The edible portion (muscle) was blended and aliquots weighed out for marine fish species during the two years of study period i.e., from August 2014 to July 2016. Sodium, potassium and micro-mineral element iron, and to assess the macro-mineral elements such as calcium, phosphorus, sodium and potassium and micro-mineral element iron, and to understand the variations in the mineral content of the above two marine fish species during the two years of study period i.e., from August 2015 to July 2016.

The Phosphorus content of T.lepturus varied month wise data was presented in table No.2 and plotted in the graph from the present analysis, it was concluded that the phosphorus content in the muscle tissue of Equulus was (206.45/100g) that was observed in T.lepturus, U.vittatus.

Three species of fishes (Trichiurus lepturus, Uvpanus vittatus and Leioptogatus equulus) from bycatch were studied for their mineral compositions which were collected monthly from Visakhapatnam fishing harbour during August 2014 to July '16. Phosphorus, calcium, sodium, potassium and iron were analyzed quantitatively by atomic absorption spectrophotometer method. The result has been explained in relation to importance of minerals found in edible bycatch and their utilization as poultry feed and other useful byproducts.

A large number of minerals are present in fish. Most of these minerals present in sea water are also present in fish tissue. Fishes are capable of supplying part of the mineral requirement for water through gill tissue or skin. Diffusible ions include chloride, calcium, phosphorus, potassium and iodine [5]. Important minerals present in fish are sodium, potassium, calcium, phosphorus, magnesium, etc. These minerals are generally higher in marine fish than in fresh water fish [6]. There are, however, considerable variations in the content of individual elements in each organism due to various factors. The present authors also reported on diversity of bycatch, microbiological and organic components of 3 species of bycatch collected from Visakhapatnam fishing harbour [7], [8] & [9].

INTRODUCTION

The commercial and industrial catch of marine fishes generally consists of edible and inedible species. Among inedible species the bulk catch of small size fishes were also included and were commonly referred to bycatch. As a part of the present study, a detailed estimation of mineral composition is estimated in muscle tissue of three selected by catch dominant species, T.lepturus, L.equulus and U.vittatus from Visakhapatnam fishing harbour. Marine fishes are very rich sources of mineral components which are directly and indirectly involved in every bodily process. The total content of minerals in the flesh of marine fish and invertebrates is in the range of 0.6-1.5% wet weight [1]. Marine organisms have shown to accumulate minerals from the diet and deposit them in their skeletal tissues and organs, so as so be considered a good source of essential minerals [2].

Aquatic animals absorb minerals from the surrounding water in addition to the food ingested, and because of their variation in response to salt regulation or osmotic pressure, the mineral composition of the freshwater and marine fish differs with each other. Marine fish live in a hypertonic environment (i.e. in a medium containing an excess of salt) they tend to suffer from desiccation through water loss across the gills. To compensate for this loss marine fish, therefore have to continually drink small amounts of water; the excess salt contained within the intestinal seawater being pumped out of the gill to the exterior [3]. Consequently, since marine fish are reported to drink up to 50 percent of their total body weight per day, drinking may satisfy a substantial part of their mineral requirements [4].

A large number of minerals are present in fish. Most of these minerals present in sea water are also present in fish tissue. Fishes are capable of supplying part of the mineral requirement for water through gill tissue or skin. Diffusible ions include chloride, calcium, phosphorus, potassium and iodine [5]. Important minerals present in fish are sodium, potassium, calcium, phosphorus, magnesium, etc. These minerals are generally higher in marine fish than in fresh water fish [6]. There are, however, considerable variations in the content of individual elements in each organism due to various factors. The present authors also reported on diversity of bycatch, microbiological and organic components of 3 species of bycatch collected from Visakhapatnam fishing harbour [7], [8] & [9].

MATERIAL AND METHODS

T.lepturus, U.vittatus and L.equulus were purchased from the market at the Visakhapatnam fishing harbour regularly for the estimation of minerals in their muscle tissue. The present study was carried out to assess the macro-mineral elements such as calcium, phosphorus, sodium and potassium and micro-mineral element iron, and to understand the variations in the mineral content of the above two marine fish species during the two years of study period i.e., from August 2015 to July 2016.

The edible portion (muscle) was blended and aliquots weighed out for the various chemical analyses. The muscle was kept in hot air oven at 95-100°C for about 24 hours to dry the muscle to constant dry weight. The dry muscle was grained into a fine powder in a porcelain mortar. Weigh 2gm of sample taken into a small crucible and ignite in a mufe 95 - 100 C for about 24 hours to dry the muscle to constant dry weight.

RESULTS

Calcium

It was observed that the calcium content of U vittatus higher than that of T.lepturus and L.equulus. The mean calcium value of T.lepturus was recorded 320.225mg/100g. and of Uvpanus vittatus 499.38mg/100g. and L.equulus recorded 360.75mg/100g. Considerable variations occurred in the quantity of calcium in the muscle tissue of both the fishes from season to season and these followed a fairly well defined cycle occurred during the two consecutive years of the study period.

