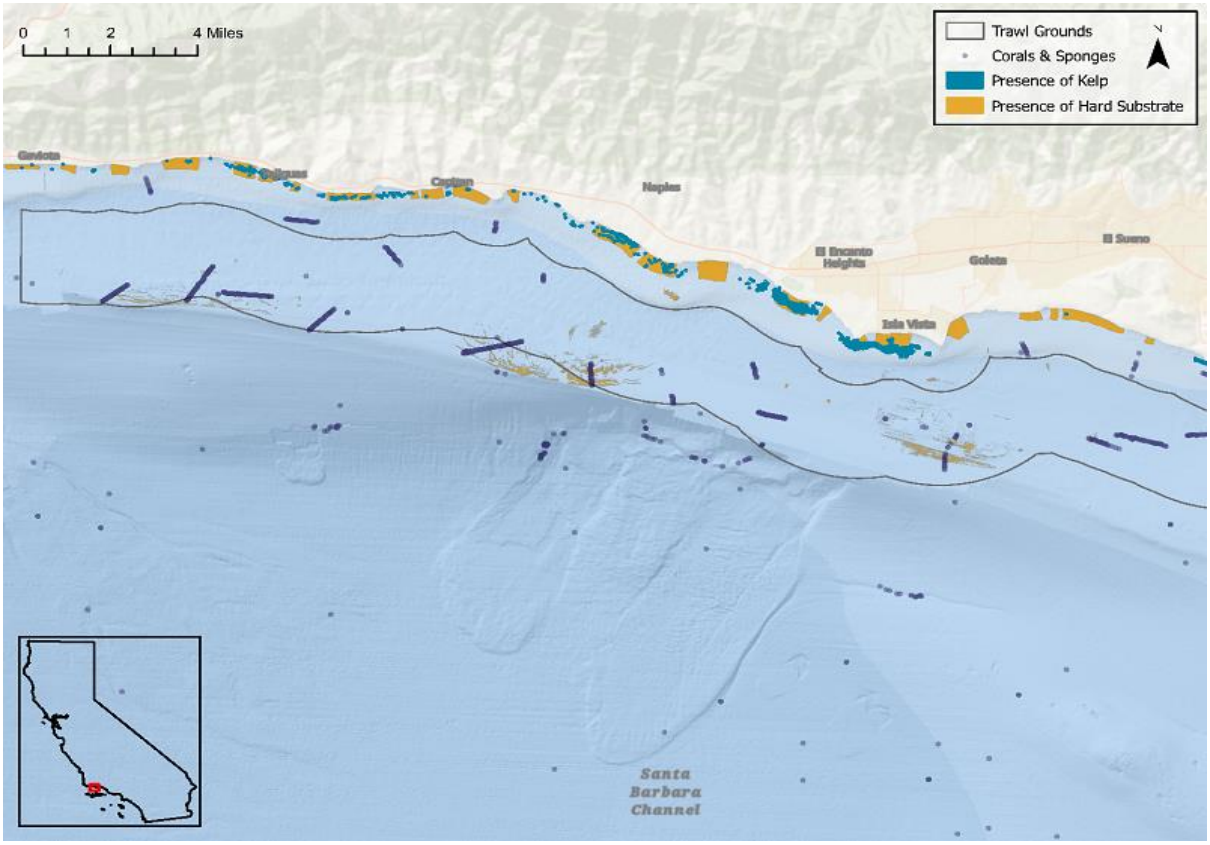

Figure 6 Biogenic habitat from Gaviota to Santa Barbara (CDFW 2016, 2023) (NOAA 2023).

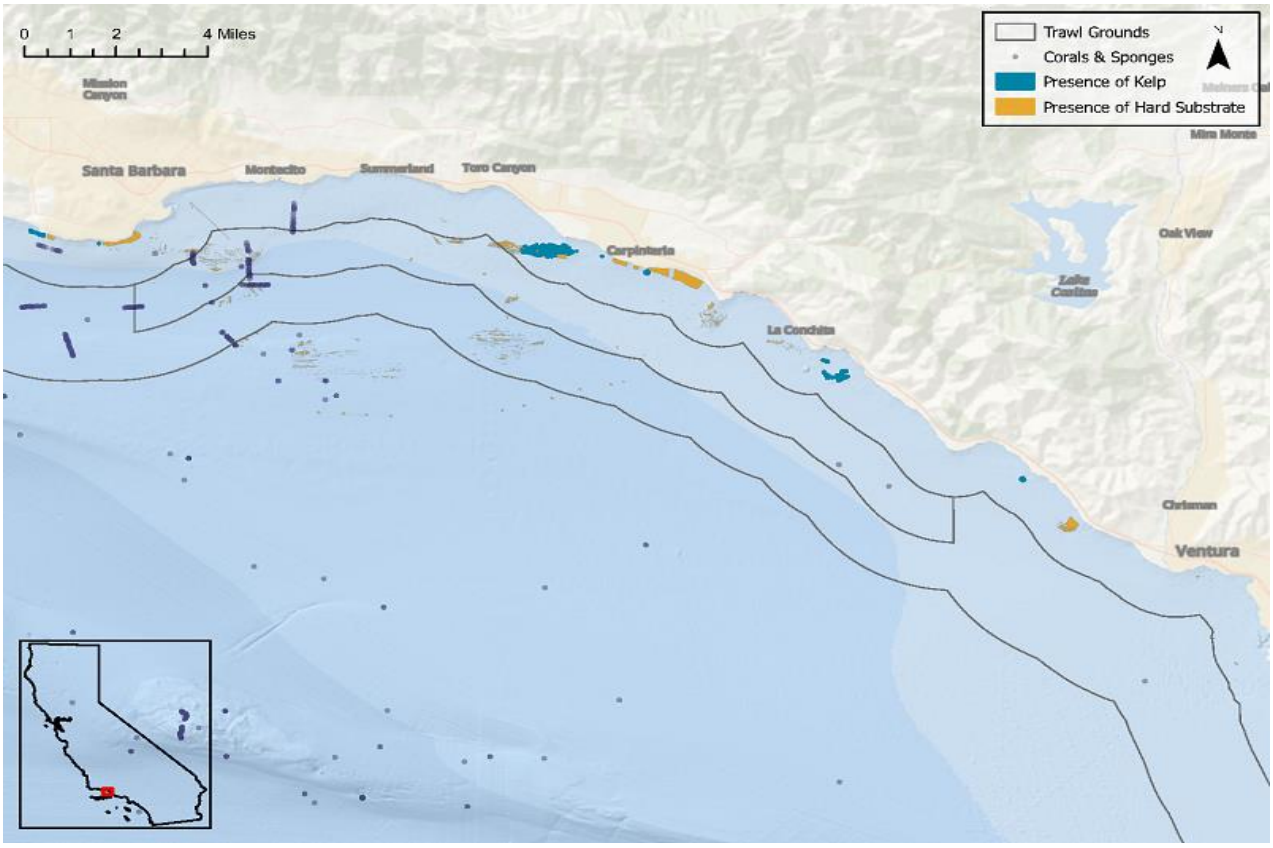

Figure 7 Biogenic and hard bottom habitat Santa Barbara to Ventura (CDFW 2016, 2023) (NOAA 2023).

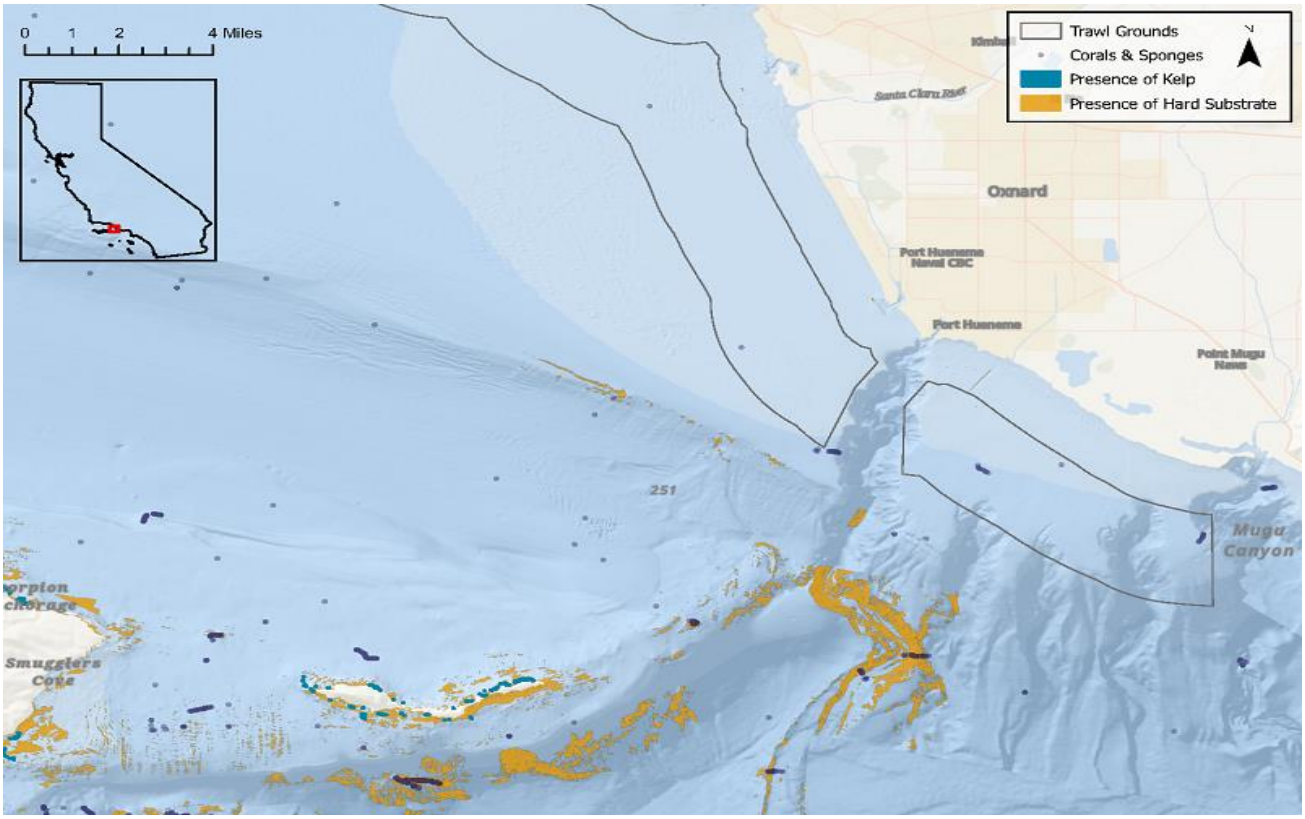

Figure 8 Biogenic and hard bottom habitat off Oxnard and Point Mugu (CDFW 2016, 2023) (NOAA 2023).

Few studies have been undertaken to evaluate the impacts of trawl gear off the west coast; however, in 2013, NOAA staff, Department staff, and fishermen from the Southern California Trawlers Association tested the bottom impact (Wick et al. 2014) of light touch trawl gear in the formerly trawled area of Monterey Bay. Since the same trawl gear in this study was observed, Department staff referenced this document to discuss potential impacts of using light touch trawl gear in the CHTG. In unrelated work, Lindholm (2014) investigated the impacts of small footrope gear on softbottom habitat in federal waters off central California.

While onboard, during the 2013 evaluation of light touch trawl gear, observers documented evidence of bottom contact by trawl gear by examining the gear after each tow and video coverage. NOAA staff placed cameras on the doors and headrope to document bottom contact. For the 2022 assessment, Department staff inspected the trawl doors and foot rope for evidence of bottom contact.

Performance Criteria 3. Adversely affecting ecosystem health

The Master Plan recognizes that managing a resource at the ecosystem level has several challenges due to a lack of data. However, the Master Plan recommends that

despite the challenges, managers should apply principles of managing at the ecosystem level. The process to evaluate ecosystem impacts includes:

1. Identification of species that play key roles in the ecosystem.
2. Considering management strategies with multiple control measures.
3. Conducting an ecological risk assessment to understand which links are most critical. There are several inquiries and recommendations for this step.

