CHAPTER. 02:

MATERIALS AND METHODS

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1. MATERIALS & METHODOLOGY

2.1 Selection of the Study Area:

The Coastline of India is approximate 7500 km long, 200 nautical mile wide Exclusive Economic Zone (EEZ), the Bay Islands of Andaman and Nicobar, and the atoll Island group of Lakshadweep which harbors a vast extent of coastal and marine habitats. The coastline consists of headlands, rocky shores, sandy shores, barrier beaches, bays, marshy lands, and offshore Islands. According to the Naval Hydrographic Chart, the Indian mainland consist nearly 43% sandy beaches, 11% rocky coast and 46% mud-flats and marshy coasts. The coastline holds almost 30% of its human population being dependent on the rich exploitable coastal and marine resources.

Sutrapada Bandar is one of the fishing villages in Gir-Somnath Dist. of Gujarat. It is situated 19 km away from Veraval – one of the major fish landing centers of Gujarat. This place is known for the Gujarat Heavy Chemicals LTD (GHCL) plant, the largest "Soda ash" producing company in the world. Here the fishing is one of the major occupations for local people; about 300 families are engaged in fishing as well as fishery activities. Occupation analysis showed that 90.5% of the respondents had fishery as the only occupation, 5.4% fishery main and non-fishery as subsidiary occupation, and 4.1% non-fishery main and fishery as subsidiary occupation. They have very limited information and infrastructure (Sehara *et. al.,* 1986). Therefore, Sutrapada is selected to study the ichthyofaunal diversity and fishery aspects due to its regional importance in marine fisheries sector (Figure. 1).

