Review Article

Bulletin of Pure and Applied Sciences.
Vol.37A (Zoology), No.1, 2018: P.39-41
Print version ISSN 0970 0765
Online version ISSN 2320 3188
DOI 10.5958/2320-3188.2018.00004.9

The progresses in fishery sciences and fisheries in South Africa and overseas

Rishan Singh*

Authors Affiliation:
Discipline of Biological Sciences, University of KwaZulu-Natal, Durban, 4001 South Africa

***Corresponding address:**
Rishan Singh
Discipline of Biological Sciences, University of KwaZulu-Natal, Durban, 4001 South Africa
E-mail: rshnsingh1@yahoo.com

Received on 20.03.2018
Accepted on 23.04.2018

Abstract

In South Africa and overseas, the progresses in fishery sciences and fisheries are known. However, these progresses are advancements often seen at a broader scale in scientific literature. Fishery science is a wide field of study encompassing water-dwelling, or water-living, mammals, fish and other fish-like creatures. Although many study fishery sciences, or an allied discipline in biology, the ideas on these organisms and crustaceans, gained from fisheries, are different. It is imperative to compare these findings with scientific discoveries in order to validate these progresses. The present and future finds in fishery sciences and fisheries would form the skeleton of this paper, with example of water-living organisms, such as teleosts, octopus and crabs, forming the key part of the discussion.

Keywords: advancement, shark, gills, Q_{10}, tentacles, “suction-like”, surface area, scales, mouthparts

1. INTRODUCTION

There are many progresses in fishery sciences and fisheries in South Africa and overseas. In fishery sciences, these progresses have been made at the molecular and morphological level, while within fisheries, progresses have been seen by there being a vast number of new sea creatures that dwell within the ocean and confined environments, like the seaworlds [Singh, 2018]. However, in both the fishery sciences and fisheries, progresses have been made by observing the patterns in which sea creatures move in the water (Jørgensen *et al*., January 2014; Shadwick and Goldbogen, April 2012). Although there are a vast number of existing sea creature, like crabs, octopus and sea urchins, advances have been made in trying to understand their feeding patterns on seaweeds and mosses in the ocean and fisheries (Singh, 2018). Furthermore, the mouth structures of these creatures are known to have become adapted overtime to feed on moderately soft plant material, like phytoplankton (Singh, 2018). In South Africa, however, the progresses in fishery sciences has been slow, due to the limited number of institutions offering development courses and degrees in that field, while in countries abroad, many institutions of higher learning offering courses in this subject, thus allowing employed staff at fisheries to understand sea-dwelling creatures, like those mentioned, better (Singh, 2018). This paper elaborates on the progresses made in fisheries and in the study of sea-living creatures in South Africa and overseas. Although this elaboration is not extensive, it provides insight into these progresses.

2. THE ADVANCES IN EXPERIMENTS INVOLVING SOME WATER-LIVING CREATURES

The advances in experiments involving water-living creatures are considered major progresses in SA and abroad (Singh, 2018). Allthough experiments are only an indication of why certain creatures, like sharks and teleosts, interact in a certain way in fisheries and the sea; they provide great cues about the evolution of these animals (Jørgensen *et al*., January 2014, Shadwick and Goldbogen, April 2012). Experiments have shown the evolution in shark gill structures to aid in metabolism in sharks and advanced fish, for example (Singh, 2018; Shadwick and Goldbogen, April 2012). In South Africa, and overseas, this progress has enabled researchers to acquire a better understanding about why the speed of young and older sharks and whales travel at varied paces in the water [2,3]. In addition to this, in fisheries, carekeepers are able to gain a greater perspective about their sharks feeding and resting patterns (Singh, 2018). This allows fish carekeepers to give the correct amount of feed so that the appetite of the sharks (or teleosts) are met (Singh, 2018). This progress has also enabled researchers, worldwide to understand the reason why fish mouthparts have become evolved amongst higher fish, starting from teleosts (Singh, 2018; Shadwick and Goldbogen, April 2012). In crabs, for example, water O_2 and land O_2 consumption has been understood in terms of their walking and/or running patterns to and from the sea (Schmidt-Nielson, 1997). Overseas, however, this has been taken further by understanding the metabolism of sea crabs in relation to the movement to and from the shore. However, in South Africa and overseas, as would be discussed in the section that follows, crab metabolism in comparison to their oxygen consumption has been well understood by a coefficient known as the Q_{10} effect (Singh, 2018). Another progress in fishery sciences, as seen in fisheries, in SA and overseas, are seen in experiments performed on squid-like creatures (such as octopus for example). Experiments have indicated the reason how these water-living creatures are able to adhere to surfaces using their tentacles (Singh, 2018). This progress has, thus, prompted an interest in squid studies amongst young scientists (Singh, 2018). The "suction-like" structures of squids are, thus, an organ that has provided an interpretation about the movement/locomotion of the varied species of octopus (Singh, 2018). Similarly, the adaptation of the fins in dolphins, whales and sharks overtime (Singh, 2018; Jørgensen *et al*., January 2014; Schmidt-Nielson, 1997). This advancement, is one, like many others, that is an example of how environment changes has reshaped water-living mammals (and mammals in general) overtime. Therefore, this progress has lead fisheries to practically understand the evolutionary lineage amongst different water-living organisms (Singh, 2018).

