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You are receiving this report because you participated in our project measuring the back and arm motions of deckhands while fishing for Dungeness crab. This report includes information collected in February and March of 2020 with 4 different vessels in three ports in Oregon and Washington, and 7 fishermen who wore sensors on their chest and both arms. From the recorded motion, we calculated the posture and repetition rates of the deckhands harvesting crab.

We relate the results from the fishermen to what we know about ergonomics. Ergonomics is an applied science for designing and arranging equipment, tools and the environment people use for efficiency and safety. From ergonomics research, we understand the risk of injury to arms, shoulders and low back due to awkward postures, force and repetition.

This report includes the results of all the fishermen together and is not any individual fisherman's result. We are preparing a manuscript to be published in a research journal and will share that with you once it is ready, hopefully later in 2020 or early 2021. Please contact us if you have any comments or questions.

Thank you for your help with this important research to help fishermen stay healthy. We hope that you, your family and your crew are doing well during this trying time.

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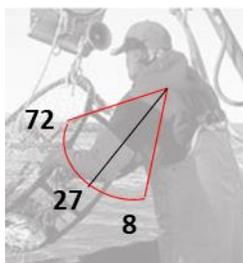
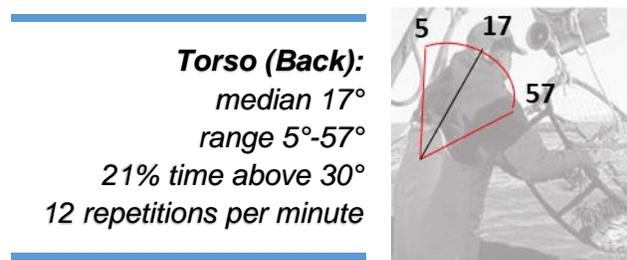
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How we collected the information: Before a fishing trip, we put sensors on each deckhand's chest (to measure the motion of the torso) and upper arms (to measure each arm's motion). These sensors recorded three dimensional motion. The fishermen were instructed to wear the sensors for at least one string of pulling pots and harvesting crab. The average total measurement time (sensor wearing time) was 26 hours, ranging from 14 to 42 hours.

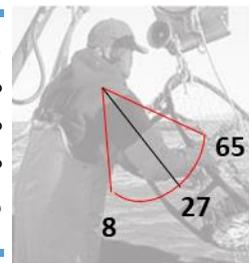
How we analyzed the information: For each fisherman, we looked at the motion in the recordings and removed any idle time (60% of the total measurement duration) between harvesting activities. The average estimated active harvesting duration was 12 hours. Then, we calculated the postural angles of each arm and torso during harvesting. A neutral posture is the healthiest (0°); upright for the back and arms relaxed next to the body. We calculated the median angle and range of motion to summarize the postural information. We also calculated the percent of the time spent in postures greater than 30° for the torso (back) and 60° for the arms, which are known to increase risk for musculoskeletal injury. Finally, we calculated the number of movements per minute (repetitions per minute) where the torso or arm angle changed more than 10°.

The results: The following figures show the postural results. The black line shows the median angle with the red lines showing the range of motion.



Left arm:
 median 27°
 range 8°-72°
 10% time above 60°
 16 repetitions per minute

Right arm:
 median 27°
 range 8°-65°
 8% time above 60°
 17 repetitions per minute



What do the results mean? These results show that harvesting crabs can pose a moderate to high risk for musculoskeletal discomfort and disorders, given the pot weight (force), posture, repetition and according to established ergonomic criteria. Keep in mind that fishermen wore the sensors in February and March, so these results may not reflect risks fishermen might experience at the beginning of the season, when fishing effort is most intense. Positions of the table, block and pots can be important factors and should be evaluated to find ways to reduce arm and torso angles. Regardless of vessel configuration, fishermen can reduce their risk for potential injury by taking frequent rests, stretching, and physical conditioning, both to prepare for the season and during the season.