The MLMA identifies preserving ecosystem function as a primary goal for sustaining commercial and recreational species over time. Sustainably managing species that play a key role within the ecosystem to maintain their population structures and the ecosystem services and functions these species provide is necessary to meet this goal. To identify important species with significant ecosystem function, staff considered the known life history function of those non-groundfish species captured. To determine the status of groundfish species, Department staff will look to NOAA's list of Ecosystem Component species which is Table 3-2 within the Groundfish FMP (Pacific Fishery Management Council 2022a).

An ecosystem-based fisheries management goal is more likely to be achieved through an integrated management strategy, involving multiple combinations of management measures, such as quotas, size limits, gear controls, and effort restrictions, when compared to a single restriction strategy. To meet the ecological, economic and social objectives for successful ecosystem-based management, a combination of management measures may provide protection to different aspects of ecosystem function and should be considered.

Additionally, understanding which ecological links, even a qualitative or semi-qualitative understanding of these relationships, can be used to make decisions to support ecosystem interactions. Understanding the main drivers and uncertainties in the ecosystem allows for precautionary management approaches to be considered or where additional information is needed for management. Utilizing the Master Plan's process for a Productivity and Susceptibility Analysis (PSA), the Department identified and ranked 36 finfish and invertebrate species with management priority. The halibut trawl fishery was ranked as medium priority based on the PSA results. To address and balance policy, stakeholder, and ecological needs, researchers and the Department further developed the Ecological Risk Assessment (ERA) process to identify species which may require additional management action (Samhouri et al 2019). Statewide, halibut trawl was ranked as high risk due to bycatch and potential habitat impacts.

Performance Criteria 4. Impedes restoration to kelp, coral, or other biogenic habitats

Biogenic habitats, made by living organisms, provide structure for other species and contribute significant ecological functions (Loh et al. 2019). The MLMA recognizes the importance of biogenic habitat protection and that managers must manage commercial fisheries with the goal of maintaining, restoring, or enhancing fishery habitat. The most common biogenic habitats off southern California include kelp and coral species, seagrasses, and other structure-forming invertebrates. Seagrasses are restricted to shallower depths in nearshore waters and are not directly influenced by trawling activity within the CHTG. A variety of kelp, coral and other biogenic habitats do occur in waters within or adjacent to the CHTGs; however, the CHTG's primary habitat is soft bottom (sand/mud) with isolated areas of hard bottom habitat.

There are three steps, each with sub-steps, described in the Master Plan on how to assess and address habitat impacts:

1. Describe the habitat utilized by the target species at each life stage.
2. Describe the threats to the habitat utilized.
3. Minimize or mitigate adverse effects fishing activity may have on habitat.

The Department used available information in the California Halibut Enhanced Status Report (ESR) (CDFW 2022) and current GIS data (CDFW 2016, 2023) (NOAA 2023) to address questions 1 and 2. To answer question 3, the Department referred to the results from the 2013 Monterey Bay light touch trawl study (Wick et al. 2014) to discuss potential impacts of this trawl gear on soft bottom habitats. The 2013 study used the same light touch trawl gear used in the CHTG today. No video surveys were conducted for the 2022 CHTG assessment. However, to determine the extent that the CHTG trawl fishery encountered kelp, coral, or hard bottom habitat, Department staff reviewed recent tow activity from logbooks and mapped these tow locations along with the observed tows from the assessment against known biogenic habitat locations.

RESULTS

Staff observed nine trawl trips aboard permitted trawlers, totaling 29 tows fishing in the CHTG during the period July 2022 through March 2023; 25 of the 29 tows occurred in sub-area C (Figure 1). Staff conducted an observation trip within the CHTG every month within the open fishing season except June 2022, and January and February 2023. Based on the number of landings by the fleet during the open season of the CHTG, staff was able to observe approximately 4.9% of available landings for the period. No observation trips were conducted during June due to staff travel conflicts and the participating vessel having a federal observer aboard. One trip was taken in January,

but fishing activity occurred outside of the CHTG due to storm debris found within the normal CHTG fishing grounds. No observations were conducted in February 2023 due to extended periods of storms and high winds. Offshore debris from high storm runoff posed a safety issue on the water, temporarily limiting fishing effort.

Performance Criteria 1. Does not minimize bycatch

Staff counted and assessed (live or dead) 21 invertebrate species and 34 finfish (Table 3). No finfish or invertebrate species of special concern, marine mammals, or birds were taken or injured. California sea lions, *Zalophus californianus*, were observed taking fish from the cod-end and following the vessel. Of the 2,152 organisms counted, 77.9% were assessed as live and released and 9.2% of species caught were retained and sold. Across all observed trips, the largest fantail sole, *Xystreurys liolepis*; legal-sized Pacific angel sharks, *Squatina californica*; and legal-sized halibut were the only species retained for sale. Marketable species such as mantis shrimp, *Hemisquilla ensigera californiensis*; starry flounder, *Platichthys stellatus*; and sand sole, *Psettichthys melanostictus,* were not retained due to the low number caught. Federally-managed groundfish species were not retained due to lack of market demand. Sea pens were encountered on the foot rope during the first observation trip. While noted, they were not counted.

Table 3 Observed and assessed catch from the net cod-end. *= killed by sea lions. **= includes four killed by sea lions.

Scientific Name	Common Name	Count (kept for market)	Count (release live)	Count (released dead)	Total Count	Total Weight
Raja inornata	California skate		640	2	642	735.9
Zaniolepis latipinnis	longspine combfish		99	120	219	9.7
Paralichthys californicus	halibut-legal	153		4*	157	1195.3
Paralichthys californicus	halibut-sublegal		119	24**	143	347.7
Squatina californica	Pacific angel shark	19	90		109	1291.2
Metacarcinus gracilis	slender crab		100	5	105	32.9
Pleuronichthys verticalis	hornyhead turbot		86	2	88	42.8
Metacarcinus anthonyi	yellow rock crab		79		79	54.7
Loxorhynchus grandis	sheep crab		75	2	77	198
Zalembius rosaceus	pink seaperch		7	59	66	2.7
Octopus spp.	Octopus		35	1	36	
Parophrys vetulus	English sole		32	3	35	17.4
Xystreurys liolepis	fantail sole	27	3		30	36.8
Kelletia kelletii	Kellets whelk		24		24	6.5

Scientific Name	Common Name	Count (kept for market)	Count (release live)	Count (released dead)	Total Count	Total Weight
Scorpaena guttata	California scorpionfish		22		22	15.8
Genyonemus lineatus	white croaker		14	8	22	4.8
Cancer productus	red rock crab		19		19	12.5
	sea star		19		19	0.4
Squalus suckleyi	spiny dogfish		13	6	19	76.8
Citharichthys sordidus	Pacific sanddab		6	12	18	0.9
Tetronarce californica	Pacific electric ray		17		17	39.45
Nudibranchia	Nudibranch		16		16	
Salpidae	Salp		15		15	
Platymera gaudichaudii	armed box crab		14		14	3.4
Paralabrax nebulifer	barred sand bass		9	5	14	28.4
Ophiuroidea	brittle star		12		12	
Porichthys notatus	plainfin midshipmen		10	1	11	5.3
	skate eggs		11		11	
Sebastes semicinctus	halfbanded rockfish		3	7	10	0.8
Pagurus spp.	hermit crab		10		10	5.9
Aplysia californica	sea hare		8	1	9	0.2
Myliobatis californica	bat ray		8		8	57.8
Porichthys myriaster	specklefin midshipman		8		8	3.8
Pleuronichthys decurrens	curlfin turbot		4	3	7	3.6
Cephaloscyllium ventriosum	swell shark		7		7	7.9
Synodus lucioceps	California lizardfish		4	2	6	2.1
Leptocottus armatus	Pacific staghorn sculpin		6		6	
Seriphus politus	queenfish		1	5	6	0.5
Panulirus interruptus	CA spiny lobster		4		4	3.7
Symphurus atricauda	California tonguefish		2	2	4	
Rhinobatos productus	shovelnose guitarfish		4		4	21.7
Doryteuthis opalescens	market squid		3		3	
Armina californica	striped nudibranch		3		3	
Heterodontus francisci	horn shark		2		2	3.5
Hemisquilla ensigera californiensis	mantis shrimp		2		2	0.3
Sicyonia ingentis	ridgeback prawn		2		2	

Scientific Name	Common Name	Count (kept for market)	Count (release live)	Count (released dead)	Total Count	Total Weight
Psettichthys melanostictus	sand sole		1	1	2	1.7
Beringraja binoculata	big skate		1		1	22
Blenniidae	blenny		1		1	
Romaleon antennarium	brown rock crab		1		1	0.2
Sebastes auriculatus	brown rockfish		1		1	4.4
Menticirrhus undulatus	California corbina			1	1	2.1
Pugettia gracilis	kelp crab		1		1	0.1
Acanthodoris lutea	orange peel doris		1		1	
Agonopsis sterletus	southern spearpoint poacher			1	1	
Roncador stearnsii	spotfin croaker		1		1	0.2
Platichthys stellatus	starry flounder		1		1	0.4
	Grand Total	199	1,676	277	2,152	4,302.25

Following the bycatch criteria from the Master Plan, the Department evaluated ten species for analysis based on the number captured (Appendices 1a-1j). No threatened, endangered, or species of concern were caught. The ten species (seven finfish, three invertebrates) that were evaluated included: California skate, *Raja inornate;* slender crab, *Metacarcinus gracilis*; longspine combfish, *Zaniolepis latipinnis;* halibut (sublegal), Pacific angel shark, hornyhead turbot, *Pleuronichthys verticalis*; yellow rock crab, *Metacarcinus anthonyi*; sheep crab, *Loxorhynchus grandis*; pink seaperch, *Zalembius rosaceus;* and English sole, *Parophrys vetulus*.

Except legal-sized Pacific angel shark, the remaining nine species analyzed are released as discards due to lack of market demand, management measures, or the species is not marketable. Two of the ten species are federally managed and one (California skate) is an Ecosystem Component species. Ecosystem Component species are not targeted or retained, are not overfished or approaching overfished status. Six of the ten have management regulations in place. Unmarketable species included pink sea perch, longspine combfish, and slender crab. Marketable species not retained included English sole, yellow rock crab, sheep crab, and hornyhead turbot.

Discard mortality

Kelp pieces, broken kelp holdfasts, plastic trash, abandoned crab traps, and other debris were present during five of seven observation trips. This debris had the effect of plugging the cod-end mesh, increasing the presence and likely mortality of smaller fish such as pink seaperch and longspine combfish. All observed holdfasts and kelp parts

were already senesced before capture by the net. While noted, these items were not counted or weighed.

Total mortality for all assessed species combined, including species killed by sea lions was 12.9%. Finfish mortality was 15.9% when including those that were killed by sea lions. Without sea lion induced mortality, finfish mortality was 15.4%. Invertebrate mortality was 2%. Of those species released dead during the assessment, the majority (64.6%) consisted of longspine combfish and pink seaperch.

Using the same gear in the north Monterey trawl study, observed mortality was 14.5% for all finfish combined. Invertebrate mortality was lower than finfish mortality at 2.7% (Wick et al. 2014).

By comparison WGCOP uses calculated trawl release mortality estimates of 50% for big skate, *Beringraja binoculata*; lingcod, *Ophiodon elongatus*; longnose skate, *Raja rhina;* and sablefish, *Anoplopoma fimbria* (Somers et al. 2023). These estimates were developed by the Pacific Fisheries Management Council's Groundfish Management Team and Scientific and Statistical Committee for management and stock assessments. Somers (2023) noted that these rates reflect potential survivorship of these species based on previous studies. Due to the lack of relevant studies, all other observed species have a default mortality rate of 100% (Somers et al. 2021) regardless of on deck disposition. While the observer program uses a default 100% mortality estimate for most trawl-caught bycatch species, CHTG fishery participants assert that the majority of bycatch is released in a live condition, which was confirmed by Department observers.

