



Characteristics and discard mortality of octopus bycatch in Alaska groundfish fisheries



M. Elizabeth Conners^{a,*}, Michael Levine^{b,1}

^a National Marine Fisheries Service, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115, United States

^b Ocean Associates, Inc. 4007 N. Abingdon Street, Arlington, VA 22207, United States

ARTICLE INFO

Article history:

Received 24 May 2016

Received in revised form 9 September 2016

Accepted 12 September 2016

Handled by A.E. Punt

Available online 19 September 2016

Keywords:

Octopus

Enteroctopus doffeini

Discard mortality

Giant Pacific octopus

North Pacific

RAMP

ABSTRACT

Octopus are caught incidentally in several US federally-managed trawl, longline, and pot fisheries in Alaska. The majority caught are giant Pacific octopus *Enteroctopus doffeini*. Recent changes in fisheries management in Alaska have resulted in the creation of an octopus species complex with annual catch limits, leading to increased interest in management and catch accounting for this data-poor assemblage. This study characterized the incidental octopus catch in Alaska groundfish fisheries and the mortality rate of octopus caught and discarded at sea. Onboard fisheries observers collected data on octopus weight, sex, and condition at discard in a variety of Alaska groundfish fisheries from 2006 to 2011. A field study aboard a commercial pot-fishing vessel examined delayed mortality resulting from the capture process in giant Pacific octopus during routine pot fishing. Octopus incidental catch varied widely in size and condition at capture for various fishing gear types. Vessels fishing using pot gear captured larger octopus than vessels using longline or trawl gear. Initial condition at capture was best in pot gear, with over 90% of octopus discarded from pot vessels alive in excellent condition. Octopus taken in trawl gear had the highest immediate mortality rate, with 68–94% dead or injured at discard. Giant Pacific octopus held for 24–60 h following pot capture showed no signs of delayed mortality or decline in condition. These results suggest that assuming 100% mortality of discarded octopus may overestimate fishing impacts.

© 2016 Published by Elsevier B.V.

1. Introduction

Commercial fisheries capture a substantial amount of non-target catch that is discarded, with a weight equal to approximately 28% of the total landed tonnage in the United States (Harrington et al., 2005). While catch of minor species may be unintended, this catch can be substantial enough to impact populations of the non-target species (Zhou et al., 2011). Effective fisheries management must account for discarded incidental catch as well as retained catch. Catching, handling, and discarding practices can lead to immediate mortality of incidental catch on deck as well as mortality following discard, termed delayed mortality (Davis, 2002; Stoner, 2012). The most common conservative management approach is to assume 100% mortality of all incidental catch. However, this approach will overestimate the impact of the fishery if a species

frequently survives discard and does not experience substantial delayed mortality.

Accounting for octopus discards has become increasingly important in the Alaska groundfish fishery, the largest fishery in the United States (National Marine Fisheries Service, 2015). Although there is currently no directed fishing for octopus of any species in this region, there is a large amount of incidental catch in the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) management regions (Conners et al., 2014; Conners and Conrath, 2015). The majority of the octopus bycatch is taken by pot fisheries for Pacific cod (*Gadus microcephalus*) in both regions. Annual catch from 2003 to 2015 has ranged from 72 t (t) to 587 t in the BSAI, and 149 t to 1298 t in the GOA (Table 1). Changes in the management of Alaska fisheries under the Magnuson-Stevens Act have led to annual catch limits for octopus in the BSAI and GOA since 2011. Stock assessment of this group is strongly hampered by a lack of information on abundance, distribution, and life history (Reuter et al., 2010). At the present time, data are not available or sufficient to support a model-based assessment for the octopus complex.

Accurate catch accounting in the octopus species assemblage requires knowledge of the amount of octopus retained as well as the total mortality of discarded octopus. Total mortality is an estimate

* Corresponding author.

E-mail address: Liz.conners@noaa.gov (M.E. Conners).

¹ Current Address: NMFS Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle WA 98115, United States.

Table 1
Incidental catch of octopus (t, all species) in commercial groundfish fisheries for the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) fisheries management areas (NOAA Fisheries: www.alaskafisheries.noaa.gov).

Year	Total Catch (mt)	
	BSAI	GOA
2003	269	212
2004	338	283
2005	338	149
2006	351	166
2007	181	266
2008	212	339
2009	72	321
2010	177	330
2011	587	927
2012	86	415
2013	223	442
2014	422	1298
2015	444	970

of the proportion of animals that die as a result of capture and discard, including delayed mortality that occurs after discard (Benoit et al., 2012). A range of capture stresses such as physical trauma due to fishing gear contact, temperature and pressure changes from capture depth to the surface, and exposure to air will influence the mortality of discarded catch (Davis, 2002). Delayed mortality is often estimated using containment experiments in which animals are held in tanks for a period of time following capture to observe mortality rates. This approach has been used with a variety of fish and invertebrate species in the North Pacific, including Pacific halibut (*Hippoglossus stenolepis*), snow crab (*Chionoecetes opilio*), and Tanner crab (*C. bairdii*) (Kaimmer and Trumble, 1998; Stoner et al., 2008). No containment experiments have been conducted for North Pacific cephalopod species, but the octopus *Eledone cirrhosa* demonstrated a survival rate of approximately 90% over 120–144 h following capture by beam trawl in the North Atlantic (Kaiser and Spencer, 1995).