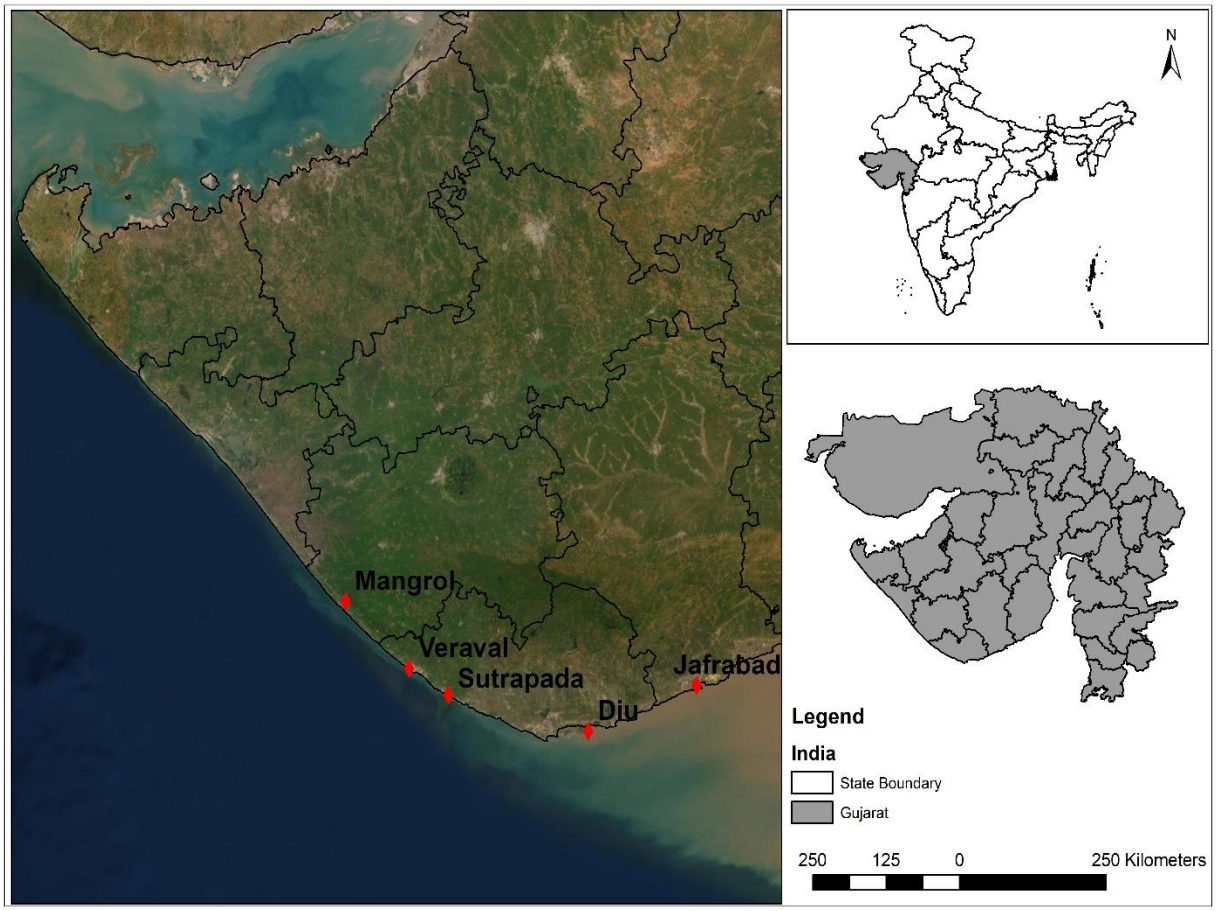

Figure. 1. Locations of Major Fish Landing Centers of South-Gujarat Coast – **Sutrapada**, Veraval, Mangrol, Diu and Jafrabad.

2.2 Sampling Procedure:

In Sutrapada village - bander, about 381 Out Boat Motors (OBM) gillnetters are operating among which most of them are active in fishing. These vessels are made up of Fiber Reinforced Plastics (FRP). The data for the present study was collected from 23 OBM gillnetters operating off the Sutrapada coast. Fisherman of Sutrapada go for multiday fishing trip mainly for 2-3 days and apart from this fisherman of this area also go for local fishing of one day trip. Multifilament and monofilament nylon nets operated by FRP canoes fitted with outboard machine were used by them for catching mackerel, croaker, seer fish, catfish, tuna, ribbon fish, silver barb, etc.

Fishing season in Gujarat is of 9 months from September to May. In the remaining months fishing activities remains closed from 10 June to 15 August as per the Marine Fishing Regulation

Act of Gujarat 2003 and due to monsoon and rough conditions of the sea. Due to this bad weather, fishermen find it very difficult to navigate their vessels in the monsoon month, so all the fishing activities remain closed. Data was collected of whole fishing season from September to May from 2015 to June 2019. The collection of the fishes was performed on monthly basis during winter (November to February) and summer (March to June) seasons. In monsoon (July to October) season fishing activities are closed due to safety reasons thus, no collection was performed during this period. Vessels for the data collections were selected by simple random sample on each time. The details of fishing operation were gathered from tandel of the boat and crew member who are directly involved in fishing as per the Questionnaire. Periodical purposive simple random sampling was done to collect the relevant data.

The following methodology has been employed for the achievement of the desired objectives. The major components have been described below:

The criteria of collection were in the following way:

- Identification and Survey of landing center and fishing ground of an area with the help of Google maps and the Department of Fisheries and development of contacts of fishermen working in that area.

- Preparation for the field visit with proper resources for on field collection and morphological and morphometric evaluation and for storage and transport to the laboratory.

- Regular survey for diversity had been carried out for landing center and occasional survey of fishing ground with fishermen during fishing.

- Visiting the water sources in a proper time where there is a possibility of receiving large amount of fish fauna for assessment.

- Collection of the specimens according to their availability and size ratio.

- On field photography of the water source, fishermen working and most importantly the specimens to preserve the actual color of the fish digitally. Also, the assemblage of the important details such as GPS location of the water source, habitat of the specimens and the local names of the species found or usually found were considered.

- Interaction with the fishermen regarding the varieties of species found, annual or bi-annual catch, growth rate of fishes, any traditional knowledge of use of any species, problems encountered by them and future outcomes.

- Post transportation to the laboratory, the specimens were studied with detail for each of the morphological characteristics and morphometric measurements also to find out details like classification, habits and habitats, distribution and description, reproduction, IUCN status, conservational measures and if any available commercial utilization (Figure. 7; Table 1).