Analysis of WCGOP data

WCGOP observers document discarded species by number and weight and retained species by weight. Observers also recorded non-fisheries catch such as debris, traps, and kelp. Animals not identified to species were grouped together by genera or as unidentified. WCGOP observer coverage rates are made at the fleet level, but locally vary based on landings and the number of observable vessels assigned to are area observer. For the period of 2002-22, WCGOP observed the statewide Open Access halibut trawl fleet a minimum of 2% and a medium of 7% (Somers et al. 2023). Based on the last five years (2018-2022) of confidential observer data specific to the CHTG, WCGOP observers documented 148 finfish and invertebrate species caught (including species groups) (Appendix 2a and 2b.) (WCGOP 2022). Within the dataset, there were several cases when the observer took a subsample, and the subsequent count or weight was expanded to the haul level according to WCGOP protocols (Northwest Fisheries Science Center 2023). Encountered species of concern included giant sea bass, *Stereolepis gigas* (5 fish) and soupfin shark, *Galeorhinus galeus* (1 fish). This dataset does not indicate disposition upon discard.

Of the 73 finfish identified to species, 29 are under federal management. Except for soupfin shark, 28 of these species are not identified as species of concern. NOAA Fisheries began a status review in April 2022 to determine if listing soupfin shark as endangered is warranted under the Endangered Species Act (ESA). The status review is still in progress and in the interim, soupfin shark are considered a candidate species under the ESA. The remaining 44 finfish species are state managed. Of these 44 species, only giant sea bass is a species of concern.

WCGOP observers document take and interaction of marine mammals, seabirds, and sensitive species with trawl gear. WCGOP data show that during the period of 2018-22, there were four California sea lions and eight Brandt's cormorants, *Phalacrocorax penicillatus* were observed entangled or killed by open access trawl gear while fishing within the CHTG (WCGOP 2024).

Bycatch mortality estimates for west coast fisheries, including marine mammals and seabirds are reported through NOAA's West Coast Fishery Observer Bycatch and Mortality Reports. These reports and estimates are applied to the entire observed fishery and are not specific to a geographic area, such as the CHTG. The at-sea data taken by WCGOP observers contribute to NOAA's estimates.

Performance Criteria 2. Likely damaging the seafloor

Staff observed net retrieval at the conclusion of every tow looking for evidence of significant bottom contact. The only consistent signs of direct bottom contact were where rust was removed from hanging chains on the foot rope and the bottom, leading edge of the trawl doors as seen previously in the 2013 light touch trawl study (Figure 9). The other indication of bottom contact was the presence of sea pens on the foot rope during the first observation trip. Sea pens were not caught for the remainder of the assessment.

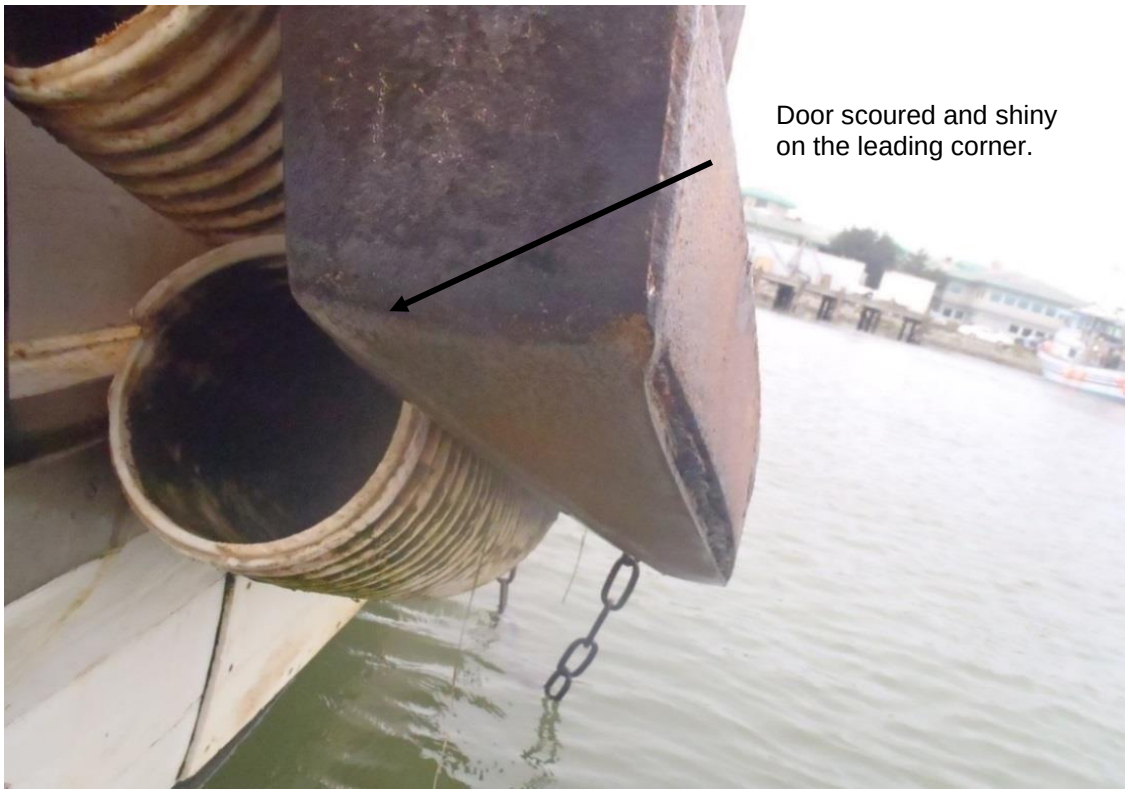

Figure 9 Trawl door showing evidence of minimal contact with seafloor (Wick et al. 2014) (Photo credit: NOAA Fisheries)

In the Wick et al. (2014) study, light touch trawl gear was proven to have minimal contact with the seafloor. NOAA researchers utilized GoPro cameras mounted on the head rope and trawl doors, oriented down, to video the extent of bottom contact. Of the 20 videos that were taken, seven had the best quality for analysis. Overall, the videos showed that the dropped chain loops and leading edge of the trawl doors made contact with the bottom. Video analysis showed the footrope skimmed the bottom without contact. The footrope was seen going over the top of several flatfish and crab.

Light touch trawl doors were shown to have minimal contact, depending on the contour of the soft bottom. Video footage documented that the trawl door edge left periodic 1-inch furrows within the sediment. Inspection after the tows confirmed that the leading edge of the door made contact with the bottom as evidenced by the rust on the door being cleaned off where contact was made.

Performance Criteria 3. Adversely affecting ecosystem health

An ecosystem-based approach to managing fisheries requires that ecosystem dynamics, such as interactions with other species, and ecosystem impacts be considered broadly. The Master Plan provides guidance on how to apply the principles

of ecosystem based fisheries management when making management decisions and identifies a three-step practical approach to managing ecosystem health:

Step 1. Identification of species that play key roles in the ecosystem.

Ecosystem roles as described in the Master Plan include keystone species, foundational or biogenic species, basal prey species, and apex predators. There are many finfish and invertebrate species that utilize the soft bottom habitat of the CHTG. A list of Department-observed species are found in Table 3 and species documented by WCGOP observers are found in Appendix 2a and 2b.

As described earlier, biogenic habitat is defined as habitat created by living organisms that contributes to significant ecological functions and provides structure for other living species. Department staff did not document any biogenic species other than sea pens within the CHTG during the observed assessment tows. Similarly, during the WCGOP trips, federal observers documented sea pens (56), and a small number of horny gorgonian (5), *Holaxonia* spp.

All the finfish species encountered during the Department observation are predators, but not all are considered apex predators. Noted apex predators included Pacific angel shark and spiny dogfish, *Squalus suckleyi.*

Additionally, WCGOP observer data (Appendix 2b) showed encounters with apex species such as common thresher shark, *Alopias vulpinus*; sevengill shark, *Notorynchus cepedianus;* and giant sea bass.

Several crustaceans were documented during the Department's observations and by WCGOP observers (Appendix 2a). Crustaceans are scavengers and predators of demersal invertebrates. WCGOP observers also noted basal prey species such as market squid, *Doryteuthis opalescens;* octopus, and smaller finfish such as unidentified midshipman, *Batrachoididae;* unidentified croaker, *Sciaenidae*; queenfish, *Seriphus politus;* unidentified combfish, *Zaniolepis;* and pink seaperch.

Step 2. Consider management strategies with multiple control measures.

To ensure ecosystem health, several management measures are in place and applicable to the trawl grounds.

1. *Gear restrictions.* Light touch trawl gear required. Previous work has shown that light touch trawl gear minimizes bottom contact (Wick et al. 2014).

2. *Effort restrictions.* A limited entry permit is required to trawl in the CHTG (FGC §8494).

3. *Temporal restriction*. The CHTG is closed March 15-June 15 to protect halibut from take during the spawning season (CDFW 2022).

4. *Area or Spatial restriction*. The CHTG encompass a defined area within state waters between 1 and 3 nm from shore within the Southern California Bight (Figure 2).

5. *Quotas and size limits.* There is a minimum length requirement of 22 in. to take halibut. Trawl fishermen without a federal groundfish permit are allowed to take minimal quantities of open access groundfish quota. This take is factored into the overall federal management allocation of groundfish per fishery sector. (Pacific Fishery Management Council 2022b)

6. Other management measures (federal observer coverage, logbooks, fish tickets). Federal observers collect data at sea to document discards, which in turn contributes to fleetwide bycatch estimates (Northwest Fisheries Science Center 2023). Mandatory logbooks provide fishery reported data on retained catch, tow position, and total time of tow (CDFW 2022). Weight and species are reported to the Department via electronic fish tickets.

Step 3. Conduct ecological risk assessments (ERA) to understand which links are most critical.

Department subject matter experts identified and scored ERA attributes on multiple fisheries, including halibut trawl. Using these attributes, Samhouri et al. (2018) evaluated the fisheries ecosystem risk based on target species, bycatch groups, and habitat groups. This analysis utilized exposure and sensitivity indices to calculate relative risk.

For halibut trawl, the risk to species was considered high, mostly due to high scores for the bycatch and habitat attributes. Samhouri et al. (2018) found that bycatch risk for this fishery was higher compared to other fisheries evaluated due to the amount of bycatch and perceived relative mortality. Similarly, risk to habitat was considered high for halibut trawl due to possible impacts to soft bottom and structure forming invertebrates (Samhouri et al. 2018). The authors noted that while risk was elevated, soft bottom and habitat forming invertebrates are not that sensitive.

The halibut trawl ERA encompasses the statewide fishery, of which there are many differences between the CHTG and southern and central fleets. Samhouri et al. (2018) suggests that regional ERAs would improve accuracy and are better to address local issues.

The Master Plan offers the following inquiries and recommended actions to help identify potential impacts to ecological function:

1. *Has the ecological role of the target species been identified? Does the target species play a key ecosystem role as defined above?*

The ecological role of the target species (halibut) is described in the Department's ESR. Halibut are predators of finfish and benthic invertebrates with food size preference depending on halibut size. Juvenile halibut prefer smaller finfish and benthic invertebrates, switching to larger fish later in life. (CDFW 2022). Halibut are not known to have a special ecological role; however, juvenile halibut may be preyed upon by sharks, rays, marine birds and mammals (CDFW 2022).

2. *Is the target species a basal prey species?*

No, halibut is not a basal prey species.

3. *Has an ERA been conducted for the target species?*

An ERA was completed for each of the four halibut sectors- trawl, gillnet, commercial hook-and-line, and recreational hook-and-line. For halibut trawl, the ecological threats identified for the statewide fishery are bycatch and habitat (soft bottom and habitat forming invertebrates). However, the trawl ERA did not consider the specifics of the CHTG fishery and was a general assessment applied to the entire fishery. A regional ERA would more appropriately address specific issues within the CHTG and improve accuracy.

