Fisheries Research 183 (2016) 294–303

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

Evaluation of a sorting grid bycatch reduction device for the selective flatfish bottom trawl in the U.S. West Coast fishery

Mark J.M. Lomeli[a,*], W. Waldo Wakefield[b]

[a] Pacific States Marine Fisheries Commission, 2032 SE OSU Drive, Newport, OR 97365, USA
[b] Fishery Resource Analysis and Monitoring Division, Northwest Fisheries Science Center, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, 2032 SE OSU Drive, Newport, OR 97365, USA

ARTICLE INFO

Article history:
Received 17 June 2015
Received in revised form 5 February 2016
Accepted 10 June 2016
Handled by P. He

Keywords:
Bycatch reduction device
Selective flatfish trawl
Recapture net
Flatfishes
Roundfishes
Pacific halibut

ABSTRACT

The U.S. West Coast limited entry groundfish trawl fishery is managed under an individual fishing quota program. For many fishermen targeting flatfishes in this fishery, catches of rockfishes (*Sebastes* spp.), sablefish (*Anoplopoma fimbria*), and Pacific halibut (*Hippoglossus stenolepis*) can be a concern because quota is limited relative to flatfish quotas. Thus, approaches to minimize bycatch of limiting species are important to the economic viability of the fishery. In this study, we examined the size-selection characteristics of a flexible sorting grid bycatch reduction device (designed to retain flatfishes while reducing catches of rockfishes, sablefish, and Pacific halibut) using a recapture net. The mean codend retention of target flatfishes (five species evaluated) ranged from 68.1% to 92.3%. Combined, the mean flatfish retention was 85.6%. Codend catches of shelf rockfishes, slope rockfishes, sablefish, and Pacific halibut were reduced by 80.3%, 64.0%, 97.0%, and 90.3% by weight, respectively. Significant differences in selectivity parameters between flatfishes, rockfishes, sablefish, and Pacific halibut were observed. Over fishing grounds where fishermen need a more selective trawl to harvest flatfishes, the experimental gear tested could provide fishermen a technique to reduce catches of non-target species.

1. Introduction

The U.S. West Coast limited entry (LE) groundfish bottom trawl fishery operates under a catch share program initiated in 2011 that allocates individual fishing quotas (IFQs) and establishes annual catch limits (ACLs) for over 30 groundfish managed units (stocks, stock complexes, and geographical subdivisions of stocks), and individual bycatch quotas for Pacific halibut (*Hippoglossus stenolepis*, a prohibited species) (PFMC and NMFS, 2010, 2012). In this program, fishermen are allocated a proportion of the fishery ACL with the option to transfer, lease, or permanently sell their quota to another shareholder. The catch share program was intended to improve the economic efficiency of the fishery, maximize fishing opportunities, and minimize bycatch. However, stocks with low ACLs have affected many fishermen's ability to maximize their quota shares of more abundant and productive stocks.

Over the continental shelf of the west coast a nearshore flatfish fishery occurs where over 10 healthy flatfish species are harvested. Dover sole (*Microstomus pacificus*) and petrale sole (*Eopsetta jordani*) are the top two species landed by weight and in ex-vessel value (PacFIN, 2015a,b). Fishermen's ability to fully utilize the available flatfish ACLs, however, has been constrained as a result of bycatch of darkblotched rockfish (*Sebastes crameri*), sablefish (*Anoplopoma fimbria*), and Pacific halibut. For example, recent catches of Dover sole have been approximately 6,087 mt (PacFIN, 2014) even though the shorebased trawl ACL was 22,234 mt (NMFS, 2014a) with catches of constraining species, such as darkblotched rockfish, sablefish, and Pacific halibut, as the primary cause preventing fishermen from maximizing their Dover sole IFQ.

Low-rise trawls (i.e., trawls with a low headrope height) with either a reduced top panel or a top panel constructed of large mesh are termed selective flatfish trawls and were developed to reduce bycatch in flatfish fisheries (King et al., 2004; Krag and Madsen, 2010; Madsen et al., 2006; Thomsen, 1993). This trawl was designed to allow non-flatfish species that have a tendency to rise when encountered an opportunity to escape before trawl entrainment. In the LE groundfish bottom trawl fishery, trawlers fishing shoreward of 183 m water depth and north of 40°10′N latitude are required to use a two-seam low-rise selective flatfish trawl to minimize bycatch of rockfishes (NMFS, 2014b). This trawl significantly reduces catches of canary rockfish (*S. pinniger*) and other benthopelagic groundfishes, for example, redstripe rockfish

* Corresponding author.
E-mail address: mlomeli@psmfc.org (M.J.M. Lomeli).

http://dx.doi.org/10.1016/j.fishres.2016.06.011
0165-7836/

(*S. proriger*) and Pacific hake (*Merluccius productus*), while maintaining flatfish catch levels (King et al., 2004; Parker et al., 2004). However, the selective flatfish trawl has been less effective at reducing catches of some of the more benthic rockfishes and other roundfishes (e.g., darkblotched rockfish and sablefish), restricting some fishermen's ability to fully reach their flatfish IFQs, particularly for Dover sole.