- Proper photography of the specimens with required background, w.r.t, to the color and size of the specimen for the purpose of future reference.

- Preparation of 10% formalin for long time preservation of the specimens in transparent glass jars.

- Storing the specimens in properly labelled glass jars in the museum at the Department ofZoology, Faculty of Science, The M. S. University of Baroda, Vadodara.

2.3 Identification:

Identification and classification of the organisms of the biological world is considered to be one of the toughest jobs of taxonomical studies. Each group has its own basic morphological characteristics which are to be identified separately for the need to identify the organism completely. Fishes, one of the diverse groups of the animal kingdom, has very much evolved with the evolution of the planet. The identification of such a group has to be very much in detail so as not to make any error.

The collected specimen had been cleaned properly. Informative photographic documentation had been done before preservation. Identification of the species was carried out using morphological features and morphometry. Morphological identification was done to discover the recognize characters of individual speciesas each fish species has maybe a couple specific characters which separate it from others. Inmorphological identification, number of dorsal fin spines and rays, caudal fin rays, anal fin rays, pelvic fin spines and rays, pectoral fin spine and rays, lateral line scale count, transverse lateralline scale count and branchiostegal rays were measured. The fish

formula was made utilizing this data. The morphometric study was done with the measurement of standard length, total length, and body width. Standard length is the measurement from the tip of the snout to the mid base of the caudal fin and total length is the distance from the tip of the snout to the tip of the caudal fin. Body width is the vertical distance across the body. The meristic study included ray and scale count which are the characteristic features for fish identification.

In this study, many varieties of specimens were found which had almost same morphological characteristics with only 1-2 differences in them which made different species but with same genus. Such differences had to be dealt with separately so as not to consider same species. The authentication of the identified fish specimens was done with the help of available keys like "Fishes of India - Francis Day", FAO factsheets, www.fishbase.org, a verified and certified website of the Food and Agricultural Organization, and Eschmeyer's Catalog of Fishes (https://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp) (Figure. 2).