4. *Have the major areas of uncertainty in ecosystem dynamics been identified?*

Major areas of uncertainty in ecosystem dynamics for the CHTG have not been identified. However, the ESR (CDFW 2022) has identified research needs which could reduce this uncertainty. These identified needs are:

- Population genetics-collect information about stock structure and stock separation/connectivity.

- Distribution and movement across all life stages-explore distribution and population connectivity across the geographic range and all life stages, including information on biological parameters such as sex, maturity, spawning condition, seasonality, prey availability, environmental conditions including temperature and salinity, and latitude. Identify nursery habitat areas and examine sex-specific seasonal movement.

- Potential climate change impacts on all life stages-determine the optimal range and upper and lower thresholds for temperature, salinity, pH, and dissolved oxygen for egg, larval, juvenile, adult stages. Determine if halibut exhibit temperature-dependent sex determination, and at what life stage sex determination occurs. Determine if water temperature influences spawning activity.

5. *Are multiple control measures in place that may help to achieve EBFM objectives?*

There are several control measures in place for the CHTG trawl fishery that provide protection to different aspects of ecosystem function. The minimum size limit and mesh size restrictions for the trawl fishery help preserve the spawning and age structure within the population. The light touch gear requirements and spatial, and temporal restriction are intended to reduce habitat and bycatch impacts and allow the target species to spawn. The limited entry program and federal and state incidental trip limits for non-target groundfish and fish other than halibut are intended to control fishing activities and minimize mortality of overfish species and non-target species. This combination of management measures is intended to have benefits to the ecosystem as a whole. See Performance Criteria 3, Step 2 for CHTG management measures.

6. *Has there been an assessment of how the target stock is likely to be impacted by changing environmental or ecological conditions?*

There is no formal ecosystem model to determine the effect of changing environmental/ ecological conditions on the halibut stock. However, halibut respond positively to warm water conditions with improved larval recruitment and conversely with cold water conditions (CDFW 2022). Within the ESR (CDFW 2022), the Department has recognized the importance of understanding the impact of weather and climate trends on population recruitment.

Performance Criteria 4. Impedes restoration to kelp, coral, or other biogenic habitats

The MLMA (FGC §7056(b)) emphasizes the importance of habitat protection and that protecting habitat from potential fishery impacts is essential for preserving healthy and productive marine resources. The Master Plan provides guidance on assessing and addressing potential impacts to achieve the goal of protecting habitats:

Step 1. Describe the habitat utilized by the target species at each life stage.

Halibut, except for the egg and larval stages, are benthic animals for their entire life. Young halibut prefer sheltered bays and estuaries before moving offshore. For their adult life, halibut prefer soft bottom habitat of varying depths, depending on their spawn cycle (CDFW 2022). Soft bottom (sand, mud) is the predominate habitat type and the one targeted by the halibut trawl fishery. Soft bottom accounts for 98.7% of the available habitat within the CHTG (CDFW 2023).

Step 2. Describe the threats to the habitat utilized.

There are several possible applicable threats to the CHTG bottom habitat. Threats could include nearshore dredging, beach nourishment, infrastructure, oil industry operations, shoreline hardening, and bottom disturbing fishing gear (North Carolina Department Environmental Quality 2023). Beach nourishment and dredging could have the negative effect of increasing turbidity and sedimentation. Shoreline hardening could affect soft bottom habitats by increasing loss of habitats (wetlands, intertidal) near the CHTG. Of these possible threats to the CHTG bottom habitat, only bottom disturbing fishing gear falls under Commission and Department regulatory authority. While fishing gear is a possible threat, the shallow, soft bottom habitat of the CHTG may have a short recovery time after trawling. Lindholm et al. (2004) found that shallow soft bottom habitat with mobile substrate movement could have a short recovery period from bottom contact gear.

According to the Master Plan, bottom trawl gear (doors, foot rope, net) has potential interactions with bottom habitat resulting significant damage to biogenic habitat and death to burrowing organisms. The solution posed is to limit trawling to resilient soft bottom habitat and use lighter gear. The CHTG halibut trawl fishery utilizes light touch trawl gear which limits door weight to 500 lb, requires 7.5-in cod-end mesh, and prohibits use of rollers or bobbins. Trawl nets are also constructed with thinner twine and have a maximum headrope length of 90 ft. Fishery practice in the CHTG indicate that fishermen avoid vulnerable habitats as shown by position data from trawl logs and trawl tows observed during this evaluation (Figures 9 and 10). These habitats also pose a risk to snagging or damaging nets. Biogenic habitats are a very small percentage of the overall area of the CHTG.

Step 3. Minimize or mitigate adverse effects fishing activity may have on habitat.

There are many strategies available to protect habitats, and many of these strategies have already been implemented to protect the State’s most sensitive marine habitats. The most common strategies include MPAs, and restrictions on the type of gear employed, or how and where a gear type can be used. The trawl fishery in the CHTG has gear restrictions (light touch trawl gear required) that are known to minimize bottom impact. The trawl fishery is limited in space to the boundaries of the CHTG and there is

also a restricted access system that limits the number of vessels that may participate in the overall fishery.

DISCUSSION

The CHTG fishery is managed with a combination of regulations, intended to reduce impacts to bycatch, ecosystem heath, and seafloor and biogenic habitats. Using performance criteria as required in FGC §8495 and direction from the Master Plan, Department staff evaluated the effect of halibut trawl fishing in the southern CHTG. In accordance with FGC §8495, information about the halibut trawl fishery operating within the CHTG was compiled from monitoring data, such as logbooks and landing receipts, relevant scientific literature, federal observer data, information published by NOAA Fisheries, Department biographical data, and Department at-sea observations. This assessment evaluated bycatch, habitat and ecosystem impacts, and the effect of trawl gear on kelp/biogenic habitats. Based on the criteria outlined in FGC §8495 and the information compiled, the Department is providing the Commission with the best available information about the halibut fishery operating within the CHTG.

Performance Criteria 1. Does not minimize bycatch

The CHTG assessment provides current information on the species composition, catch by weight, and disposition of catch in the halibut trawl fishery. All catch quantities and disposition documented by Department staff are found in Table 2. For all tows, halibut (22 in. or greater) was the intended target. Utilizing onboard observation, staff assessed over 2,100 animals with 78% released in live condition and 9% retained for market. Several species caught, depending on buyer demand, can be considered incidental and marketable. Halibut trawlers may retain a small amount of groundfish but often do not do so due to price, market demand, or the requirement to comply with Federal groundfish requirements, which includes a vessel monitoring system. For the duration of the CHTG study, incidental/marketable species included larger fantail sole and legal-sized Pacific angel shark.

Staff utilized confidential, but aggregated WCGOP data from 2018 to 2022 to determine catch trends, including encounters with species of concern. Except for the catch of five giant sea bass and one soupfin shark, no other species of concern were encountered. Due to WCGOP protocols, all species, except for a select few, have a default mortality of 100% regardless of actual disposition. The MLMA suggests the importance of determining mortality to determine discard impacts.

Discard impacts were evaluated using the Master Plan’s four-step evaluation. The results from the assessment of the top ten captured species indicate that the bycatch encountered in the CHTG fishery is acceptable. A majority of the species encountered

through Department observation were released in a live condition. Many species caught were managed federally or by the state and have regulations dictating take, thus promoting sustainability. Additionally, the regulations governing fishing in the CHTG, such as the use of 7.5-inch cod-end mesh and having a closed season of March 15-June 15 minimizes impact to encountered bycatch species and spawning adult halibut.

Performance Criteria 2. Likely damaging the seafloor

The CHTG fishery occurs over shallow, soft bottom habitat characterized by sand and mud. The CHTG is also subject to sediment transport from creek flows and the California current (CDFG 2008). Bordered by the shallow nearshore at one nautical mile and two submarine canyons, the CHTG consists of a shallow, soft bottom shelf with an average depth of 28 fathoms. (CDFG 2023) “Light Touch” trawl gear, as defined in Title 14 CCR §124 is required in the CHTG.

In 2013, NOAA staff and the Southern Trawl Association partnered in a joint study to test the feasibility of using light touch trawl gear over shallow soft bottom habitat in Monterey Bay. Department staff participated in the research cruise as local subject matter experts and to assist with the permitting process. Using video cameras on the trawl doors and head rope, NOAA staff documented trawl gear-seafloor interactions. In addition to video, staff critically examined both trawl doors for evidence of bottom contact. This study, especially with the contribution of video footage showed that light touch trawl gear “successfully caught fish with minimal disturbance to the seafloor while minimizing bycatch” (Wick et al. 2014).

While light touch trawl gear is the only trawl method allowed in any of the trawl grounds, this assessment would have limitations if applied to the central CHTG (San Luis Obispo and Monterey Counties). Gear contact to the bottom would be comparable, but species composition and habitat substrate would not. Additional work would be required to address Performance criteria 1,3, and 4. Under FGC§8495(c)(1) the two central trawl ground areas would remain closed unless the Commission takes action to collect the data necessary to address the other criteria.

Using smaller scale trawl gear can also minimize impact to soft bottom habitat. After studying the effects of trawling off central California, Lindholm et al. (2015) found that trawling with “with small-footrope gear may have limited impacts in sandy habitats”.

Halibut trawl fishermen, by general practice to prevent gear damage, avoid areas with hard bottom. The CHTG also has many snags and obstructions leftover from previous oil exploration in the Santa Barbara channel; these areas are also avoided by trawlers.

Performance Criteria 3. Adversely affecting ecosystem health

The California-wide ERA performed on the halibut trawl fishery showed high risk to all ecosystem components. (Samhouri et al. 2019). However, this ERA did not take into account the regional specifics of the CHTG, posing a challenge to managers. The Master Plan suggests that despite the challenges of ecosystem level management, managers should apply principles to manage at that level, including evaluation of ecosystem impacts. The process to evaluate ecosystem impacts includes:

1. Identification of species that play key roles in the ecosystem.
2. Considering management strategies with multiple control measures.
3. Conducting an ecological risk assessment to understand which links are most critical. There are several inquiries and recommendations for this step.

After analyzing the top ten species encountered, key ecosystem roles for those species were evaluated, which ranged from apex predators, such as the Pacific angel shark to basal prey species, such as longspine combfish and pink sea perch The discard mortality for the top ten species analyzed was less than 5% for the majority of these species, except for sublegal halibut, longspine combfish, and pink seaperch. While the discard mortality rate is high for these two basal prey species, the number of fish caught was relatively low and would not result in changes to the structure of these species' populations.

Staff considered the management strategies with control measures that are in place for the trawl fishery. The CHTG fishery is managed with a combination of regulations, intended to reduce impacts to bycatch, ecosystem heath, and seafloor and biogenic habitats. The halibut minimum size limit and cod-end mesh size requirement for the trawl fishery helps preserve the spawning and age structure within the population. The light touch gear requirements and spatial, and temporal restriction are intended to reduce habitat and bycatch impacts and allow the target species to spawn. The limited entry program and federal and state incidental trip limits for non-target groundfish and non-target halibut are intended to control fishing activities and minimize mortality of overfished species and non-target species.

Finally, staff identified the important links within the halibut ERA using the Master Plan's inquiries and recommendations. The inquiry process helped identify the uncertainties around population genetics, distribution and movement across life stages, and potential climate impacts on halibut life stages. These information gaps have been described in the ESR and that external funding and resources are needed to supplement Department resources to accomplish these studies.

There is uncertainty, particularly regarding identification of ecosystem dynamics. While mostly unknown, the Department's ESR identified research needs to minimize this uncertainty.

This CHTG assessment showed that, based on the Master Plan's suggested control measures and recommendations to assess ecosystem health, that the management measures in place for trawl fishery may be effective in minimizing adverse effects on ecosystem health in the CHTG.