Phosphorus

The Phosphorus content of T.lepturus ranged between 1510.98, Uvpanus vittatus 1520.96 and 1420.47mg/100g and in L.equulus it varied month wise data was presented in table No.2 and plotted in the graph. From the present analysis, it was concluded that the phosphorus content in the muscle tissue of Equulus was higher than that of U vittatus and L.equulus. The mean phosphorus content of T.lepturus was recorded 499.38mg/100g. and of Uvpanus vittatus 485mg/100g.

Sodium

In the second annual cycle, the highest potassium value was observed in January (2392mg/100g) and the lowest value (1456mg/100g) was
recorded in September. In *U. vittatus*, the highest potassium value (2087mg/100g) in the muscle tissue was observed in July-2015 and the lowest value (1742mg/100g) was noticed in January-2015. In the second annual cycle, the highest potassium value (2385mg/100g) was noticed in May-2016 and the lowest value (1290mg/100g) was recorded in May-2015. In the second annual cycle, the highest potassium value was noticed in January-2015 with (2208mg/100g) was noticed in May-2016 and the lowest value (1.22mg/100g) was observed in May-2015. In the second annual cycle, the highest Iron content was observed in Jun-2015 with (3.65mg/100g) and the lowest value (1.22mg/100g) was recorded in March-2015. In the second annual cycle, the highest Iron value was noticed in Aug-2015 with (2.42mg/100g) was observed in January-2015. In the second annual cycle, the highest Iron content was observed in Jun-2015 (3.32mg/100g) and the lowest value (1.02mg/100g) was observed in May-2015. In the second annual cycle, the highest Iron value was noticed in Jun-2016 with 3.65mg/100g and the lowest value 1.22mg/100g was recorded in May-2016.

**Iron**

In the *T. lepturus*, the highest Iron content was observed in Jun-2015 with (4.48mg/100g) and the lowest value (2.42mg/100g) was observed in January-2015. In the second annual cycle, the highest Iron value was noticed in Aug-2015 with (4.10mg/100g) and the lowest value (2.30mg/100g) was recorded in Dec-2015. In the *U. vittatus*, the first annual cycle, the highest Iron content was observed in Jun-2015 with (3.32mg/100g) and the lowest value (1.01mg/100g) was observed in May-2015. In the second annual cycle, the highest Iron value was noticed in Jun-2016 with (3.65mg/100g) and the lowest value (1.22mg/100g) was recorded in May-2016. As shown in the above table, in the *L. equulus*, for the first annual cycle, the highest Iron content was observed in Jun-2015 with (3.32mg/100g) and the lowest value 1.02mg/100g was observed in May-2015. In the second annual cycle, the highest Iron value was noticed in Jun-2016 with 3.65mg/100g and the lowest value 1.22mg/100g was recorded in May-2016.

**Table 1- Calcium (mg/100g) in T. lepturus, U. vittatus and L. equulus during 2014-'15 and 2015-'16**

<table>
<thead>
<tr>
<th>Month</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014-'15</td>
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<td>329.12</td>
<td>328.12</td>
<td>328.12</td>
<td>329.12</td>
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<tr>
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<td>329.12</td>
<td>328.12</td>
<td>328.12</td>
<td>329.12</td>
<td>328.12</td>
</tr>
</tbody>
</table>

**Table 2- Phosphorus (mg/100g) in T. lepturus, U. vittatus and L. equulus during 2014-'15 and 2015-'16**

<table>
<thead>
<tr>
<th>Month</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
</tr>
</thead>
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<tr>
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<td>1879.73</td>
<td>1879.73</td>
<td>1879.73</td>
<td>1879.73</td>
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<tr>
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<td>1879.73</td>
<td>1879.73</td>
<td>1879.73</td>
<td>1879.73</td>
<td>1879.73</td>
</tr>
</tbody>
</table>

**Table 3- Sodium (mg/100g) in T. lepturus, U. vittatus and L. equulus during 2014-'15 and 2015-'16**

<table>
<thead>
<tr>
<th>Month</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
</tr>
</thead>
<tbody>
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<td>329.12</td>
<td>328.12</td>
<td>328.12</td>
<td>329.12</td>
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<td>328.12</td>
<td>328.12</td>
<td>329.12</td>
<td>328.12</td>
</tr>
</tbody>
</table>

**Table 4- Potassium (mg/100g) in T. lepturus, U. vittatus and L. equulus during 2014-'15 and 2015-'16**

<table>
<thead>
<tr>
<th>Month</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
</tr>
</thead>
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<td>328.12</td>
<td>328.12</td>
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<td>328.12</td>
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<td>328.12</td>
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</tbody>
</table>

**Table 5- Iron (mg/100g) in T. lepturus, U. vittatus and L. equulus during 2014-'15 and 2015-'16**

<table>
<thead>
<tr>
<th>Month</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
<th>T. lepturus</th>
<th>U. vittatus</th>
<th>L. equulus</th>
</tr>
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<td>329.12</td>
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<td>328.12</td>
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<td>328.12</td>
<td>329.12</td>
<td>328.12</td>
</tr>
</tbody>
</table>