In the LE groundfish bottom trawl fishery, Lomeli and Wakefield (2013, 2015) examined Pacific halibut flexible sorting grid (size selection panels with square or rectangular openings) bycatch reduction devices (BRDs) designed for harvesting assemblages of roundfishes and flatfishes. These studies have demonstrated that flexible sorting grid BRDs can be effective at reducing bycatch in the groundfish fishery, are easy for the vessel crew to handle, and add no additional steps to the fishing operations. In 2014, Lomeli and Wakefield (2015) designed a selective flatfish flexible sorting grid BRD for use in the nearshore flatfish fishery. This BRD utilizes two vertical sorting panels with long rectangular slots to allow flatfishes to pass through and move aft towards the codend while excluding larger-sized rockfishes, other roundfishes, and Pacific halibut. Results from this initial work (using a recapture net to quantify fish escapement out the BRD) showed a mean flatfish retention of 85.1% by weight while reducing catches of non-target species by over 72%. Modeling the size-selective properties of the BRD, however, was not performed in the study. The purpose of the current study was to model the size-selection parameters of the BRD developed by Lomeli and Wakefield (2015) for roundfishes, Pacific halibut, and other flatfishes.

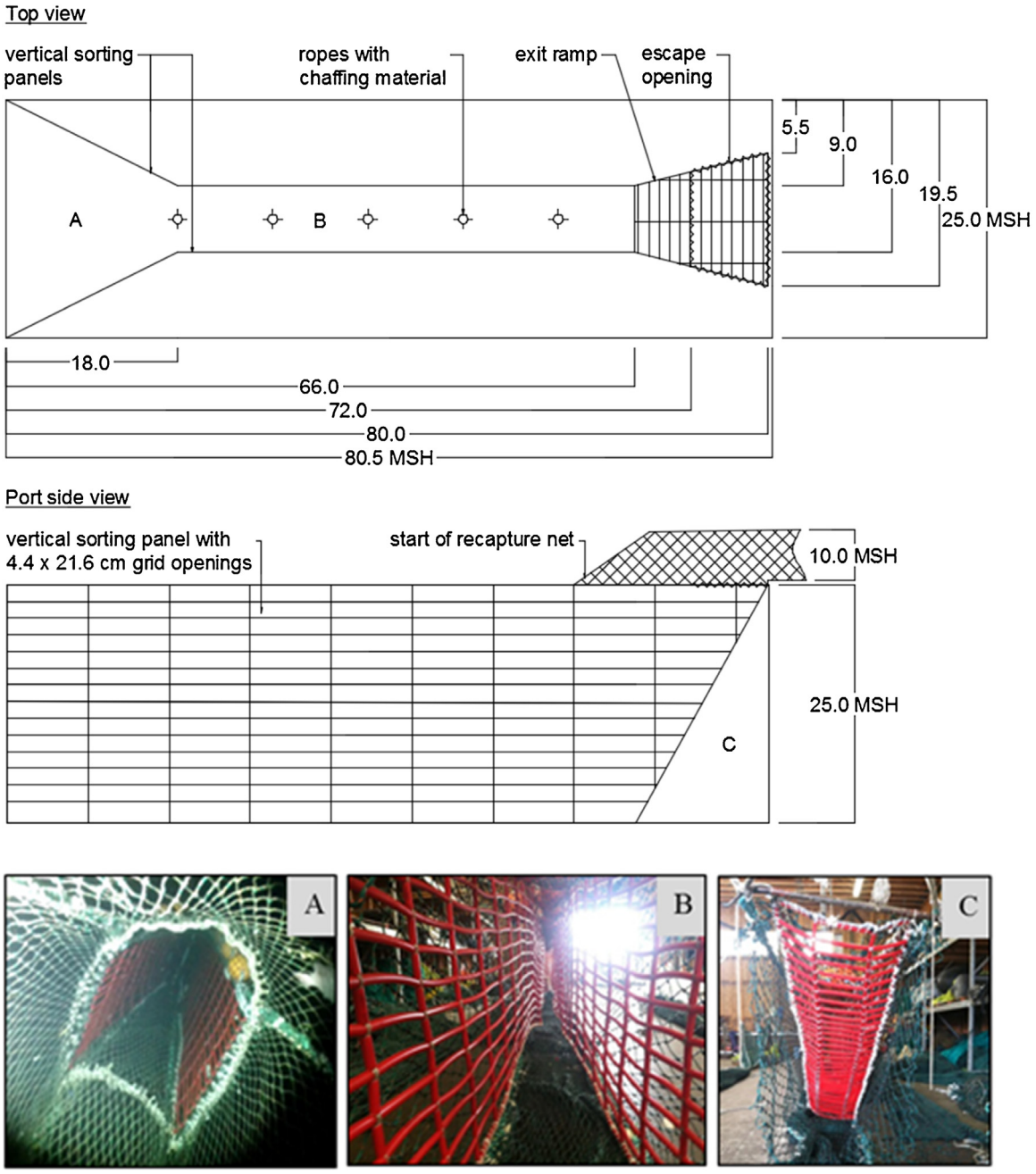

Fig. 1. Schematic diagram of the flexible sorting grid tested (top); aft view of the forward portion of the gear where fish enter and encounter the device (image A); aft view of the "hallway" section of the gear being built (image B); fore view of the upward-angled exit ramp (image C). MSH = meshes. *Note:* schematic diagram is not drawn to scale.