Performance Criteria 4. Impedes restoration to kelp, coral, or other biogenic habitats

The overall area of the CHTG does have known locations of biogenic habitat. Kelp locations are located outside the trawl grounds near the intertidal zone. Potential impacts to biogenic/kelp habitats by trawl gear were mapped using trawl log tow position data against known biogenic habitat and kelp (Figures 10 and 11). According to current Department Biogeographic Information and Observation System data (CDFW 2016, 2023) (NOAA 2023) the CHTG contains 0.0015% biogenic habitat, and hard bottom habitat is 0.87%. Observed tows from this assessment and those previously reported by the fleet showed that fishing activities avoided biogenic halibut and known kelp locations. While small in surface area, fishermen prefer to not fish in these areas to avoid snagging their net or doors. Trawl fishermen tend to deploy their gear at known locations free of snags or structure than can damage nets or result in lost gear.

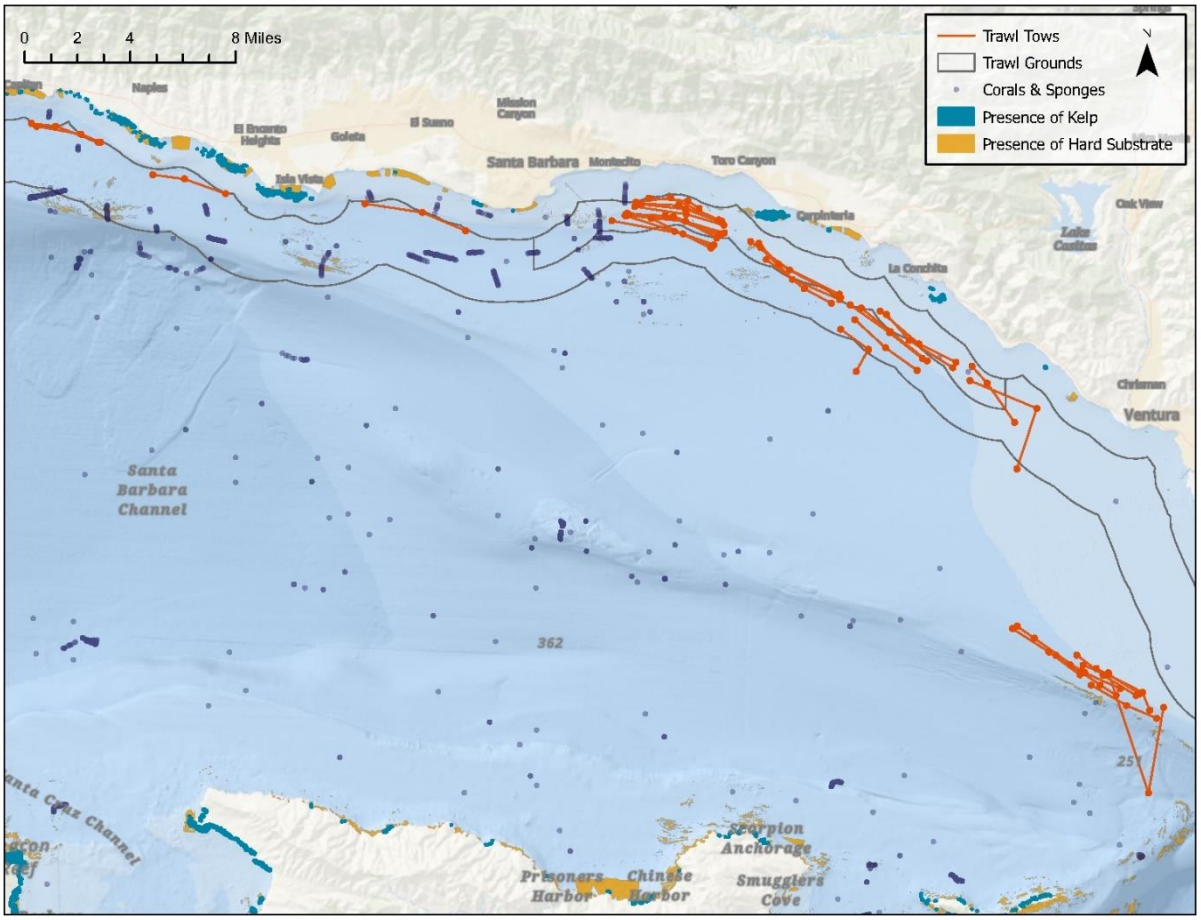

Figure 10 Biogenic habitat, kelp, and hard bottom locations relative to observed tow locations (CDFW 2016, 2023) (NOAA 2023).

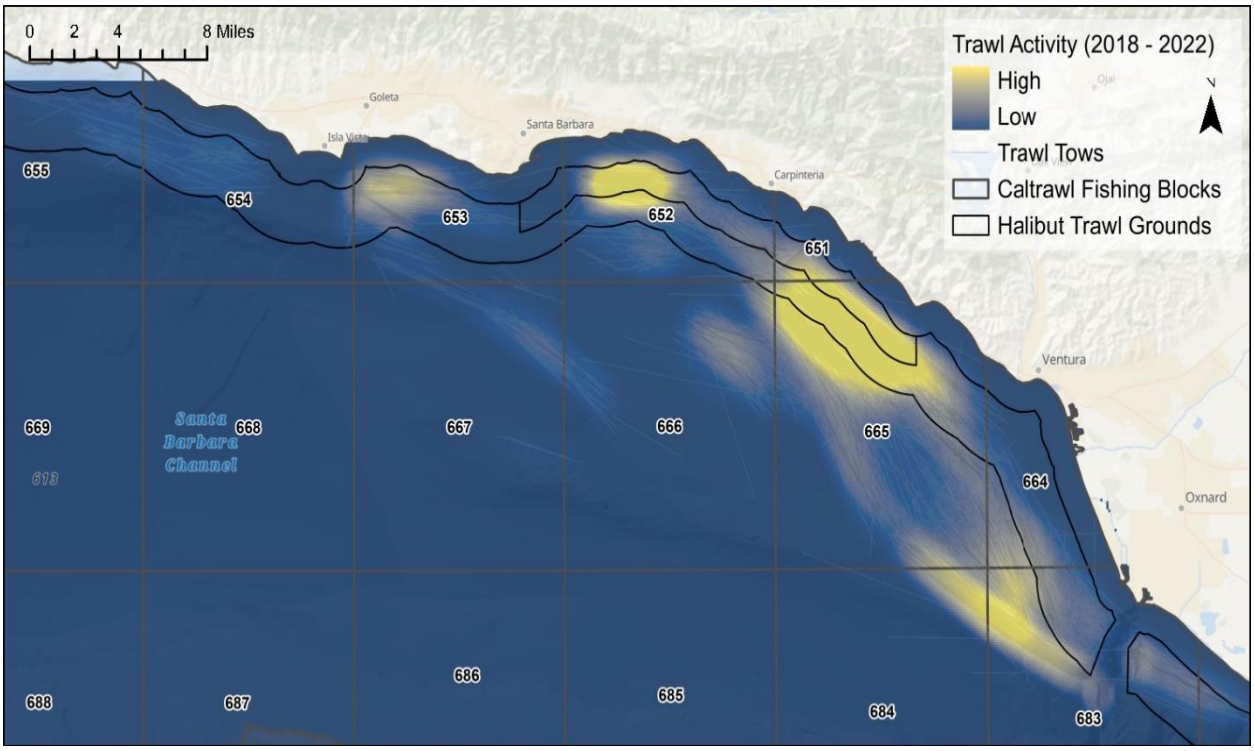

Figure 11 Trawl location frequency, inside and outside, the Trawl Grounds (Marine Log System 2023).

CONCLUSION

As directed by the Master Plan, the Department began a process to prioritize our state-managed species based on their inherent productivity and their susceptibility to environmental and fishing pressures. In December, 2019, the Department presented the prioritization of 17 state-managed commercial fisheries and 14 state-managed recreational fisheries to the Commission (Fish and Game Commission 2019). Through this process, halibut was identified as a high priority species for management attention, primarily due to the potential risk to the species from fishing activities, and to other species that may be caught as bycatch in the fishery.

The Master Plan calls for a scaled management approach to fisheries management, in which a suite of management alternatives, ranging from the completion of ESRs to rule-makings to more comprehensive Fishery Management Plans, is considered. In 2020, the Department began the initial stages of considering the best scale of management for the halibut fishery and partnered with stakeholders to identify areas of concerns.

Learning from the knowledge gained in the stakeholder process and information gathering stage, the Department engaged in an internal strategic planning process from September 2021 to February 2022 to identify management priorities for the halibut fishery. This strategic planning process confirmed six management priorities for the

halibut fishery: 1) refinement of the 2020 stock assessment; 2) completion of the ESR; 3) completion of an ecosystem evaluation; 4) conducting a California Halibut Southern Trawl Ground assessment; 5) expansion of the halibut MSE; and 6) performing a bycatch evaluation.

These six management priorities are in different stages of completion and continue to be a high priority for the Department. Staff are actively working with outside contractors to refine the 2020 stock assessment (item 1) and expansion of the halibut MSE (item 5). The halibut ESR (item 2) has been published on the Department's Marine Species Information Portal and receives periodic updates with new information and data. The Farallon Institute partnered with the Department to evaluate predator-prey relationships for halibut as part of the ecosystem evaluation (item 3) and final results are currently in press. As summarized in this report, the Department has successfully completed the assessment of the southern CHTG (item 4) using the Performance Criteria, as required in FGC §8495(e). Results of this assessment have documented significant bycatch by way of discards (live or dead) and low discard mortality within the CHTG fishery. The amount of retained incidental catch fluctuates depending on market order and whether species caught meet management standards such as minimum length, thus affecting potential discard rate. There are minimal or no impacts to the seafloor, kelp or biogenic habitat from the light touch trawl gear, and there are several management control measures in place that provide protection to different aspects of ecosystem function. Despite the potential of the CHTG trawl fishery to have a significant discard rate, the majority of species are released in a live condition (~78%), and with no observed impacts to the seafloor, ecosystem health, or biogenic habitats, the Department concludes that the light-touch trawl gear fishery in the CHTG meets the Performance Criteria as evaluated using the standards established in the Master Plan and thus does not recommend any closures within the CHTG.

Looking forward, the Department will continue to explore opportunities to improve management of the statewide halibut fishery and is prioritizing completion of the six management priorities identified above. A key next step in this process is to incorporate this data and engage in a comprehensive bycatch evaluation of the federal trawl gear type utilized within the federal trawl grounds. Learning from the recent process to evaluate bycatch in the set gill net fishery, as part of the scaled-management process, Department staff are prepared to complete the four-step process to identify potential concerns surrounding bycatch in the state-wide trawl fleet and to collect necessary data in the two new CHTG off the central coast.