**Fig-1: Mineral composition of T. lepturus during Aug 2014 to Jul 15’ & Aug 2015 to Jul 16’**

**Fig-2: Mineral composition of U. vittatus during Aug 2014 to Jul 15’ & Aug 2015 to Jul 16’**

**Fig-3: Mineral composition of L. equulus during Aug 2014 to Jul 15’ & Aug 2015 to Jul 16’**
**DISCUSSION**

Marine bycatch species were having very rich sources of mineral components. Minerals are a very important component of a diet, because they cannot be synthesized by the human body and therefore should be provided with food in the right amounts and proportions. Fish is an excellent source of mineral elements. With respect to the mineral content, some fishes are superior to other types of food. [10] and [11] reported that the mineral content of fish makes fish unavoidable in the diet as it is a source of different minerals that contribute greatly to good health. Marine foods are very rich sources of various mineral components. The feeding habits and the influence of the environment on *Telescopium*, *Uvittatus* and *Lequulus* made them a good source of minerals which are of nutritional importance.

**Calcium**

Seafood is one of the useful sources of the calcium in the present study. *Telescopium* recorded the calcium content of 322.12mg/100g in during the year 2014-2015 and 317.36mg/100g in during the year 2015-16 in their muscle tissue. *Uvittatus* recorded the calcium content of 492.71mg/100g in during the year 2014-2015 and 505.38mg/100g in during the year 2015-16 in their muscle tissue. *Lequulus* recorded the calcium content of 331.77mg/100g in during the year 2014-2015 and 392.32mg/100g in during the year 2015-16 in their muscle tissue. The similar results were reported by [12] in *Sardinella brachysoma* (240.56mg/100g). These values are in the moderate range. But in some marine fishes, fairly high calcium content was reported.

**Phosphorus**

Stated [13] that the phosphorus content in fishes ranged between 1520 mg/100g and 2600 mg/100g. In the present study, the average phosphorus content of *Telescopium* recorded 1513.97mg/100g in during the year 2014-2015 and 1475.33mg/100g in during the year 2015-16 in their muscle tissue. *Uvittatus* recorded 1533.92mg/100g in during the year 2014-2015 and 1428.44mg/100g in during the year 2015-16 in their muscle tissue. *Lequulus* recorded 1380.43mg/100g in during the year 2014-2015 and 1469.25mg/100g in during the year 2015-16 in their muscle tissue. The value of *Telescopium* falls within the above stated phosphorus levels. Phosphorus levels in some commercial fish species were ranged as 1077.27-3184.77 mg/kg. [14], reported concentrations of phosphorus in the muscles of roach and bream were 1914.60-2287.0 and 1429.8-2268.3mg/100g of potassium in their muscle tissue. Potassium is also an essential element in the body system that plays a vital role in protein synthesis, nerve conduction; control of heart beat, muscle contraction and synthesis of nucleic acids [17]. In the present investigation, *Telescopium*, *Uvittatus* and *Lequulus* reported 2080mg/100g, 2087mg/100g and 2385mg/100g of potassium in their muscle tissue during 2014-15. And the period of 2015-16, *Telescopium*, *Uvittatus* and *Lequulus* contain 2392 mg/100g, 2301 mg/100g and 2208 mg/100g of potassium in their muscle tissue. Potassium is also reported to vary in concentration in salt water fishes. The levels of potassium in some commercially important fish species from the south Caspian Sea samples ranged from 1809.06-2678.36mg/kg by [18]. [19] reported the average potassium value of commercial fish as 300 mg%.

**Iron**

The levels of iron found in sea foods can range between 0.3-7.0 mg/100g [20]. In the present investigation, the iron content of *Telescopium*, *Uvittatus* and *Lequulus* were recorded within the above said range. Marine fishes contain higher iron content than freshwater fishes; however, the iron content of fish is very low compared to that of mammals [21].

*Telescopium* contains slightly higher iron content than, *Uvittatus* and *Lequulus*. *Telescopium* contains 4.48mg/100g, *Uvittatus* 3.23mg/100g and *Lequulus* contain 3.32 mg/100g during the year 2014 to 2015; *Telescopium* contains 4.02mg/100g. *Uvittatus* 4.32mg/100g and *Lequulus* contain 3.65 mg/100g during the year 2015 to 2016; The iron concentration obtained in the present study is found close to the value that was reported by [22] and [23]. [24] reported the iron content in traditionally cured marine fish which ranged from 15 to 28 mg%.

**CONCLUSION**

The present study reveals that these fishes are very good source of iron and other mineral elements. In the diet can prevent or cure diseases that are associated with nutritional elements. The major mineral composition of the bycatch along the Visakhapatnam fishing harbour provides information on the mineral constituents. It can be concluded that the bycatch, especially the three selected species available in the post monsoon season in the months of November and December are more nutritious with respect to the calcium content.

**REFERENCES**