3. ENERGY BUDGETS AND METABOLISM COEFFICIENTS IN SEA-LIVING CREATURES

A significant progress in fishery sciences in South Africa and overseas is the finding of energy budgets, sometimes known as metabolism coefficient, in sea-living creatures (Papkovsky and Zhdanov, 2015; Pethybridge *et al*., 2014). Energy budgets, in sharks and teleosts, for example, have lead to an advanced understanding about the gill action of these organisms (Shadwick and Goldbogen, April 2012). Also, the vaso-dilation and –constriction mechanism of propulsion in fisheries has been well observed in relation in relation to oxygen consumption (breathing) and gill action (Southall and Sims, August 2003, Dahdul *et al*., July 2010; Schmidt-Nielson, 1997). A well-known progress, in South Africa and overseas, is that a larger gill surface area would allow for optimum gaseous exchange (Schmidt-Nielson, 1997). However, an advanced elaboration is that this is not necessarily the case and that that is dependent on the gill mechanism and blood flow (iron content) (Singh, 2018)]. In crabs, as mentioned in the previous section, the phenomenon of energy budgets is determined by a universal concept known as the Q_{10} effect (Schmidt-Nielson, 1997). A previous paper, appearing in the Bio-Science Research Bulletin 2014 issue (V.30., N0.2., 69–72), on *Caridina* has shown that crabs invest much energy when they are mobile in the water (Singh, 2018). In this study it had been found that, in this crustacean, more energy was consumed for locomotion to match the metabolic needs of the organism (Singh, 2018). Similarly, the same trend in the evolution of land-dwelling mammals is also noted (Schmidt-Nielson, 1997). This implies that progresses in fishery sciences, as seen in fresh-, sea-water and within fisheries, is also an indication of the advanced gaseous exchange mechanism that higher animals are ought to possess [read 8]. In South Africa and abroad, however, studies on *Xenopus laevis* (the frig), has shown a similar gaseous exchange trend as that in the shark and crustacean (Singh, 2018). A progress made in all 3 organisms is that the energy consumption is proportional to the metabolic coefficient, since it has been shown that more metabolic waste is measurable in the laboratory (Singh, 2018; Schmidt-Nielson, 1997). Similar, in fisheries, a similar trend could be expected to be achieved with sea-living mammals, except boned fish (Singh, 2018). The scales in teleost create differences in the metabolic coefficients achieved when compared to shark and whales. Although there are no scales in sea-living mammals, the gill surface area accounts for maximum oxygen consumption in the latter (Southall and Sims, August 2003). A progress that has been noted in the teleosts is that, perhaps, their smaller sizes allow faster movement in fisheries (or water in general) (Singh, 2018). However, although the scales covering their skins may be many, it is possible that perhaps some gases/oxygen would be able to permeate through the skin surface (Singh, 2018).

4. CONCLUSION: The Studies, Current Findings and Future of Fishery Science and Fisheries in South African and Overseas.

Many studies have been conducted in the respiratory mechanisms in fish and shark (Singh, 2018). In addition, as it has been discussed, in SA and abroad, crustaceans have also been studied, for their oxygen consumption rate in comparison to their metabolic coefficients (Schmidt-Nielson, 1997). The current research has found that the progresses in fishery sciences, and in fisheries, are variable. However, new species of water-living creatures are currently been pursued. Although the future progresses in fishery sciences would depend on past discoveries, those in fisheries would always be more valuable to fishery scholars (Singh, 2018). In general, the future of fishery sciences and fisheries, are highly dependent on advances made in fisheries. The studies on the molecular basis/genetic control of respiration would remain significant, however, the observation in fisheries are needed to complement these finds (Singh, 2018). This article provides an important account on some of the worldwide progresses found in fisheries sciences and in fisheries. Although it isn't extensive, it's valuable in that it is informative from a personal viewpoint. Furthermore, this is perhaps the first generalised article on this topic (Singh, 2018).

REFERENCES

1. Singh R, personal writing, Representing the Republic of South Africa
2. Jørgensen C, Enberg K, Mangel M. January 2016. Modelling and interpreting fish bioenergetics: a role for behaviour, life-history traits and survival tradeoff. Journal of Fish Biology 88 (1):389-402.
3. Shadwick RE, Goldbogen JA. April 2012. Muscle function and swimming in Sharks. Journal of Fish Biology 80 (5):1904-1939.
4. Dahdul WM, Lundberg JG, Midford PE, Balhoff JP, Lapp H, Vision JJ, Haendel MA, Westerfield M, Mabee PM. July 2010. The teleost anatomy ontology: anatomical representation for the genomic age. Systematic Biology 59 (4):369-383.
5. Schmidt-Nielson K (1997). Animal Ecophysiology: Adaptation and Environment (fifth edition), Cambridge University Press, USA.
6. Papkovsky DB, Zhdanov A. 2015. Cell energy budget platform for assessment of cell metabolism. Methods Molecular Biology 1265:333-348.
7. Pethybridge HR, Parrish CC, Bruce BD, Young JW, Nichols PD. 2014. Lipid, Fatty acid and energy density profile of white shark: Insights into the feeding ecology and ecophysiology of a complex top predator. PLoS One, 9 (5):E97877.
8. Southall EJ, Sims DW. August 2003. Shark Skin: a function in feeding. Proceedings o the Royal Society B: Biological Sciences 270 (suppl 1):S47-S49.