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APPENDICES

Appendix 1a. Evaluation of California skate based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take		
A1. Under what laws, regulations, or guidance documents is the species covered?	Fish and Game Code Federal Code of Regulations	The possession of skate wings on any boat is prohibited as there are no equivalents or conversion factors established in statute or regulation under which other than whole skates may be brought ashore (FGC §§5508, 8042). §8597.b(3) skates under 18 inches may be taken or possessed under marine aquaria collector permit. Title 14 CCR, §27.60 28.49(a); general bag limit of 10, §27.60 Federal groundfish seasonal closures,
A2. Are there prohibitions against take using specific gear type?	No	
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	No	
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl, however Department observers documented 0.3% mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	Open access quotas allow limited take, but generally all are released.
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	No	Classified as an Ecosystem Component Species under federal GFMP, no harvest guidelines.
A6b. If yes, does the catch comply with them?	Not applicable	
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	Yes	A vulnerability score of 2.12 indicates relatively high concern (Status of the Pacific Coast Groundfish Fishery 2020).
B2a. Does a population status estimate or stock assessment exist for this species?	No	

Category and question	Response	Comments
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Not applicable	
B3a. Are there any existing state and/or federal management measures?	Yes	Possession of skate wings on any boat is prohibited as there are no equivalents or conversion factors established in statute or regulation under which other than whole skates may be brought ashore (FGC §§5508, 8042). §8597.b(3) skates under 18 inches may be taken or possessed under marine aquaria collector permit. Title 14 CCR, §27.60 28.49(a); general bag limit of 10, §27.60. Federal groundfish seasonal closures.
B3b. If yes, are they effective in ensuring sustainability?	Not applicable	
B4. Is the bycatch the product of recreational catch-and-release practices?	No	
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl, however Department observers documented 0.3% mortality during the 2022-23 Department assessment.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	No	
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	

Category and question	Response	Comments
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	There is no federal harvest guideline for retention.
C7. If there is a directed fishery for the species, have there been any of the following?	Not applicable	
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	Not applicable	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	Not applicable	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	Not applicable	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	Not applicable	
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	Not applicable	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	Not applicable	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	Not applicable	
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?		CA skates are mesopredators; they eat primarily crustaceans and fishes.
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	No	
References		Status of the Pacific Coast Groundfish Fishery Stock Assessment and Fishery Evaluation September 2020, https://www.pcouncil.org/documents/2020/09/status-of-the-pacific-coast-groundfish-fishery-stock-assessment-and-fishery-evaluation-september-2020.pdf/

Appendix 1b. Evaluation of slender crab based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take	-	-
A1. Under what laws, regulations, or guidance documents is species covered?	Fish and Game Code, Title 14-CCR	FGC 8834 max weight of crab to be take w/trawl is 500 lbs; Recreational under 29.85(c). Same bag and carapace limitations as rock crabs.
A2. Are there prohibitions against take using specific gear type?	No	Take is recreationally legal using same gear as other crabs (crab trap, hoop net, snares, or by hand)
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	No	There is a minimum carapace length of 4" and a sport bag limit of 35.
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl, however Department observers documented 4.8% mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Not applicable	The slender crab typically not a target species because maximum size (4.5 in.) is smaller than other Cancridae crabs.
A6b. If yes, does the catch comply with them?	Not applicable	
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	Not assessed	
B2a. Does a population status estimate or stock assessment exist for this species?	No	
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Not applicable	
B3a. Are there any existing state and/or federal management measures?	Yes	Slender crab have a minimum carapace length of 4.5 in.
B3b. If yes, are they effective in ensuring sustainability?	Not applicable	Slender crab typically don't get large enough to meet the minimum length.
B4. Is the bycatch the product of recreational catch-and-release practices?	No	

Category and question	Response	Comments
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl, but Department observers documented a 4.8% discard mortality during the 2022-23 Department assessment..
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	No	
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	
C7. If there is a directed fishery for the species, have there been any of the following?	Not applicable	
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	Not applicable	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	Not applicable	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	Not applicable	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	Not applicable	

Category and question	Response	Comments
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	Not applicable	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	Not applicable	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	Not applicable	
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?	Slender crabs are macropredators. They eat primarily crustaceans and fishes.	
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	No	
References	Add specific references you used other than the general ones listed in Question A1.	

Appendix 1c. Evaluation of longspine combfish based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take		
A1. Under what laws, regulations, or guidance documents is species covered?	Fish and Game Code, Title 14-§27.60	There is a default recreational 10 fish limit.
A2. Are there prohibitions against take using specific gear type?	No	
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	No	There is no directed fishery for longspine combfish.
A4. Is the discard mortality rate known?	Unknown.	Unknown for trawl, however Department observers documented 54.8% mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Not applicable	
A6b. If yes, does the catch comply with them?	Not applicable	
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	Not assessed	This species is not evaluated under the International Union for Conservation and Nature (ICUN).
B2a. Does a population status estimate or stock assessment exist for this species?	No	
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Not applicable	
B3a. Are there any existing state and/or federal management measures?	Yes.	State recreational default bag limit of 10
B3b. If yes, are they effective in ensuring sustainability?	Not applicable	Not targeted or retained by recreational or commercial.
B4. Is the bycatch the product of recreational catch-and-release practices?	No	-

Category and question	Response	Comments
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl, but Department observers documented a 54.8% discard mortality for the 2022-23 Department assessment.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	No	
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	
C7. If there is a directed fishery for the species, have there been any of the following?	Not applicable	
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	Not applicable	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	Not applicable	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	Not applicable	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	Not applicable	

Category and question	Response	Comments
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	Not applicable	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	Not applicable	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	Not applicable	
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?		The longspine combfish is a predator of benthic invertebrates.
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	Unknown	
References	Add specific references you used other than the general ones listed in Question A1.	

Appendix 1d. Evaluation of Pacific angel shark based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
	IUCN Red List of Threatened Species	The species is listed as "Near threatened" on the IUCN Red List of Threatened Species in 2014. This category is between "Least concern" and "Vulnerable". Source: https://www.iucnredlist.org/species/39328/177163701
A. Legality of take		
A1. Under what laws, regulations, or guidance documents is species covered?	Fish and Game Code	A commercial minimum size limit established in 1986 was created to ensure that sharks had a chance to reproduce at least once before being retained in the catch. FGC §8388(a) states "No female angel shark measuring less than 42 inches in total length or 15 ¼ inches in alternate length and no male angel shark measuring less than 40 inches in total length or 14 ½ inches in alternate length may be possessed, sold, or purchased, except that 10 percent of the angel sharks in any load may measure not more than ½ inch less than the minimum size specified herein." There is a restricted access fishery for set gill nets (FGC §8610, 8680, 8681, and 8682).
A2. Are there prohibitions against take using specific gear type?	Yes	The set gill net fishery requires the use of a minimum mesh size and a maximum net length. Inside the CHTG, required cod-end mesh is 7.5 in, outside the CHTG in federal waters, the minimum mesh is 4.5 in.
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	Yes	There is a minimum size limit which requires discard of undersize fish. See A1.
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl. Department observers documented 0.0% discard mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Yes	There is a minimum legal size; see A1.
A6b. If yes, does the catch comply with them?	Yes	Fishermen may not legally land undersize fish.
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	Yes	Department PSA completed in 2019 indicated angel shark ranked first in vulnerability among 36 fish and invertebrate species analyzed.

Category and question	Response	Comments
B2a. Does a population status estimate or stock assessment exist for this species?	No	
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Not applicable	Pacific angel shark are largely protected from fishing pressure. Therefore, it is presumed that the population remains stable in California (ESR).
B3a. Are there any existing state and/or federal management measures?	Yes	Commercial set gill net and trawl fishing is allowed in their primary inshore sandy-bottom habitat. There is a minimum length requirement for retention.
B3b. If yes, are they effective in ensuring sustainability?	Yes	The Pacific angel shark is largely protected from fishing pressure. Therefore, it is presumed that the population remains relatively stable in California (ESR).
B4. Is the bycatch the product of recreational catch-and-release practices?	No	Recreational anglers do not target this species.
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl gear. Department observers documented 0% release mortality during the 2022-23 Department assessment.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	There have been no post-release studies for this species.
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	The Pacific angel shark is largely protected from fishing pressure. Therefore, it is presumed that the population remains stable in California (ESR).
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	Yes	It is taken as an incidentally caught species in the halibut set gill net fishery and halibut trawl fishery.
C2. Has the bycatch and associated discard mortality been accounted for?	No	Discard mortality unknown. Department observers documented 0% release mortality during the 2022-23 assessment.
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	The bycatch of Pacific angel shark is incidental catch since this is a desirable and marketable species.
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	Yes	This is discussed in the Pacific angel shark ESR.

Category and question	Response	Comments
C5a. Is the species constrained under a federal rebuilding plan?	No	This is not a federally managed species.
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	-
C6. Is there a management allowance for percent of catch or a prohibition on retention?	Yes	There is a prohibition on landing fish below the minimum legal size.
C7. If there is a directed fishery for the species, have there been any of the following?		
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	Yes	A ban on set gill netting in state waters and north of Point Conception, and closure of primary processing plant for angel sharks, led to a significant decline in catch and effort in the 1990s.
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	No	There is no quota for this species.
C7c. Early closures of a fishery based on higher-than-expected bycatch?	No	There are no early closures based on the amount of bycatch.
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	No	There have been no changes for which the Department is aware.
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	No	There have been no changes for which the Department is aware.
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	Yes	A ban on set gill netting in state waters and north of Point Conception, and closure of primary processing plant for angel sharks, led to a significant decline in catch and effort in the 1990s.
C7g. Negative impacts to juveniles of a species targeted by another fishery?	No	A minimum size limit offers protection to juveniles.
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?		"As apex predators, sharks play an important role in regulating trophic interactions. In California, Pacific angel shark prey on common reef fish, and thus probably exert some top-down regulation on the distribution and abundance of lower trophic level fishes and invertebrates in inshore food webs (Pittenger 1984, cited in ESR)."

Category and question	Response	Comments
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	No	"There are no formal overfishing threshold criteria for Pacific angel shark. However, landings are tracked in both the commercial and recreational sectors, and, given the low landings that have occurred since the ban on set gill net and trammel nets in the early 1990s, there are currently no concerns about overfishing occurring on this stock." (ESR)
References		Pittenger G.G. 1984. Movements, distribution, feeding, and growth of the Pacific angel shark, *Squatina californica*, at Catalina Island, California. Long Beach, California. California State University. 83 p.

Appendix 1e. Evaluation of hornyhead turbot based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take	Fish and Game Code, Title 14-§27.60	There is a default recreational 10 fish limit.
A1. Under what laws, regulations, or guidance documents is species covered?	No	
A2. Are there prohibitions against take using specific gear type?	No	There is no directed fishery for hornyhead turbot
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	No.	Unknown for trawl. Department observers documented 2.3% discard mortality during the 2022-23 Department assessment.
A4. Is the discard mortality rate known?	No	
A5a. Are special permits required to retain or interact with the species?	Not applicable	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	No	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Not applicable	
A6b. If yes, does the catch comply with them?		
B. Threats to sustainability	No	No PSA has been done, but the species is listed as least concern by ICUN.
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	No	
B2a. Does a population status estimate or stock assessment exist for this species?	Not applicable	

Category and question	Response	Comments
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Yes	Per Title 14, 27.60, there is a default recreational 10 fish limit. Generally, not commercially retained.
B3a. Are there any existing state and/or federal management measures?	unknown	Hornyhead turbot are not encountered by the recreational fishery or commercially retained.
B3b. If yes, are they effective in ensuring sustainability?	No	
B4. Is the bycatch the product of recreational catch-and-release practices?	Unknown	Unknown for trawl. Department observers documented 2.3% discard mortality during the 2022-23 Department assessment.
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	No	
B6. Do any post-release studies exist to verify the estimated mortality rate?	Unknown	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?		
C. Impacts on fisheries	No	Hornyhead turbot are taken incidentally in the halibut trawl and gill net fisheries.
C1. Does a directed fishery exist for the bycatch species?	No	
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	There is no ESR or FMP for hornyhead turbot.
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	
C5a. Is the species constrained under a federal rebuilding plan?	Not applicable	

Category and question	Response	Comments
C5b. If yes, will bycatch compete with fleets that target the species?	No	
C6. Is there a management allowance for percent of catch or a prohibition on retention?	Not applicable	
C7. If there is a directed fishery for the species, have there been any of the following?	Not applicable	
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	Not applicable	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	Not applicable	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	Not applicable	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	Not applicable	
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	Not applicable	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	Not applicable	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	Not applicable	
D. Impacts on ecosystem		The hornyhead turbot is a predator of benthic invertebrates.
D1. What is the ecosystem role of the bycatch species?	None available	

Category and question	Response	Comments
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	Add specific references you used other than the general ones listed in Question A1.	
References		

Appendix 1f. Evaluation of sheep crab based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take	-	-
A1. Under what laws, regulations, or guidance documents is species covered?	Fish and Game Code, Title 14	8598.2 legal for take with Marine aquaria permit; 8284(a) - any fish can be retained in crab traps used to take Dungeness crab 9011; 8284(c)(3) - Districts 19 and 118.5 in rock crab traps; 8250 (b)(1) - legal in lobster traps; 126(b)(3) legal for take in trap gear
A2. Are there prohibitions against take using specific gear type?	No	
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	No	
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl. Department observers documented 2.6% discard mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Yes	Per Title 14-126(b)(3), 95,000 lb are allowed for take statewide in a calendar year
A6b. If yes, does the catch comply with them?	Yes	52,000 lb were landed in 2022
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	Not assessed	
B2a. Does a population status estimate or stock assessment exist for this species?	Not assessed	
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Not applicable	

Category and question	Response	Comments
B3a. Are there any existing state and/or federal management measures?	Yes	Per FGC 8598.2, sheep crab are legal for take with Marine aquaria permit; Per Title 14 126(b)(3), sheep crab are legal for take in trap gear.
B3b. If yes, are they effective in ensuring sustainability?	unknown	Take of sheep crab is relatively low.
B4. Is the bycatch the product of recreational catch-and-release practices?	No	
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl. Department observers documented 2.6% discard mortality during the 2022-23 Department assessment.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	No	Sheep crab are taken incidentally in halibut trawl and gill net fisheries.
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	There is no ESR or FMP for sheep crab.
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	
C7. If there is a directed fishery for the species, have there been any of the following?	Not applicable	

Category and question	Response	Comments
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	Not applicable	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	Not applicable	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	Not applicable	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	Not applicable	
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	Not applicable	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	Not applicable	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	Not applicable	
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?		The sheep crab is a scavenger and predator of benthic invertebrates.
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	None available	
References	Add specific references you used other than the general ones listed in Question A1.	