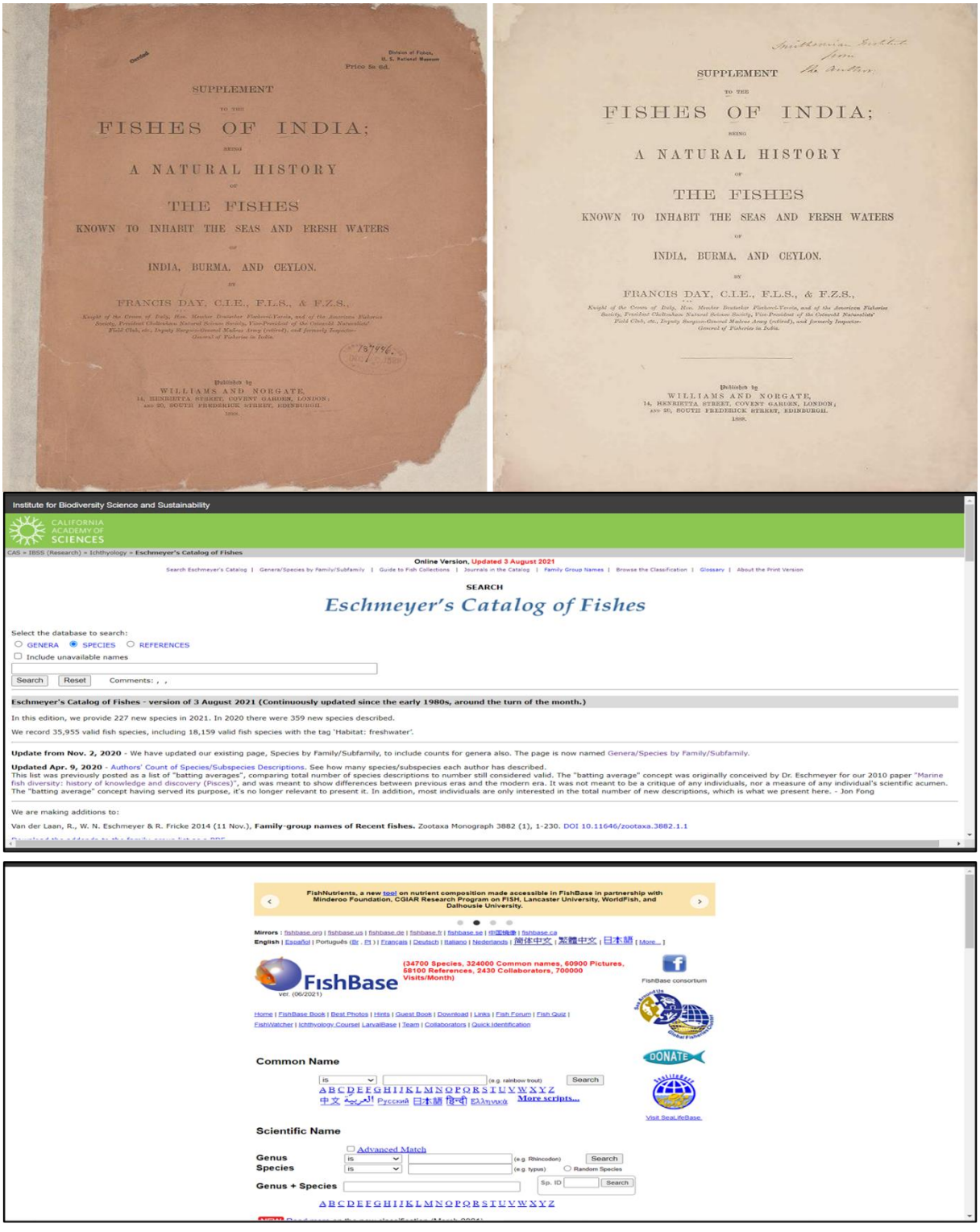

Figure. 2: Authentic Reference Guide and Web Portals for the Identification of the Ichthyofauna Collected from Sutrapada, Gujarat, India.

2.4 Storage Techniques:

Proper care and maintenance are taken to preserve the specimen and keep it intact. 10% formalin is used for the preservation of the specimen. It is important to change the formalin of the glass jars at regular intervals of 2-3 months because it too gets degraded with the release of the fat content from the body of the fish (Figure. 3, 4, 5, 6).

Figure. 3: Ice Box: for preservation of fish

Figure.4: Preservative Chemicals

Figure.5: Camera – Sony HX400V for onfield and in-laboratory photographic documentation

Figure.6: Laboratory Equipments for Morphology and Morphometry

Figure.7: Morphology and Morphometry of the Collected Fresh Fish Specimen in Biology Laboratory of Dalamia Public School Sutrapada.

2.5 Fishery Component:

To evaluate the fisheries status of the Sutrapada Fish landing center demographic data was collected for the fishermen community. As the nearby fisheries centers like Mangrol and Veraval are overcrowded for the berth facilities and landing center activities, this Sutrapada fish landing center has become one of the developing centers. Fishermen demographic archive data were collected from local fisheries office and recent data were procured through questionnaires supplied to present fishermen community. The analysis of both sets of data is presented here in the thesis.

The regular visit to Sutrapada- bunder was made to understand and to collect the information/ data related with fisheries component. The wholesale price of fishes was obtained from fisherman, the information related to offseason activity was recorded. Mostly the offseason activity undertaken at Sutrapada coast is like netmaking, repairing of boats and its engine. The regular visits to the Department of Fisheries were carried out to get the information on fishing activities carried out at Sutrapada Coast (Figure.8).

2.6 Questionnaire:

Questionnaire was formulated to fulfill the requirements of the present study (Masani, 2012). Due care was taken while formulating the questionnaire to include all the relevant questions necessary to be answered by the respondent to fulfill the laid down objectives of the present study. The questionnaire used for the present study is given in Annexure II.

Following data was collected through the formulated questionnaires.

01) Age-group of the Fishermen

02) Sex-ratio of the Fishermen

03) Household facilities of the Fishermen family

04) Literacy rate in the Fishermen community

05) Residential status of the Fishermen community

06) Government assistance received by the Fishermen community

07) Basic needs of the local Fishermen

Figure.8: Fisheries Data Collection from the Department of Fisheries, Sutrapada, Gujarat.