Fisheries Research 155 (2014) 177–184

Contents lists available at ScienceDirect

Fisheries Research

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

Research Paper

Catch comparison between otter and rollerframe trawls: Implications for sampling in seagrass beds

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ARTICLE INFO

Article history:
Received 11 July 2013
Received in revised form 24 February 2014
Accepted 4 March 2014
Handling Editor Dr. P. He
Available online 4 April 2014

Keywords:
Active sampling
Field experiment
Gear comparison
Otter trawl
Rollerframe trawl
Submerged aquatic vegetation

ABSTRACT

The use of otter trawls as a sampling gear in habitats with shallow, submerged aquatic vegetation (SAV) has been criticized due to its variable and low capture efficiency. Moreover, the area swept by otter trawls is dynamic both between and within tows; capture of fauna associated with seagrass can be strongly influenced by gear-induced turbulence, and animals are able to escape under the net that often rides on top of the SAV. We compared catch from the commonly-used otter trawl with that from the rollerframe trawl, which has not been previously evaluated for fishery-independent research purposes. We found that the rollerframe trawls had higher catch rates and caught more species of fauna in seagrass beds across the northeastern Gulf of Mexico. Among the species captured, 72% were more abundant in the rollerframe trawls compared to 11% more abundant in otter trawls (17% of species were captured at equal abundances). These results were consistent across sites and for a wide range of taxa. Additionally, the rollerframe trawls captured 25% more species than the otter trawls. Our findings suggest that rollerframe trawls generally have a higher capture efficiency than otter trawls in seagrass beds. We therefore recommend that the rollerframe trawl be used as an alternative or supplemental gear for ecologists and fisheries scientists working in seagrass beds.

1. Introduction

Ecologists and fishery scientists often use trawls to collect specimens and estimate community composition, abundance and diversity of mobile animals in habitats with submerged aquatic vegetation (SAV) such as seagrass beds. Several trawl designs are available, each with associated advantages and disadvantages in their use and efficacy (review by Rozas and Minello, 1997; also see Kubecka et al., 2012 and contributions within for a special issue of *Fisheries Research* comparing other active sampling gears and techniques). The otter trawl is one of the most common gears towed in seagrass and other estuarine habitats, as it is relatively easy to use (i.e., deployment and recovery can be accomplished with 1–2 people), inexpensive and readily available from numerous gear suppliers.

However, like all sampling gears, otter trawls have some associated pitfalls that can affect the accuracy and precision of estimating the abundance of populations as well as the structure and diversity of communities. They have been criticized as having low and unstable capture efficiencies, which can be influenced by a suite of factors including the biology of target fauna (e.g., size and behavior), habitat (e.g., seagrass blade length, sediment type), gear specificities (e.g., rigging, net size), and methods employed (e.g., tow direction and speed) (see Rozas and Minello (1997) for an extensive review of the advantages and disadvantages of various sampling gears in estuarine habitats). Because researchers generally require abundances of captured fauna to be standardized to densities, the area sampled must be known or estimated. However, the area sampled by an otter trawl can change during a tow as the doors are pulled inward as the mass of the catch in the net increases (Koenig and Coleman, 1998; O'Neill et al., 2005), thus confounding estimates of the swept area and making density calculations tenuous. Additionally, the shallow depths of seagrass beds make associated fauna vulnerable to turbulence from the propeller of the vessel towing the otter trawl (commonly called "prop wash") which can alter catch characteristics of the gear (Hein and Meier, 1995). The doors

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http://dx.doi.org/10.1016/j.fishres.2014.03.002
0165-7836/