Appendix 1g. Evaluation of yellow rock crab based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take		
A1. Under what laws, regulations, or guidance documents is species covered?	Fish and Game Code, Title 14	Per FGC 8598.2, yellow rock crab are legal for take with Marine aquaria permit; 8284(a) - any fish can be retained in crab traps used to take Dungeness crab 9011; 8284(c)(3) - Districts 19 and 118.5 in rock crab traps; 8250 (b)(1) - legal in lobster traps; Per Title 14, 126(b)(3), yellow rock crab are legal for take in trap gear; Per FGC 8834, the maximum weight of crab to be take with trawl is 500 lbs; 125(a) - permit required to take rock crab with traps; FGC 8282 and 125.1 - minimum size of 4.25 in.
A2. Are there prohibitions against take using specific gear type?	Yes	Recreational fishing using traps is prohibited south of Point Arguello; there ae limits to amount of recreational hoop net gear south of Point Arguello; Commercial trap fishing permit is open-access north of Lopez Point, limited-entry south of Lopez Point.
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	Yes	Yes, there is a minimum size limit of 4.25 in commercial, 4 in recreational (sublegal crab must be discarded).
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl. Department observers documented 0.0% discard mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Yes	Yellow rock crab has a minimum legal carapace length.
A6b. If yes, does the catch comply with them?	Yes	
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	Not assessed	
B2a. Does a population status estimate or stock assessment exist for this species?	Not assessed	

Category and question	Response	Comments
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Not applicable	
B3a. Are there any existing state and/or federal management measures?	Yes	Yes. Yellow rock crab has a minimum legal carapace measurement; take is permitted in commercial trap fisheries, and there is a recreational bag limit of 35.
B3b. If yes, are they effective in ensuring sustainability?	Unknown	Yes. the sport limit has been 35 for many decades.
B4. Is the bycatch the product of recreational catch-and-release practices?	No	
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl. Department observers documented 0.0% discard mortality during the 2022-23 Department assessment.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	Yes	Yes. There are northern and southern California rock crab trap fisheries. The species is also taken incidentally to Dungeness crab in the recreational fishery.
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	Yes, as related to the trap fishery. Other gear types are not considered.
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	

Category and question	Response	Comments
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	
C7. If there is a directed fishery for the species, have there been any of the following?	Not applicable	
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	No	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	No	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	No	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	No	
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	No	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	None	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	None	Most trawl-caught yellow rock crabs are released live. The Department's 2022-23 CHTG assessment saw 0% yellow rock crab mortality.
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?		The yellow rock crab is a scavenger and predator of benthic inverts
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	None available	

Category and question	Response	Comments
References	Add specific references you used other than the general ones listed in Question A1.	

Appendix 1h. Evaluation of sublegal halibut based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take	-	-
A1. Under what laws, regulations, or guidance documents is species covered?	Fish and Game Code: Title 14; Title 50 Federal Code of Regulations	Per FCG 8494-97: within the California Halibut Trawl Grounds, a trawl permit required; Per FGC 8392, there is a minimum length requirement with a tail sweep allowed;
		Per Title 14, 124: light touch trawl gear is required in trawl grounds, 124.1: requires halibut trawl permit renewal;
		Per Title 50 sec 660.333: participation in halibut trawl fishery defined,
A2. Are there prohibitions against take using specific gear type?	Yes	Sublegal-sized halibut are not allowed for retention with any gear.
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	Yes	There is a minimum legal length of 22 in.
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl. Department observers documented 16.8% discard mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Yes	There is a minimum legal length for retention regardless of gear type.
A6b. If yes, does the catch comply with them?	Yes	
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	Yes	
B2a. Does a population status estimate or stock assessment exist for this species?	Yes	Based on the 2011 California Halibut Stock Assessment, the southern population is estimated to be depleted to about 14% of its unexploited spawning biomass level); 2020 California Halibut Stock Assessment, Executive Summary; California Halibut 2020 Stock Assessment Review Panel Report
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	No	The CA halibut ESR states that the results of the 2020 efforts were reviewed by a panel of stock assessment experts and found not to be ready for use in management, particularly for the northern stock. The California Halibut 2020 Stock Assessment Review Panel Report outlined recommendations for additional data collection, analysis, and model improvements, including reconstructing historical halibut landings to reflect an unfished or nearly unfished condition and initial population estimates.
B3a. Are there any existing state and/or federal management measures?	Yes	From the CA halibut ESR: The minimum size limit is intended to allow halibut the opportunity to reproduce at least once before they become eligible for take by the fishery. Trawl fisheries are required to complete logbooks and under certain conditions they are subject to the requirements of the federal observer program and Vessel Monitoring Systems, which allows for monitoring of these gear types when fishing in federal waters or transiting federal waters with groundfish. Area closures and gear restrictions are intended to protect the halibut population, incidental co-occurring species, and habitat.

Category and question	Response	Comments
B3b. If yes, are they effective in ensuring sustainability?	Yes	From the CA halibut ESR: The Department has not established formal overfishing criteria for the halibut resource. The MLMA defines overfishing as a rate or level of take that the best available scientific information, and other relevant information, indicates is not sustainable or that jeopardizes the capacity of a marine fishery to produce the maximum sustainable yield on a continuing basis. Department staff continue to monitor catch, effort, and life history trends with fishery-dependent and fishery-independent datasets on a monthly to annual basis. These data are evaluated relative to historic trends and environmental factors. If a problem is detected by the Department or reported by stakeholders, Department resources and management attention focus on the situation. The halibut fishery is currently being evaluated with a Management Strategy Evaluation (MSE) using the Data Limited Methods Toolkit framework which is intended to establish formal overfishing rules. Should the MSE or the stock assessment indicate that the halibut population is overfished, a rebuilding plan will be required. There are currently no formal indications that the halibut resource is overfished, although the stock status may be different north compared to south of Point Conception.
B4. Is the bycatch the product of recreational catch-and-release practices?	No	
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl. Department observers documented 16.8% discard mortality during the 2022-23 Department assessment.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	Yes	The fishery is for legal size halibut 22 in. and up.
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	Currently no, but this may be considered during a statewide process to determine bycatch acceptability with trawl gear.
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	Bycatch impacts of sublegal halibut are not explored in detail in the ESR.
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	
C7. If there is a directed fishery for the species, have there been any of the following?		
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	No	

Category and question	Response	Comments
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	No	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	No	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	No	
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	No	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	None	

Appendix 1i. Evaluation of pink sea perch based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take		
A1. Under what laws, regulations, or guidance documents is species covered?	Title 14-§27.60	There is a default recreational 10 fish limit.
A2. Are there prohibitions against take using specific gear type?	No	
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	NO	Pink sea perch are not commercially or recreationally targeted or retained.
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl. Department observers documented 89.4% discard mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	No	Pink sea perch are not commercially or recreationally targeted or retained.
A6b. If yes, does the catch comply with them?	Not applicable	
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	No	
B2a. Does a population status estimate or stock assessment exist for this species?	No	
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?	Not applicable	

Category and question	Response	Comments
B3a. Are there any existing state and/or federal management measures?	Yes	There is a state default recreational 10 fish limit. However, this species is not targeted or retained by commercial or recreational fishermen.
B3b. If yes, are they effective in ensuring sustainability?	unknown	
B4. Is the bycatch the product of recreational catch-and-release practices?	No	
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl. Department observers documented 89.4% discard mortality during the 2022-23 CHTG assessment. Typically, the large cod-end mesh used in the CHTG allows pink sea perch to pass unless the net is clogged with debris.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	No	
C2. Has the bycatch and associated discard mortality been accounted for?	No	
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	No	
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	
C7. If there is a directed fishery for the species, have there been any of the following?		There is no directed fishery for pink sea perch.

Category and question	Response	Comments
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	No	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	No	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	No	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	No	
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	No	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	None	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	No	
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?		The pink sea perch is a predator of benthic worms, brittle start, and small crustaceans.
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	None available	
References	Add specific references you used other than the general ones listed in Question A1.	

Appendix 1j. Evaluation of English sole based on MLMA Master Plan bycatch criteria.

Category and question	Response	Comments
A. Legality of take		
A1. Under what laws, regulations, or guidance documents is species covered?	Title 50, Fed Code of Regulations; Managed groundfish	Title 50. 660.23 establishes fixed gear limits, Title 50. 660.55: established an allocation limit.
A2. Are there prohibitions against take using specific gear type?	No	
A3. Is the species a target species that requires discard of individuals based on size limits, seasons, or gear type restrictions?	No	
A4. Is the discard mortality rate known?	Unknown	Unknown for trawl, however Department observers documented 8.3% mortality during the 2022-23 Department assessment.
A5a. Are special permits required to retain or interact with the species?	No	
A5b. If yes, does the fishery currently have such permits?	Not applicable	
A5c. If yes, do the levels of bycatch comply with them?	Not applicable	
A6a. Does the species have an incidental catch allowance, ACL, or other restrictions on the amount, size, or sex of catch allowed?	Yes	A quota amount is set under Groundfish Management Plan (GMP).
A6b. If yes, does the catch comply with them?	Yes	Directed catch is primarily by the groundfish fleet. Retention by the halibut trawl fleet is minimal.
B. Threats to sustainability		
B1. Has a peer-reviewed risk assessment of the vulnerability of the particular bycatch species to overfishing been conducted (e.g., PSA)	No	
B2a. Does a population status estimate or stock assessment exist for this species?	Yes	English sole was assessed in 2013 under GMP and was not overfished.
B2b. If yes, is there confidence in the underlying data such that a reasonable determination can be made if the stock is considered healthy, overfished, or depleted?		The stock is not overfished. The directed catch is less than 1% of GF trawl quota.

