Mediterranean Action Plan
Barcelona Convention

United Nations
Environment Programme

List of Case Studies
for the
Ecological Objective 2
(Non-Indigenous Species)

EO2	Title	Contracting Parties, Partners	Authors and Affiliation
1	Invasive versus native bottom-trawl fish species diversity and population dynamic at the soft-bottom habitats of the Southeastern Mediterranean coast of Israel.	Israel	Nir Stern, Israel Oceanographic and Limnological Research (IOLR) Hadas Lubinevsky, Israel Oceanographic and Limnological Research Dror Zurel, Marine Monitoring and research Coordinator, Israel Ministry of Environmental Protection, Marine Environment Protection Division. Prof' Barak Herut, Israel Oceanographic and Limnological Research

Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species)

Case study title: Invasive versus native bottom-trawl fish species diversity and population dynamic at the soft-bottom habitats of the Southeastern Mediterranean coast of Israel.

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1. Brief introduction

Non-indigenous species (NIS) are regularly reported from various coastal habitats in the Mediterranean Sea but fundamental knowledge on the assemblage structure of coastal fish communities are lacking. The vectors of introductions can be divided into two main categories, namely *accidental* and *intentional*. *Accidental* introductions include the well-known ballast water transportation which is considered the most important mode of unintentional dispersal of aquatic species worldwide. *Intentional* introductions are mainly related to human consumption and thus mainly concerns fish and mollusca species. For instance, approximately one hundred fish species have already resided in the Levant (Galil and Goren 2013; Galil et al. 2015; Kletou et al. 2016).

The data-collection capabilities of the bottom-trawl fishing industry has been long harnessed for monitoring and stock assessment around the world (Godø and Wespestad 1993; Weinberg et al. 1994). At the Israeli coasts of the Levant Basin, employing the local bottom-trawl fleet for scientific purposes have been proven crucial to evaluate shifts of fish communities and habitat distribution among native and NIS fauna (Stern 2010; Edelist et al. 2012; Levitt 2012). In addition, accurate taxonomic inspection over the survey's catch has repeatedly uncovered new NIS for the Mediterranean, some of which displayed population outbursts (Goren et al. 2009; Goren et al. 2010; Goren et al. 2011; Stern et al. 2014; Stern et al. 2015). Lastly, conducting such time-series studies eventually provides viable information to estimate local fishing pressure over time and space that may serve to form sustainable management protocols (Stern 2016).

Epifaunal long-term monitoring of the sandy-bottom at the southern fishing grounds of Israel started in the fall of 2014 within the framework of the Israel's National Marine Monitoring Program in the Mediterranean Sea carried out by IOLR (Herut et al. 2016). This programme focuses on the dynamic population structure and the

temporal and spatial distribution of the Levantine epifauna. The extensive database obtained allows multiple variable and parameters analyses, and upholds a great computation power for future understanding the continuing changes in faunal biodiversity and distribution in the Levant Basin.

2. Methodologies used for the collection and analysis of the data

iannual bottom-trawl set of monitoring surveys, during spring and fall, were conducting from November 2014 off the coast of Ashdod, encompassing bottom depths of 20, 40, 60, and 80 m in both day and night net hauls. Each sampling campaign was for 24 hours and included 8 hauls in total, with a tow duration of 90 min for each haul. Tow duration is the time between the achievement of optimal net opening and the moment when speed was reduced in order to lift the net on deck. The trawler was sailing at an average speed of 2.8 Nautical miles, thus covering an estimated area of approximately 7-8 km per haul. Each haul catch was then sorted on deck into the possible lowest taxonomic level, tagged and kept in refrigerated room during the entire campaign.

At the end of each campaign, the entire catch was brought to IOLR in Haifa for further examination. At the institute, the catch was identified to specific taxonomic level, and basic measures were taken: total length, to the nearest mm, and weight to the nearest 0.1 g. Certain species were preserved and vouchered at the Steinhardt Museum of Natural History in Tel Aviv University. In addition, selected specimens were regularly sampled individually for the DNA barcoding campaign held in IOLR (Israeli barcode data center, www.ocean.org.il). Lastly, the data was added to the whole dataset for further statistical analyses.

3. Results of the Indicators Assessment

During the entire monitoring programme, different ratios of native versus non-native fish parameters were observed across the sampled isobaths. The shallow waters of 20 and 40 meters always presented higher ratios of introduced fish species, with a mean of 17.25±2.34 and 12.63±3.00 non-native fish species per haul, in comparison with 7.5±3.01 and 7.2±3.18 fish species at the 60 and 80 meters, respectively. The native Mediterranean species, however, show an opposite trend with higher average species count in the deeper waters of 60 and 80 meters (Figure 1). These differences have been previously shown by Levitt (2012) and were attributed to the water temperature and natural preferences for shallow bottoms for the Red Sea invasive species.

Adding temporal parameters to the database shows approximately stable values of the average number of invasive fish species per haul during 2014-2016 at the depths of 20-60m, with an increase in the number of non-native fish species in the 80m hauls of 2016 (Figure 2). This finding is particularly important to monitor in order to apprehend whether there is a specific trend for the non-native fish species to venture into deeper waters.