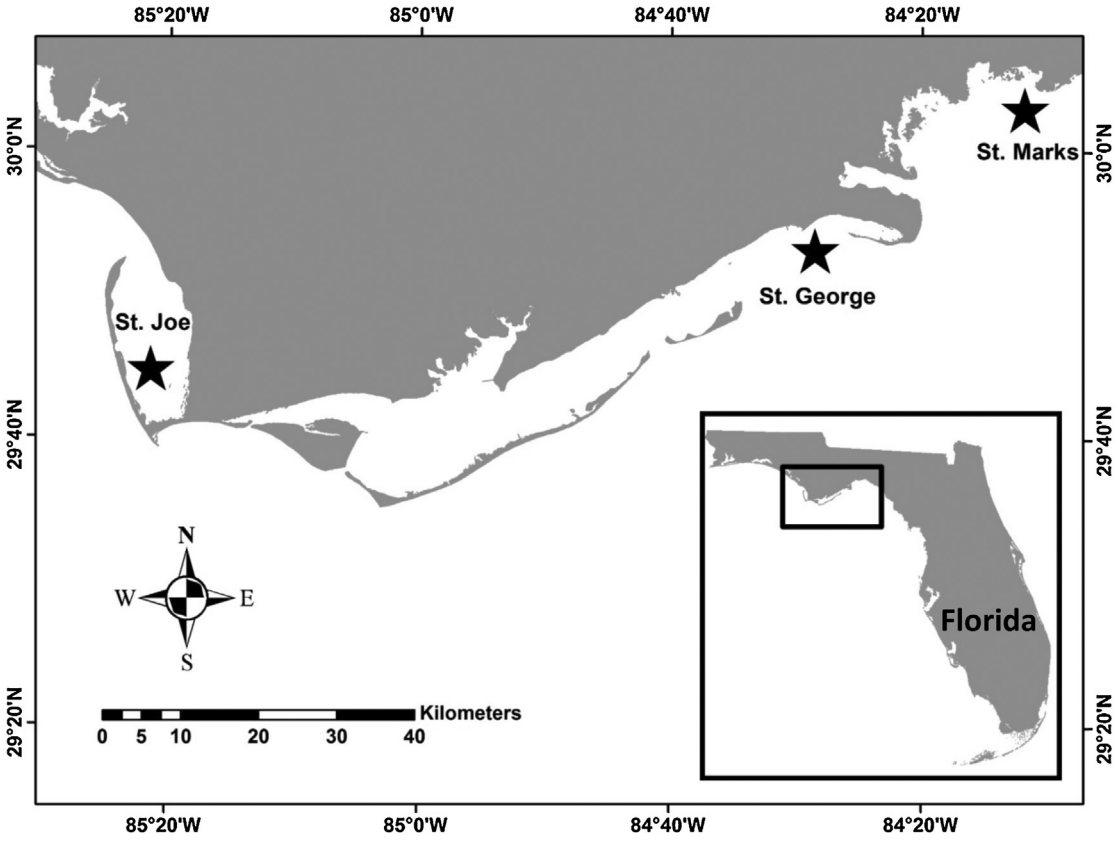

Fig. 1. Map of the study region, showing the trawling sites in St. Joe Bay, St. George Sound, and Apalachee Bay (St. Marks).

themselves can also create turbulence and sediment clouds (de Madron et al., 2005; Pusceddu et al., 2005; Schoellhamer, 1996) that may influence the vulnerability of targeted fauna (Main and Sangster, 1981). Otter trawls can also ride on top of SAV allowing animals to escape underneath the net, leading to the low capture efficiency often observed for this gear in seagrass habitats (Leber and Greening, 1986).

The use of rollerframe trawls as an alternate sampling gear may provide solutions to some of the inherent disadvantages of otter trawls in seagrass beds. Rollerframe trawls have a rigid mouth, so the area sampled remains constant both within and between tows. They are generally towed from the sides of the vessel (at about amidships) rather than astern like the otter trawl so propeller turbulence is likely minimized or eliminated. There are no doors or any other gears towed in front of the mouth opening, so sediment clouds are also eliminated. Last, the rigid frame is heavy, potentially allowing it to ride directly on the seafloor without the buffering effect of seagrass observed with the tickler chains of otter trawls. To our knowledge, rollerframe trawls have not been previously considered for research purposes, aside from studies directly aimed at understanding their catch characteristics in light of their use by a regional inshore fishery for juvenile penaeid shrimp in seagrass beds and other soft bottom habitats in Florida, USA (De Sylva, 1954; Tabb and Kenny, 1969; Berkeley et al., 1985; Upton et al., 1992; Coleman and Koenig, 1998; Meyer et al., 1999; Baum et al., 2003; Crawford et al., 2011). Some of these previous efforts have reported high bycatch by the rollerframe trawls, suggesting they may have high capture efficiencies of various fauna associated with seagrass habitats.

In the current study, we experimentally compared the catch from the commonly-used otter trawl with that from the rollerframe trawl across three sites with varying seagrass characteristics and associated faunal communities. Specifically, we compared the community composition, abundance (standardized as density), and diversity (species richness and rarefied richness) of catch from the two gears.

2. Methods

2.1. Study sites

We conducted our field sampling in seagrass beds at three locations along the coast of the Florida panhandle in the northeastern Gulf of Mexico: (1) St. Joe Bay, (2) St. George Sound, and (3) St. Marks – Apalachee Bay (Fig. 1). All three sites were of similar depths (2–3 m) but with some variation in the seagrass habitats. St. Joe Bay was dominated by 20–50 cm *Thalassia testudinum* with interspersed patches of *Syringodium filiforme*, *Halodule beaudettei* and "hard-bottom" sand. St. George Sound had large patches of *T. testudinum* and *S. filiforme* with blade lengths of 50–100 cm and few soft sand patches. Last, the site in Apalachee Bay (St. Marks) was dominated by 40–80 cm *S. filiforme* mixed with interspersed *T. testudinum* and had a soft sand bottom. Our goal in choosing these sites was not to describe how the different gears operated relative to specific differences in seagrass composition and benthic geological qualities, but to instead incorporate a range of common habitat characteristics of seagrass beds found in the northeastern Gulf of Mexico (Stallings and Koenig, 2011).

2.2. Gear descriptions and paired experimental design

We used a 5 m otter trawl (empty net working width = 3.6 m, height = 2 m, length = 4 m, net body = 1.9 cm stretch mesh, bag = 3 mm mesh) towed astern at a standard speed of 1.8–2.0 km h^{-1}