This study describes a fishery observer special project from 2006 to 2011, which collected information about the sizes, sexes, and condition of captured octopus across a range of fishery seasons, areas, and gear types. In addition, a small field containment study was conducted aboard a commercial pot fishing vessel to examine short-term delayed mortality in the fishery where most octopus are caught as bycatch. The goal was to estimate the proportion of octopus that die or show decreased condition during the first 24–48 h following capture. Together, the North Pacific fisheries observer special project and field containment study provide a “first look” at the extent of mortality of incidentally-caught octopus in Alaska groundfish fisheries. A larger study conducted at the Alaska Fisheries Science Center’s Kodiak Research Laboratory used on-shore containment to look at longer term delayed mortality (Conrath and Sisson, 2016).

2. Methods

2.1. Octopus incidental catch

The incidental catch of octopus in Alaska is estimated by the National Marine Fisheries Service (NMFS) Alaska Regional Office catch accounting system (Table 1; www.alaskafisheries.noaa.gov). The NMFS directs the deployment of fisheries observers aboard commercial fishing vessels in all Alaska federal water groundfish fisheries to account for retained and incidental catch by recording information on vessel fishing location, effort, and catch composition and amount (Calahan, 2010). Observers are also deployed at shore-based processing plants receiving groundfish deliveries. While exact sampling protocols differ depending on the observed

vessel and gear type, observers generally randomly sampled 33% of the total vessel catch when aboard pot and longline vessels, and observed trawl vessel fractions typically varied from 2% to 29% (Calahan, 2010). Data from most vessel and plant observers are transmitted in real time to an in-season catch accounting system, and total catch by vessel class and regional management area is monitored throughout the year by the Alaska Regional Office.

2.2. Observer special project

US federal fisheries observers in the BSAI and GOA collected supplemental data on octopus caught incidentally during fishing operations during 2006–2011. Observers on commercial fishing vessels collected data on all octopus found in catch species composition samples, and observers at processing plants collected octopus data from all octopus encountered during the delivery. Observers did not identify octopus to species. Data were collected in three of the four large marine ecosystems off Alaska (Fig. 1), including the Bering Sea (BS) and Aleutian Islands (AI), which are both within the BSAI management region.

In 2006–2007, vessel-based observers noted the visual condition of octopus at the point of catch sample processing as either “alive”, “injured”, or “dead.” Vessel and plant observers also recorded the whole weight and sex of octopus. Sex was identified by looking for the specialized 3rd arm tip in males, and was left as “unidentified” where not determined. In 2008–2009, vessel and plant observers recorded the whole weight and sex of octopus but did not assess condition. In 2010–2011, the condition assessment was modified to more accurately reflect animal condition under normal crew handling procedures. Octopus condition was assessed at the point the vessel usually discarded incidental catch, and condition was not assessed if an octopus did not represent typical handling procedures. Condition was assessed using the viability codes “excellent,” “poor,” and “dead,” as determined using a key based on movement, external injuries, tissue strength, and color. A brief summary of this key is shown in Table 2. At processing plants, observers only recorded octopus sex and weight (noting if octopus was whole or gutted). A range of weighing scales were used by vessel- and plant-based observers, with accuracy from approximately ± 0.1 kg–0.5 kg. It is important to note that this effort was not evenly distributed throughout the entire fleet and observer participation was voluntary. Observer special project data are considered an opportunistic look at incidentally caught octopus and not a randomly selected sample.

2.3. Discard mortality field study

The experiment was conducted aboard the commercial fishing vessel F/V *Aleutian Mariner* in January 2013. The *Aleutian Mariner* is a 118 ft, house-forward vessel rigged for pot fishing, and fishes commercially in the BSAI for crab and Pacific cod. As with other pot boats, the *Mariner* routinely takes octopus as incidental catch in their Pacific cod fishery and agreed to participate in the project during their normal winter fishing season. Fishing was conducted in the southeast Bering Sea just north of the Alaska Peninsula, at depths ranging from 64 to 95 m (Fig. 1). Octopus were captured in standard 7 × 7 crab pots rigged for the Pacific cod fishery. When an octopus was caught, it was dropped onto a catch sorting table by the fishing crew, and moved from the sorting table to the point of discard at the outboard rail. Typical handling was rough, and octopus were separated from the table and transported as efficiently as possible. These practices are consistent with those observed by the authors on many other pot boats.

Octopus sex was noted and weight was measured at the time of capture. Octopus were weighed using a 50 kg hanging scale (± 0.5 kg accuracy, Salter, 235-6S-110 model). Octopus condition was then

Download English Version:

<https://daneshyari.com/en/article/4542652>

Download Persian Version:

<https://daneshyari.com/article/4542652>

[Daneshyari.com](https://daneshyari.com)