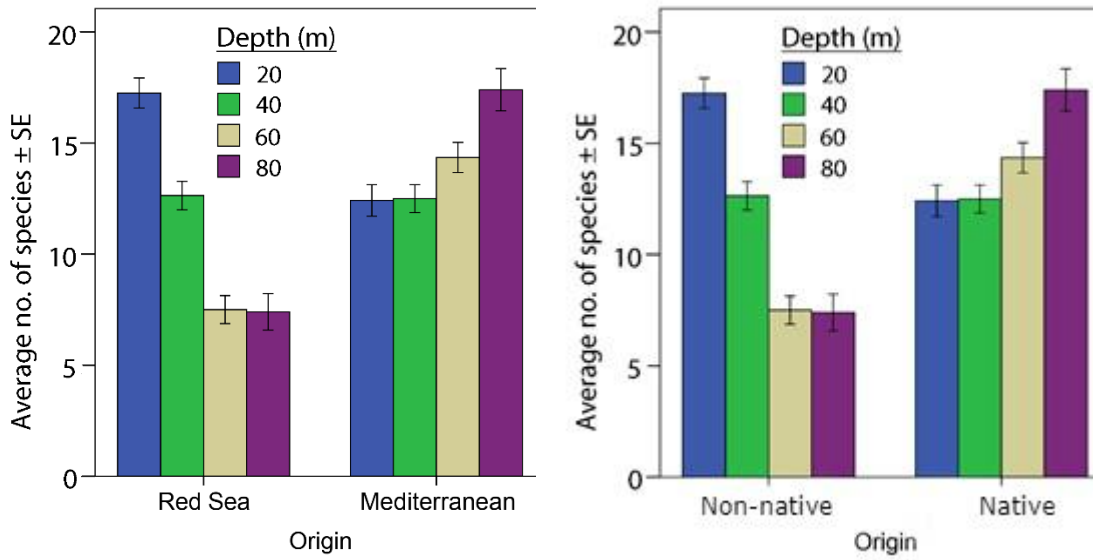

Figure 1. Average no. of fish species per bottom-trawl haul±SE, separated by the origin of the fish and sampled depths.

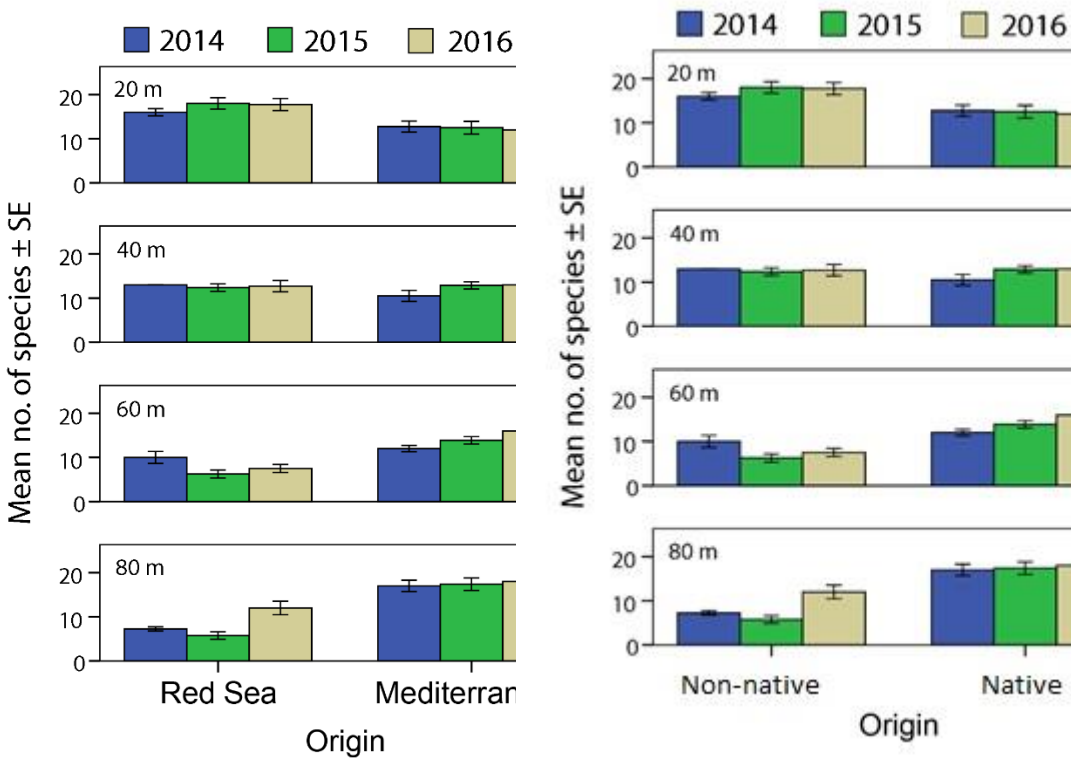

Figure 2. Average no. of fish species per bottom-trawl haul, separated by the origin of the fish, the sampled depths and years.

4. Lessons learnt and/or recommendations

Shift in non-native fish preferences: as for today, the majority of the non-native fish species are significantly more common in shallow isobaths, as shown in our data. It is vital to continue monitoring a gradient of isobaths in order to detect any change

within these biological characteristics. A change within this distribution may unbalance the local trophodynamics or pose an ecological threat to the unexperienced native fauna in the newly-invaded deeper waters.

Seasonal variation: due to its non-selectivity characteristics, the bottom-trawl industry is known to be especially destructive during the recruitment season of the new generation of the catch (Stern 2016). While continuing the biannual methodology, we may witness and time the recruitment seasonality of the different commercial species (data not shown). Such long-term information is highly imperative to construct an effective sustainable fisheries management in term of optimal annual fishing moratorium.

The data gather through this monitoring programme demonstrate our ability to detect ecological trends and shifts in the Levantine soft-bottom epifauna, especially considering the fragile dynamics between the local and NIS fauna.

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