Category and question	Response	Comments
B3a. Are there any existing state and/or federal management measures?	Yes	There is a state default recreational 10 fish limit. However, the species is not targeted or retained by recreational anglers. There are commercial catch limits established under GMP.
B3b. If yes, are they effective in ensuring sustainability?	Yes	
B4. Is the bycatch the product of recreational catch-and-release practices?	No	
B5. What is the estimated discard mortality rate given the characteristics of the fishery and gear type?	Unknown	Unknown for trawl, however Department observers documented 8.3% mortality during the 2022-23 Department assessment.
B6. Do any post-release studies exist to verify the estimated mortality rate?	No	
B7. What is the probability of mortality exceeding levels that have been scientifically determined to be necessary for the continued viability of the species?	Unknown	Unknown but probably low. The directed trawl fishery takes little of the quota and the southern halibut fishery retains little. The required large cod-end mesh may contribute to reduced net retention.
C. Impacts on fisheries		
C1. Does a directed fishery exist for the bycatch species?	Yes	A directed groundfish trawl fishery exists.
C2. Has the bycatch and associated discard mortality been accounted for?	Yes	They are accounted for under federal catch limits by fishing sector.
C3. Is bycatch affecting the directed fishery management strategy (i.e., restrictions on size, sex, or season)?	No	
C4. Are the impacts of bycatch considered and made explicit in an ESR or FMP?	Yes	The species is managed under the groundfish FMP.
C5a. Is the species constrained under a federal rebuilding plan?	No	
C5b. If yes, will bycatch compete with fleets that target the species?	Not applicable	
C6. Is there a management allowance for percent of catch or a prohibition on retention?	No	
C7. If there is a directed fishery for the species, have there been any of the following?		There is a federal groundfish fishery.

Category and question	Response	Comments
C7a. Reductions in opportunities or income for participants in fisheries that target the bycatch species	No	
C7b. Reductions in fishery quotas or opportunities (e.g., time and area closures) based on bycatch issues?	No	
C7c. Early closures of a fishery based on higher-than-expected bycatch?	No	
C7d. Changes in fishing, processing, disposal, and marketing costs due to bycatch?	No	
C7e. Changes in the social or cultural value of fishing activities due to bycatch?	No	
C7f. Negative socioeconomic impacts from bycatch on fisheries and/or fishing communities which target or need incidental catch of this species?	None	
C7g. Negative impacts to juveniles of a species targeted by another fishery?	No	
D. Impacts on ecosystem		
D1. What is the ecosystem role of the bycatch species?		The English sole is a predator of benthic worms, brittle stars, and small crustaceans.
D2. Does scientific evidence show the amount of bycatch mortality significantly increases the risk that a bycatch species will be unable to serve its ecosystem role?	None available	
References	Add specific references you used other than the general ones listed in Question A1.	

Appendix 2a. Observed invertebrate trawl catch from 2018-2022 (June 16-March 14) for southern California CHTG (WCGOP 2022,2023**). (Unid = unidentified to species). Discard counts include estimates based on species subsamples that are expanded to haul level. Weight in metric tons.**

Species	Scientific Name	Retained MT	Discard Count	Discard MT
Armed box crab	*Platymera gaudichaudii*	0	1,030	0.17
Bivalve Unid	Bivalvia	0	62	0.002
Bobtail squid	Sepiolida	0	24	0.001
Brittle/Basket star unid	Ophiuroidea	0	2	0.0
CA sea cucumber	*Parastichopus californicus*	0	142	0.042
California spiny lobster	*Panulirus interruptus*	0	NA	0.011
Crab unid	Decapoda	0.086	NA	0.054
Crab unid	Brachyura/Anomura	0.094	NA	0
Decorator/Spider crab Unid	Majidae	0	4	0.0
Dungeness crab	*Cancer magister*	0	13	0.009
Graceful crab	*Cancer gracilis*	0	1,714	0.237
Horny gorgonian	Holaxonia	0	5	0.0
Humboldt (Jumbo) squid	*Dosidicus gigas*	0	NA	0.005
Invertebrate unid	N/A	0.001	NA	0.02
Isopod unid	Isopoda	0	22	0.0
Jellyfish unid	Scyphozoa	0	59	0.039
Kelp crab unid	Pugettia	0	14	0.002
King crab unid	Lithode	0.005	NA	0
Market squid	*Doryteuthis opalescens*	0.078	NA	0
Masking crab	*Loxorhynchus crispatus*	0	4	0.001
Mollusk unid	Mollusca	0	2	0.001
Non-Humboldt squid unid	Teuthida	0.054	4,563	0.146
Nudibranch unid	Nudibranchia	0	240	0.039
Octopus unid	Octopoda	0	441	0.018
Pacific rock crab	*Cancer antennarius*	0	89	0.027
Purple globe crab	*Randallia ornata*	0	13	0.002
Pyrosome unid	Pyrosoma spp	0	844	0.206
Red rock crab	*Cancer productus*	1.137	22	0.012
Ridgeback prawn	*Sicyonia ingentis*	0	1,101	0.013
Rock crab	N/A	0.008	2	0.007
Sea anemone unid	Actiniaria	0	17	0.008
Sea cucumber unid	Holothuroidea	0	127	0.026
Sea pansy	Renillidae	0	1	0.0
Sea pen	Pennatulacea	0	56	0.001
Sea star unid	Asteroidea	0	4,687	0.02
Sheep crab	*Loxorhynchus grandis*	0.007	932	1.062

Species	Scientific Name	Retained MT	Discard Count	Discard MT
Shrimp unid	Caridea	0.002	4,928	0.101
Spiny lobster unid	Palinura	0	169	0.111
Spot prawn	*Pandalus platyceros*	0	18	0.0
Tunicate unid	Tunicata	0	48	0.002
Urchin unid	Echinoidea	0	18	0.0
Xantus swimming crab	*Portunus xantusii*	0	16	0.0
Yellow rock crab	*Cancer anthonyi*	0	1,783	0.54

Appendix 2b. Observed finfish trawl catch from 2018-2022 (June 16-March 14) for southern California CHTG (WCGOP 2022,2023**). (Unid = unidentified to species). Discard counts include estimates based on species subsamples that are expanded to haul level. Weight in metric tons.**

Species- finfish	Scientific Name	Retained MT	Discard Count	Discard MT
Anchovy unid	Engraulidae	0.07	2	0.0
Banded guitarfish	*Zapteryx exasperata*	0	1	0.001
Barred sand bass	*Paralabrax nebulifer*	0	252	0.262
Bass unid	Percichthyidae/Serranidae	0	NA	0.002
Bat ray	*Myliobatis californica*	2.780	928	6.539
Bay pipefish	*Syngnathus leptorhynchus*	0	3	0.0
Big skate	*Raja binoculata*	0.166	54	0.278
Bocaccio rockfish	*Sebastes paucispinis*	0	1	0.0
Brown rockfish	*Sebastes auriculatus*	0.029	35	0.014
Brown smoothhound shark	*Mustelus henlei*	0	128	0.161
Cabezon	*Scorpaenichthys marmoratus*	0	2	0.002
California barracuda	*Sphyraena argentea*	0.012	NA	0
California butterfly ray	*Gymnura marmorata*	0	1	0.006
California halibut	*Paralichthys californicus*	10.918	2,663	3.554
California lizardfish	*Synodus lucioceps*	0.036	1,931	0.452
California scorpionfish	*Scorpaena guttata*	0.576	1,355	0.324
California sheephead	*Semicossyphus pulcher*	0.016	5	0.007
California skate	*Raja inornata*	0.358	12,917	4.808
C-O (C-O Turbot) sole	*Pleuronichthys coenosus*	0	3	0.0
Combfish unid	Zaniolepis	0	NA	0.342
Common thresher shark	*Alopias vulpinus*	0.084	2	0.004
Copper rockfish	*Sebastes caurinus*	0	52	0.002
Croaker unid	Sciaenidae	0.001	NA	0
Curlfin sole	*Pleuronichthys decurrens*	0.007	219	0.04
Cusk-eel unid	Ophidiidae	0	1	0.0
Diamond turbot	*Hypsopsetta guttulata*	0	2	0.001
Dover sole	*Microstomus pacificus*	0	57	0.004
Eelpout unid	Zoarcidae	0	4	0.0
Egg case unid	N/A	0	17	0.001
English sole	*Parophrys vetulus*	0.324	3,518	0.492
Fantail sole	*Xystreurys liolepis*	0.511	2,272	0.756
Flatfish unid	Pleuronectiformes	0.01	NA	0.014
Giant sea bass	*Stereolepis gigas*	0	5	0.01
Gray smoothhound shark	*Mustelus californicus*	0	3	0.004
Halfbanded rockfish	*Sebastes semicinctus*	0	34	0.001
Horn shark	*Heterodontus francisci*	0	76	0.072

Species- finfish	Scientific Name	Retained MT	Discard Count	Discard MT
Hornyhead turbot	*Pleuronichthys verticalis*	0.206	10,479	1.431
Kelp rockfish	*Sebastes atrovirens*	0	2	0.0
Leopard shark	*Triakis semifasciata*	0.042	1	0.02
Lingcod	*Ophiodon elongatus*	0	26	0.005
Longfin sanddab	*Citharichthys xanthostigma*	0	3,691	0.056
Longspine combfish	*Zaniolepis latipinnis*	0	103,977	2.479
Mexican rockfish	*Sebastes macdonaldi*	0	5	0.0
Midshipman (Toadfish)	Batrachoididae	0	4114	0.609
Mixed species	N/A	0.0	NA	0.007
Nearshore rockfish unid	Scorpaenidae	0.001	NA	0
Northern anchovy	*Engraulis mordax*	0.001	297	0.004
Ocean whitefish	*Caulolatilus princeps*	0	22	0.003
Pacific angel shark	*Squatina californica*	2.976	2,260.4	5.462
Pacific butterfish	*Peprilus simillimus*	0.003	172	0.007
Pacific hake	*Merluccius productus*	0	8	0.003
Pacific sanddab	*Citharichthys sordidus*	0.008	844	0.058
Pacific sardine	*Sardinops sagax*	0	3	0.0
Pacific staghorn sculpin	*Leptocottus armatus*	0	2	0.0
Painted greenling	*Oxylebius pictus*	0	1	0.0
Pink surfperch	*Zalembius rosaceus*	0	263	0.008
Plainfin midshipman	*Porichthys notatus*	0	46	0.052
Queenfish	*Seriphus politus*	0	154	0.008
Ray unid	Myliobatiformes	0	1	0.014
Rock sole	*Pleuronectes bilineatus*	0.133	NA	0
Sand sole	*Psettichthys melanostictus*	0.004	2	0.001
Sanddab unid	Citharichthys	0.01	NA	0
Sarcastic fringehead	*Neoclinus blanchardi*	0	11	0.001
Sculpin unid	Cottidae	0	681	0.007
Sevengill shark	*Notorynchus cepedianus*	0	5	0.026
Shark unid	Squaliformes	0.012	16	0.082
Shark unid	Elasmobranchii	0.022	1	0
Shiner surfperch	*Cymatogaster aggregata*	0	3	0.0
Shovelnose guitarfish	*Rhinobatos productus*	0	37	0.087
Skate unid	Rajidae	0.372	2	0
Smooth stargazer	*Kathetostoma averruncus*	0	81	0.03
Smoothhound shark unid	Mustelus	0.033	NA	0.012
Soupfin shark	*Galeorhinus galeus*	0	1	0.034
Speckled sanddab	*Citharichthys stigmaeus*	0	22	0.001
Specklefin midshipman	*Porichthys myriaster*	0	289	0.095
Spiny dogfish shark	*Squalus suckleyi*	0.077	55	0.282
Splitnose searobin	*Bellator xenisma*	0	2	0.0

Species- finfish	Scientific Name	Retained MT	Discard Count	Discard MT
Spotted batfish	*Zalieutes elater*	0	19	0.001
Spotted ratfish	*Hydrolagus colliei*	0	56	0.025
Spotted turbot	*Pleuronichthys ritteri*	0	49	0.008
Squarespot rockfish	*Sebastes hopkinsi*	0	7	0.0
Starry skate	*Raja stellulata*	0	3	0.001
Stripetail rockfish	*Sebastes saxicola*	0	119	0.002
Surfperch unid	Embiotocidae	0	4,452	0.11
Thornback	*Platyrhinoidis triseriata*	0	72	0.054
Thresher shark unid	Alopias	0.009	NA	0
Vermilion rockfish	*Sebastes miniatus*	0.017	252	0.002
White croaker	*Genyonemus lineatus*	0.137	7,652	0.714
White sea bass	*Atractoscion nobilis*	0.025	2	0.016